Part Three.

THE TECHNIQUE OF HYDROTHERAPY.

THE modes in which water may be applied to the human body therapeutically are almost infinite in form and variety. It is not proposed in this section to undertake to exhaust the subject, but only to describe those procedures which are capable of being employed in an exact and scientific manner, and have been shown by the test of practical experience to be really essential to enable the hydrotherapeutist to produce each and all of the various therapeutic effects which belong to scientific hydrotherapy.

Disregarding temperature, all hydrotherapeutic measures may be divided into two general classes: —

1. *Applications in which thermic effects alone are produced.* This class comprises all forms of water baths in which the application itself is not accompanied by rubbings or frictions, percussions with the hand, or the mechanical effects produced by water in motion, the applications being purely passive in character. Of this class are immersions, general and partial, when not accompanied by friction; compresses, hot and cold; packs; hot air, vapor, and electric-light baths; irrigations; applications of coils or rubber bags filled with hot or cold water,—in short, all purely passive applications of heat and cold to the body, either internal or external. **1000**

2. *Applications in which thermic impressions are supplemented by mechanical effects*, either (*a*) by giving more or less vigorous movement to the mass of water brought in contact with the skin, or (*b*) by manual manipulations, such as rubbing or friction, and percussion. In this class are included **1001**

douches of all sorts, also the so-called *percutient* measures, wet and dry friction, rubbing sheets, affusions, and immersions accompanied by friction, such as the Brand bath, the shallow bath, the rubbing sitz.

In most general hydriatic procedures mechanical effects of some sort are employed to a greater or less extent as a necessary aid to reaction. It is only in comparatively exceptional cases, in which reaction must be prevented, or is not required, as in most hot applications, that mechanical effects are absolutely excluded.

In certain cases it is desirable to secure mechanical effects alone. The thermic effects of water are then suppressed by the employment of neutral temperatures (92° to 97°), or of such purely mechanical measures as dry friction and percussion. The last-named procedures belong properly to the province of massage; but, as elsewhere remarked, the effects produced by massage and by thermic applications are so closely allied, and these procedures so constantly and intimately associated, that it is almost impossible to avoid considering both under the same head. Indeed, hydrotherapy in practice is essentially a thermo-mechanico-therapy; but we lack a convenient word to express this compound idea, and so are by the poverty of our nomenclature compelled to describe and discuss under the general heading "Hydrotherapy" some procedures into which water does not enter at all.

In the description of the various hydriatic processes, it is not possible to follow closely the above classification, although in the therapeutic application of the resources of hydrotherapy, it is of the highest importance that it should be held constantly in mind.

The discussion of the therapeutic application of individual hydriatic processes is rendered not a little difficult by the fact that almost every one of the procedures described in this work, numbering more than two hundred, is possessed of such versatility and capacity for modification that it constitutes in itself almost a complete hydriatic armamentarium. In gen-

eral, it may be said that the therapeutic applications which have been indicated for individual procedures are those to which the measure in question most conveniently or aptly lends itself, and those the value of which has been proved by clinical experience. It is true that a physician possessed of a sufficient amount of knowledge, skill, and experience will be able to secure nearly all and perhaps the very best results of hydrotherapy by the aid of comparatively few and simple measures. Indeed, there are very few effects which can not be secured by such extraordinarily simple means as a sheet, a few towels, a pail, and an ample supply of hot and cold water, provided the requisite experience and skill are added. But the ability to accomplish large and efficient results with such small means can be attained only by long practice and training, while they may be much more readily reached by the employment of means more exactly adapted to the purpose required. An expert, with a pocket-knife alone, can accomplish nearly all that is produced with the varied tools of the wood-carver and the cabinet-maker, but certainly not with the same facility or rapidity. An expert may be able to do more even with a single implement than a bungler with a hundred tools. But the best results of all will be attained by the expert who has at command a full complement of instruments of precision adapted to the work in hand.

It is also a purpose of this work to present in a methodical form the varied resources of the most versatile and marvelously potent curative agent which a beneficent Creator has given to man, and not to him only, but to the whole animal kingdom.

In describing the various hydriatic procedures in the following pages, those which are similar in method of application will be grouped together, although their physiological effects may be quite different, the various therapeutic effects of water and the methods by which each may be produced having already been systematically discussed at considerable length in the preceding section of this work.

DOUCHES.

1002 A douche consists of a single or multiple column of water directed against some portion of the body. In the therapeutic employment of the douche, three factors are active: (1) *Temperature*, (2) *Pressure*, (3) *Mass*.

The range of temperatures employed in douches is from 45° to 125° F. The pressure ordinarily employed is from 10 to 60 pounds, represented by a water column of 25 to 150 feet. The mass varies greatly, according to the effect desired. For the single horizontal jet, a nozzle with an aperture of one fourth to three eighths of an inch is commonly employed. In the filiform douche, the column of water is scarcely larger than a fine hair. Both the pressure and the mass effect may be easily regulated by means of the finger placed in the water column near the mouth of the nozzle, thus breaking or dispersing the stream. More exact and certain means of regulating the pressure should be employed, however, in regular hydriatic practice.

1003 The douche apparatus should be constructed with pipe of ample size (at least one and a half inches in diameter), and should be directly connected with the sources of both hot and cold water, the connections being so arranged that the use of hot and cold water elsewhere in the bath-rooms or in the establishment shall not cause a variation of the temperature of the water delivered to the apparatus after it has once been adjusted for use. This is not always easy to accomplish, but can always be done if sufficient intelligence and experience are brought to bear upon the problem.

An accurate pressure gauge and thermometer should be connected with the apparatus, so that pressure and temperature may be accurately determined. For facility in the use of the douche, and for the most efficient work, it is highly important to have the apparatus so constructed that it may be quickly adjusted for any form of douche, and for any temperature desired, and in rapid alternation if required.

1004 The author has devised and used for a number of years (1899) a very convenient apparatus, the general form of construction of which may be seen in the accompanying cuts (Figs. 31, 32). With this apparatus it is possible to administer the douche in every required form, at any required temperature, and to regulate to a nicety both the pressure and the temperature of the application.

As will be seen by reference to the figure, the apparatus consists of two ordinary douche apparatuses (A and B) connected by a pipe (X). Each of these is supplied with a thermometer. A pressure gauge placed between the two valves indicates the pressure for both. By means of a switch connecting the two valves so that they move together, water from either of these sets of pipes may be directed upon the patient with the same service hose. By this means the attendant has complete and instant control of both the temperature and the pressure in the administration of the douche. The temperature range is from 45° to 125°, and the pressure from one-half pound to 45 pounds. In giving the Scotch douche and the alternate douche, the temperature is carefully regulated in each of the twin apparatuses to suit the needs of the case. By adjustment of the proper valves the pressure may be regulated instantly, and the switch permits the alternations of different temperatures to be made instantaneously. An extra service hose for each side permits the simultaneous employment of water at any desired temperature.

With this apparatus for supplying water at any temperature and pressure desired, there are connected short pieces of rubber hose with variously shaped nozzles and other appliances for determining the form of the douche, as the jet, fan, rain, needle, percussion. The rain douche and the multiple circle or needle douche are each supplied by a pipe from each one of the twin apparatuses, so that in making successive applications at different temperatures, as in the use of the Scotch or alternating douche, there may be no delay on account of the time required for heating or cooling the service pipe.

A steam-pipe with service hose and a suitable nozzle supplies the means for the vapor douche when required.

With an instrument of precision of this sort, water may be applied to the body with the same accuracy as electricity is employed by the aid of a galvanometer.

This apparatus has been used by the author and his colleagues in the Battle Creek (Mich.) Sanitarium and its branches in several hundred thousand applications, and has proved to be eminently satisfactory.

In regulating the temperature of the douche it must be remembered that considerable cooling takes place in the column of water while it is passing from the apparatus to the patient. Descantes* showed that in giving a cold douche at 48° F. in a room at a temperature of 72° F., the temperature fell 1.8° in a distance of 3½ meters (11½ ft.). In giving a hot douche under the same conditions, the loss of temperature was 4½°.

1005 Douches are named according to the form or direction of the stream, the part to which they are directly applied, or the organ or set of organs which they are intended to influence.

Douches are classified according to their form, as the *horizontal jet*, *vertical jet*, *fan*, *broken jet*, *vertical rain* or *shower*, *horizontal rain* or *spray*, *filiform*, *percussion*, *circle*, *multiple circle* or *needle bath*, *Scotch*, *alternate*, *massage douche*, *irrigation*.

Localized Douches. Special applications of the douche to particular parts of the body are described under the following names: *Cephalic*, *dorsal*, *lumbar*, *thoracic*, *epigastric*, *hypogastric*, *abdominal*, *plantar*, *perineal*, *anal*.

Visceral Douches. A number of special applications of the douche are described and designated by the names of the organs or internal parts which they are specially designed to influence, as follows: *Cerebral*, *cerebro-*

* Descantes, *Revue d'Hydrologie*, Paris, 1896, p. 51.

spinal, pulmonary, cardiac, gastric, enteric, hepatic, splenic, renal, genito-urinary, articular, muscular.

In some instances the visceral douche is a compound or complex procedure involving several different successive or simultaneous applications, as in the case of the renal and the gastric douche.

The principal applications of irrigation are to the nose, eye, ear, stomach, rectum, colon (coloclyster), bladder, urethra, and vagina.

Physiological Effects.— The douche, combining as it does **1006** both thermal and percussion effects, is essentially an exciting procedure, and is capable of producing the most powerful effects which can be elicited by hydrotherapeutic procedures of any sort.

The precise effects obtained by the application of the douche depend upon (1) the temperature of the water, (2) pressure, (3) duration, (4) form of the stream as determined by the shape of the outlet, (5) whether it is general or local, and if local (6) the part to which it is applied. According to Schüller's experiments,* the temperature of the water employed in the douche, though important, is of less importance than the mechanical effect. The special adaptation of the several forms of the douche to individual morbid conditions will be indicated in connection with the description of the several forms of this procedure.

The douche, like the centripetal stroking of massage, aids **1007** the movement of blood through the heart, and accelerates the current of lymph in the lymph channels, in this action co-operating with the peripheral heart and other normal agencies by which a constant movement of blood through the vessels is maintained. As Winternitz wrote years ago (1882), "The *vis a tergo* of the blood by the *normal rhythmical contraction of the vessels so like peristaltic action*, prevents a retrograde movement." Ludwig has shown that the movement of

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* *Arch. für Klin. Med.*, 1874.

lymph is accelerated by the increase of blood pressure in the capillaries.

The blood pressure of the part upon which the column of water plays is increased under the influence of the douche, and Ludwig has shown that increase of pressure in the capillaries accelerates the movement of the lymph and increases the flow of lymph from the blood-vessels out through the lymph spaces. The douche, like the stroking of massage, accelerates the movement of lymph in the vessels.

The effect of the douche upon cutaneous sensibility differs chiefly according to its duration. The short douche (either hot or cold) increases sensibility of all kinds; while if sufficiently prolonged, the douche, either hot or cold, may diminish all the sensory functions of the skin.

Muscular capacity is increased by the *short cold* douche, as shown by the experiments of Vinaj and Maggiori. In paresis the patient sometimes finds himself perfectly able, after a short cold douche with strong pressure over the affected parts, to control voluntary muscles which previously were almost wholly useless. The hot douche may lessen muscular capacity to one fifth the normal amount.

The reaction effects produced by the cold douche are not necessarily more *vigorous* than those following any other hydriatic application of the same temperature, but are more *immediate.*

008 The interesting experiments of Couette on the effects of different forms of the bath upon the body temperature showed that a short cold douche (5 to 30 secs.) may cause a fall of temperature amounting to half a degree by the end of 20 minutes, after a brief rise of a few tenths of a degree. A cold douche of 3 minutes' duration causes an immediate fall of temperature amounting to nearly 1½° F. within 20 minutes after the douche. The temperature still remains below normal more than an hour after the application of the cold douche, even when vigorous measures to encourage reheating are employed.

The *warm* and the *neutral* douche have no effect upon the temperature.

The hot douche always elevates the general temperature; the longer the bath and the higher its temperature, the greater the elevation.

The form of the bath seems to have little relation to its effect upon the temperature. The controlling factors are the temperature of the bath, its duration, and the amount of exercise following it. Pressure apparently has no effect.* Pressure hastens reaction, but has little or no effect upon metabolic processes. Hence the most important element in the douche is the temperature. Pressure plays an important but secondary rôle.

The general cold douche is one of the most powerful of all tonics. It creates an appetite for food and a disposition to, and capacity for, both mental and muscular activity to a remarkable degree.

The douche encourages both thermic and circulatory reaction to a high degree — thermic reaction because of the rapid cooling of the skin, and circulatory reaction by reason of the massage effect produced by the intermittent pressure of the stream of water upon the cutaneous surface.

In the employment of *non-percutient* hydriatic measures, *temperature* and *duration* are the principal factors to be regulated; but in the employment of the douche, as the horizontal jet, for example, two other factors of importance must be taken into consideration; viz., *volume* and *pressure*. These factors may be controlled in various ways. Pressure is regulated primarily by the elevation of the source from which the water supply comes, or the pressure in the general system with which the pipes supplying the douche apparatus are connected. It may likewise be regulated by valves, by the distance of the patient from the nozzle, and by breaking and partially dispersing the stream by the finger. The volume

*Couette, "Étude Experimentale sur l'Action Thermique de l'Eau Froide en Applications Hydrotherapeutiques."

of the stream in size and form determines to a considerable degree the effect produced as regards the thermic as well as the mechanical effects. The greater the volume, the greater the effect produced, both thermically and mechanically, other things being equal.

1009 **Therapeutic Applications.**— The douche is one of the most universally useful of all hydrotherapeutic measures. In some Continental hydriatic establishments, especially in France, the writer found the douche used almost to the exclusion of every other measure. The *cold* douche is perhaps the most powerful of all known tonics. The alternating douche and the Scotch douche are excitant measures of most extraordinary power. The *warm* or *neutral* douche is decidedly sedative or calmative in its effects. The *hot* or *very hot* douche, with strong pressure, produces exciting effects similar to those of the cold douche, but being often followed by atonic reaction, is inferior to the cold for tonic effects.

Used with little pressure, the hot douche is a powerful analgesic measure, especially when employed in connection with cold, as in the Scotch or revulsive douche. The very hot or revulsive douche is indicated in such painful affections as *sciatica*, *painful rheumatic joints*, *sprains*, *neuralgic affections*, *visceral disease* accompanied by pain, as *chronic gastritis*, *hyperpepsia*, *gastric ulcer*, *congestions* of the *liver* and *spleen*, and in some cases of *pelvic congestion*, and in so-called *inflammation of the uterus* and *ovaries*.

Contraindications.— The douche is contraindicated in cases in which it is desirable to suppress reaction as much as possible, as in *acute inflammation*, and when *acute nervous irritability* or *excitability* exists. Other contraindications are referred to elsewhere (**803–807, 1023**).

THE HORIZONTAL JET.

1010 This is the most useful and generally employed of all forms of the douche; and in this work, when the word *douche* is used without a definite description indicating some particu-

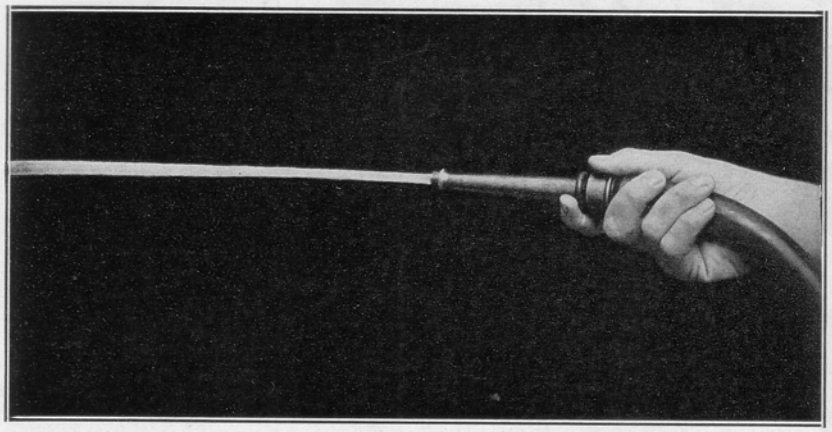


FIG. 33. DOUCHE — Horizontal Jet (p. 433).

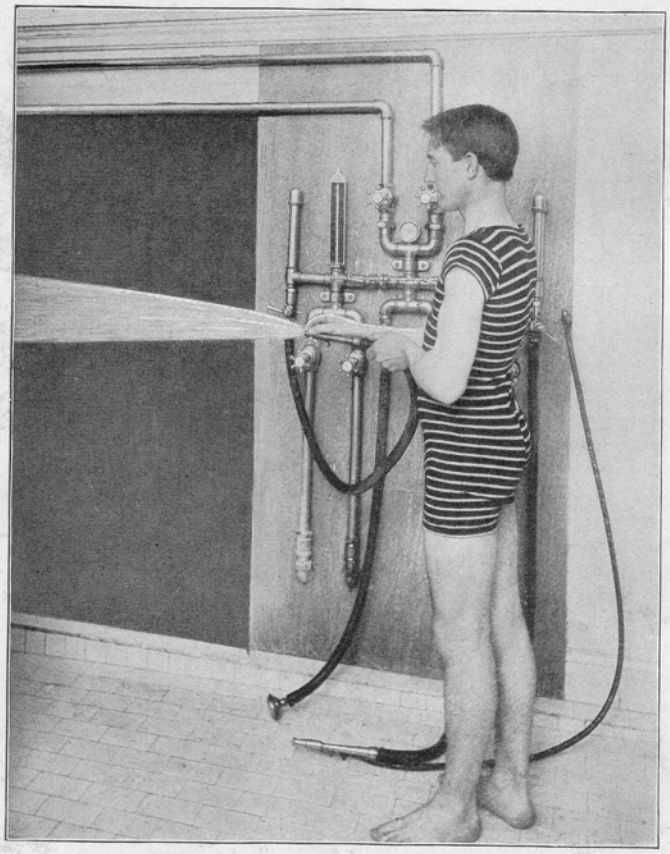


FIG. 34. DOUCHE — Broken Horizontal Jet (p. 434).

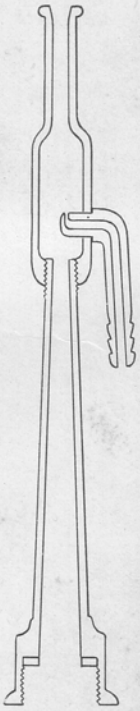


FIG. 35. DIAGRAM OF AUTHOR'S PERCUSSION DOUCHE NOZZLE.

lar form of douche, the horizontal jet is the form of procedure referred to.

The jet douche consists of a single stream, varying in diameter from a millimeter or less (the filiform douche) to an inch or even more. The usual size is about three eighths to half an inch. The horizontal jet is applied by means of a nozzle not unlike that of a garden hose, attached to a piece of rubber tubing two or three feet in length, so as to permit free movement (Fig. 33).

Method.— In administering the horizontal jet, water may be employed at any temperature applicable to therapeutic purposes. The full force of the stream may be used where indicated, or the pressure may be broken, either by adjustment of the pressure-regulating valve or by breaking the force of the stream by placing the end of the finger in the stream near the mouth of the nozzle so as to scatter the column of water to the extent desired. The last-named means of lessening the pressure is always available, and must be used in all general applications in adapting the force of the stream to the different regions of the body.

Lemarchand* employed water at a pressure of ten to fifteen atmospheres, but so great a force is certainly not required for securing the good effects of the douche, and is exceedingly liable to abuse. It is a most excellent thing, however, to have in reserve an ample force for use in any special case which may demand powerful mechanical effects.

The pressure employed may vary from 5 to 50 pounds. Still higher pressures may be employed with proper precautions. The degree of pressure should be carefully measured in each case by the pressure gauge.

To insist, however, that the douche can not be scientifically administered without the pressure gauge is an error; but if the application of the douche is left to nurses or attendants, the pressure gauge is quite essential. In the author's opinion, the employment of so vigorous a therapeutic pro-

* Lemarchand, *Annales de la Société d'Hydrologie*, 1893.

cedure as the cold douche should always be conducted under the immediate supervision of an intelligent person who has been medically trained.

The *broken jet* (Fig. 34) is used over the heart and anterior portions of the chest; to the cervical region; and to all sensitive parts, as over the stomach, liver, bowels, and uterus, in inflammation of these organs; *to inflamed or sensitive points; and over painful nerves.* The *full jet* (Fig. 33), at appropriate pressure, may be used upon the back, arms, legs, feet, and over the liver and spleen when not contraindicated.

The head must be very thoroughly cooled before the douche, and should be protected by a cold towel around the head or neck or both. The jet is usually first applied to the back for a few seconds, then the legs and arms, then over the anterior portions of the body and the liver, ending with a strong dash upon the feet. The whole body may be gone over several times in the manner suggested, each particular region being carefully respected as regards the appropriate degree of pressure, the patient turning around as directed by the attendant.

When the cold douche is employed for other than general tonic effects; in other words, when this measure is used as a means of exciting activity in some special organ, the application should first be made to the back, arms, and legs, then over the part in which it is desired to produce the most pronounced effects, as over the stomach in hypopepsia, over the lumbar region in cases of amenorrhea, etc. At the close of the application, a few aspersions should be made to the whole body, and at the last the stream should be directed upon the feet for 2 to 5 seconds.

When it is desired to protect a congested organ against the inrush of blood produced by a general cold application, the douche should first be applied for 3 to 5 seconds to the reflex area connected with the part concerned, before the general application is made. By this means the blood-vessels of the congested part are strongly contracted before

the general inrush of blood occurs, and thus the part is protected. This practical fact has led to the application of the douche over the liver and stomach first after the back, and before the general application, on account of the almost universal feebleness of these organs and the need of both protecting and energizing them.

In the general application of the douche, it should be remembered that the stream should not be allowed to fall steadily upon one spot, except in case of the *localized* douche, in which a very pronounced effect is required. By constant movements of the nozzle, the stream should be directed upon different portions of the surface in succession, in dashes or aspersions. In a very short application, two or three aspersions will suffice.

When the patient has previously been prepared for the cold douche by a heating process of some sort, which is generally the case, great care must be taken that he does not become chilled by exposure to the cooling effect of evaporation. To avoid this a cold procedure should follow the hot application instantly; or if a short interval must intervene, a few seconds perhaps, the patient must be protected by a warm woolen blanket. If there is the slightest cooling off by evaporation, causing chilliness, or if an interval of a minute or two has elapsed by reason of some emergency, the skin must be thoroughly warmed up again by a hot rain or needle douche before the cold jet is applied. The condition of the patient should be such that the cold water will not be regarded with extreme aversion and dread.

The patient usually stands in taking the douche. If quite feeble, he may sit, or better, may be supported.

The duration of the douche is from 3 or 4 seconds (cold) to as many minutes (hot or neutral). For prolonged applications, other means are, with rare exceptions, better suited.

In many cases it is well to combine the different forms of the douche in an application, beginning perhaps with the warm rain douche, applying the cold fan douche over the

liver, abdomen, and chest, and ending with the full jet to the spine, legs, and feet.

The temperature of the *cold* douche is from 45° to 65°; of the *cool* douche, from 65° to 80°; of the *tepid* douche, from 80° to 92°; of the *neutral* douche, from 92° to 97°; and of the *hot* douche, from 104° to 125°.

The exact temperature as well as the duration must be indicated in each individual case, unless the application is to be made by the physician himself, in which case the immediate effects produced may serve as a useful aid to the knowledge of the case obtained by previous examination. The douche must be regarded as a therapeutic agent of too great power for evil as well as good to permit of careless or routine employment; and the German and French physicians who make use of this potent hydriatic procedure have much foundation for maintaining that no one but a physician can be fully competent to apply so powerful a measure.

1011 **Physiological Effects.**— This extremely versatile hydriatic procedure, though constantly used by Priessnitz and the early empirical hydropaths, was systematized and developed by Fleury about the middle of the present century at his establishment at Belleville, France. Charcot made large use of the douche in certain forms, especially the dorsal, or spinal, douche; and to the use of this simple agent he doubtless owed, in large measure, the successes which gave him a world-wide reputation, not only as a pathologist and an original investigator, but as a medical practitioner. The cold spinal douche is sometimes known as the Charcot douche, though not devised by him. In 1883 and also in 1889 the author found the douche in great use in the hospital Salpêtrière, under the supervision of Charcot, and on visiting this great medical workshop in 1899, he found this and other hydriatic measures occupying a most prominent place in the therapeutics of neurasthenia, hysteria, and all forms of nervous maladies. The same may be said of the hospital Charité and other great centers of scientific medicine in Paris.

The douche is a compound procedure, combining both thermic and mechanical effects. When used in its most vigorous and efficient form, it is capable of producing the most profound effects, both general and local, which can be obtained by any hydriatic measure. It may be usefully employed at all temperatures, and at varying degrees of pressure. It is invaluable both as a general and as a local procedure.

The effects of cold applied in the form of the douche are those which have been described in the section of this work devoted to the physiological effects of water at various temperatures, with the addition of such special features as result from the localization of the procedure, or such modifications as may arise from the special forms in which it may be administered, the combination of thermic and mechanical effects serving to intensify the influence of both these means of impressing the nervous system. The thermic effect may be varied at will by modifying the temperature of the water, while the mechanical effect may be modified by changes in the form and size of the column of water used, or the number of streams employed simultaneously.

Wertheimer* showed that cold applications, as the cold douche to the cutaneous surface, produce vascular changes in the kidney and mesenteric vessels. That similar changes take place in the brain has been demonstrated by Schüller and others.

Carefully conducted experiments made by Storoscheff, of 1012
Moscow, showed conclusively the powerful effects of the cold douche upon metabolism. The consumption of nitrogen was found to be considerably increased; the temperature immediately after the application was lowered a few tenths of a degree and slightly elevated later; respiration during and after the application was lowered eight breaths per minute; the pulse was diminished ten to sixteen beats per minute; the tactile sense was diminished, while the muscular response

* M. Wertheimer, *Académie des Sciences*, 1893, p. 44.

to both the galvanic and the faradic currents was decidedly increased.

The author has undertaken some experiments for the purpose of ascertaining whether or not the last-named effect was the result of increased conductivity of the skin due to saturation with water, or to an actual increase in the muscular excitability. The details of this experiment are given elsewhere (Exp. 54).

1013 The exhaustive researches of Vinaj and Maggiori have shown clearly the remarkable effects of the douche upon the muscles. The cold douche shows by its modification of the fatigue curve an enormous increase of muscular irritability and capacity for work (Exp. 55).

The hot douche produces an effect in an opposite direction even more pronounced, hence its great value in relieving muscular spasm (Exp. 56). The Scotch douche may produce either increase or decrease of muscular excitability and capacity, according to the way in which it is managed.

The rise of blood pressure produced by the cold douche may be followed somewhat later by a diminution in pressure, when the blood-vessels are well dilated by a strong circulatory reaction. This is due to the fact that the influence of the douche upon the surface vessels may endure longer than its effect upon the heart. This is especially true of a very short and energetic application (45° to 55°, at 40 lbs. pressure, 3 to 5 secs.).

The most powerful effects of the douche are produced at from 45° to 60°; time, 4 to 30 seconds. A good working temperature is between 55° and 70°. *The higher the temperature, the longer must be the duration and the greater the pressure required to produce decided tonic effects.* At a low temperature a transient but powerful impression is made upon the skin and through the strong reflexes produced upon the entire organism, manifested chiefly through the thermic and circulatory reactions.

When the douche is administered at a higher temperature (80°), in some instances undesirable nervous phenomena are produced, as headache, lassitude, and imperfect reaction. In such cases it is necessary to educate the patient to the use of low temperatures by very short cold or even very cold applications. **1014**

In the administration of a cold jet douche with strong pressure and an unbroken stream, it will be noted that at the exact point upon which the column of water falls the skin becomes instantly blanched, the color reappearing as soon as the stream is allowed to fall upon some other part. Each time that the water column impinges upon any point of the cutaneous surface, this phenomenon is repeated. The blood-vessels are not only made to contract by the thermic impression of cold water, but the weight of the stream of water, the force of impact, compresses the tissues, and forces the blood out of the vessels, leaving them free to dilate again as soon as the pressure is removed. Thus the tissues are alternately compressed and released; in other words, a veritable massage is produced, whereby the circulation is excited and accelerated; and the thermic effect of the douche is thus materially aided by the purely mechanical or percussion effects of the moving water as really as if friction or percussion movements had been executed with the hand. **1015**

When the pressure employed is sufficient to produce a decided stinging sensation at each point of contact, a powerful reflex effect is produced by stimulation of the various sets of nerves which recognize temperature, pressure, pain, and tactile impressions. When we recall that in addition to the nerves mentioned, the douche, in common with other procedures, influences the vasoconstrictors, the vasodilators, and the sympathetic ganglia of the vessel walls, it is apparent that this procedure excels all others as a means of awakening or controlling local activity in the skin, also, through the wide-spreading reflexes set up by it, of arousing or otherwise impressing metabolic processes and all other vital activities.

The douche is unquestionably the most powerful and most versatile of all hydriatic procedures, and one which may be most readily and perfectly adapted to all conditions and indications. The only disadvantage which can be mentioned is the fact that it can not be administered without apparatus of some sort. In an emergency, some simple device may be adopted, such as allowing water to fall from a height. In the old water-cure at Graefenberg, this was the only form of douche employed. The stream of the principal douche was of the size of the arm, and fell from a height of fifteen feet. The temperature of the water employed was often that of ice-water, or 32° F. But these crude measures were by no means capable of accomplishing the results which may be obtained by the use of the scientific instrument previously described, and for which the world is chiefly indebted to the ingenuity and sagacity of that eminent French clinician and hydrotherapist, Fleury. In the absence of any more convenient apparatus, a greenhouse pump may be used, with good effect.

1016 **Therapeutic Applications.**—The powerful perturbing influence of the cold douche gives to it the very highest value as an alterative and restorative procedure. Under its influence the whole organism is aroused to the highest degree of activity; the intensity of every function is heightened; the whole body is lifted upon a higher plane of being; the vital resistance is increased; digestive activity is augmented, both by increase of motility and by the production of a greater quantity of hydrochloric acid; glandular activity of every sort is quickened; the processes of assimilation and disintegration are hastened; oxidation and elimination are increased; all the wheels of life move with a quickened vigor and regularity. The individual begins to live a more vigorous and vital life, physically, mentally, and we may even say morally.

The versatility of the douche permits its adaptation to every morbid condition. Fleury depended almost wholly

upon this measure in the hydriatic treatment of invalids of all classes, as do the majority of physicians who practice hydriatry in France at the present time. While not underestimating the value of the douche, the author does not share in this extreme partiality to it. Many of the therapeutic purposes for which it is employed by Duval, Beni-Barde, Bottey, and many other leading French specialists, may be more conveniently obtained by the employment of other simple measures requiring no apparatus of any kind. It must be said, however, that the douche is the most powerful and valuable of all tonic measures. There is no drug known to man that is possessed of such marvelous renovating and permanently restorative properties.

As a tonic, the cold douche may be advantageously **1017** employed in almost every case of chronic disease. If not appropriate at the beginning of a course of treatment, the constant aim should be to train the patient, by a series of carefully graduated measures, to a condition which will admit of the employment of the cold douche. This training may be accomplished by a variety of means. In general, it will begin with nonpercutient measures, such as wet-hand rubbing, cold friction, the cold-towel rub, the wet-sheet rub, and the half bath. When the patient's strength and ability to develop strong reaction have been increased to a sufficient degree, the douche may be employed, at first at a moderate temperature, beginning at 75°, or 80°, or even 90° in very extreme cases, and being gradually lowered from day to day as the patient's strength and resistance increase. The pressure is also gradually increased, beginning with 10 or 15 pounds and gradually increasing to 20, 25, or even 40 pounds, and finally reaching that of the percussion douche.

There is room for discussion as to which is the better method of graduating the cold douche,— whether it is better to apply it at first with higher temperature, less pressure, and longer application ; or to employ at once the lowest temperature likely to be used at all, making the application at first

very brief, perhaps not more than 2 or 3 seconds, and gradually increasing the duration from day to day.

It must be admitted that both methods may be employed, and perhaps the two are equally serviceable, provided discrimination is used in their application, and care taken to apply each plan to the class of cases to which it is especially adapted. From the observations which the author has made upon this point, he is, however, of the opinion that in most cases it is better that the patient should begin with cool or cold, but very short, applications, rather than with tepid and prolonged ones, as the cold application, though short, is certain to produce vigorous reaction by the powerful stimulation of the vasomotor centers, while not infrequently a prolonged application of higher temperature results in imperfect reaction and the development of the many disagreeable symptoms which accompany this condition.

In persons suffering from *rheumatism* and *neuralgia*, however, it is evident that the very cold douche can not be employed at the beginning of a course of treatment. This is likewise true of persons suffering from *Bright's disease* of the kidneys, *gastric ulcer*, *locomotor ataxia*, *spinal sclerosis*, and most organic affections of the brain and spinal cord. In these cases it is preferable to begin a course of treatment with very mild non-percutient measures, as the tepid fan douche (90° to 80°) with little pressure (4 to 8 lbs.).

1018 It is in some cases necessary to employ at the beginning of treatment a very much lower pressure (8 to 10 lbs.) than will be readily tolerated after the patient has had the benefit of a few weeks' training. Low pressures (1 to 4 lbs.) are especially indicated in cases in which great *hyperesthesia* of the skin exists, and also in relation to special regions which are the seat of tenderness or pain, as in douches to the joints in *chronic rheumatism*, with much pain or tenderness, to the chest in *intercostal neuralgia*, to the abdomen in *chronic hyperesthesia* of the *solar plexus* and the *sympathetic ganglia*, and to all parts in which much irritability is present.

As nonpercutient measures of training, arranged in the order in which they may be advantageously introduced into the prescription for a feeble patient in training for the douche, the following may be enumerated: Dry rubbing, wet-hand rubbing, cold wet friction, the salt glow, the towel rub, wet-sheet rubbing, rubbing sitz, the shallow bath. Each of the above measures is capable of being graduated to a nicety, and through a wide range of intensity. **1019**

In the majority of cases, the cold douche requires a preliminary preparation of the skin by a short application of heat. When the douche is used for this purpose, a temperature of 104° to 120° may be readily employed; 125° may be tolerated for a few seconds, rapidly moving over the surface treated. **1020**

It is apparent that the douche may be advantageously combined with a variety of other hydriatic procedures, especially such as produce heating effects, as the heating or sweating pack, the electric-light bath, the vapor, Turkish, Russian, and hot-air baths, the immersion bath, the hot immersion bath, fomentations to the spine and abdomen, the hot enema, etc. It forms a fitting conclusion for any heating procedure in which its mechanical effects are not contraindicated.

No other therapeutic agent is of such value as the cold douche in the treatment of *neurasthenia* in most of its forms. In nearly all chronic cases the cold douche sooner or later becomes the sheet-anchor of treatment. In *chlorosis* and all the curable forms of *anæmia*, the cold douche daily wins successes in scientific hydriatic establishments when iron and all the other usual remedies have failed.

As a general awakener and regulator of *nutrition*, the cold douche has no equal; and it is also unrivaled as a curative agent in *chronic atonic dyspepsia* or *hypopepsia*, and in most cases of *chronic toxemia* from chronic infections of the alimentary canal. It may even be employed, after careful training, and with the exercise of great care, in quite a large proportion of cases of *cardiac insufficiency* and *renal disease*,

In *chronic inebriety*, and in the treatment of the *opium* and other *drug habits*, cold water holds a high place, not simply as a means of aiding escape from the thraldom of the drug, but especially as a means of building up the patient's vital resistance, restoring the tone and equilibrium of his nervous system, and establishing a condition of perfect health and independence of narcotic or stimulant drugs of any kind, and so removing the excuse and temptation to relapse.

The cold douche may be used to relieve *insomnia* due to cerebral congestion. It acts by producing powerful derivative effects toward the lower extremities when reaction is established, and also through reflex contraction of the cerebral vessels, from stimulation of the rich network of vasomotor nerves distributed in the plantar region of the foot.

1021 In the administration of the cold douche to relieve *cerebral congestion* the following method is to be recommended: —

A thick, dry woolen sheet is wrapped about the patient, being drawn tightly about the neck so as to protect the body. Standing in a foot bath of hot water (104° to 110°), he bends forward while one to two gallons of water at 60° is poured upon the vertex of the head and the back of the neck. A towel wet with water at 50° is then wrapped about the head, and the patient stands erect while the cold broken jet or spray douche is administered to the feet from half a minute to two minutes. If an apparatus for the administration of the plantar douche is not at hand, the patient, standing with his face toward the attendant, turns half around at intervals of 15 to 20 seconds, and raises first one foot and then the other so as to receive the force of the stream upon the plantar surface of each foot for about 10 seconds. The application to the dorsum of the feet and to the ankles is then continued as before, thus repeating for 1 or 2 minutes.

1022 A short cold douche (10 to 30 sec.) or a very hot douche (110°–122°) of the same duration may be advantageously employed in cases of *hysterical anesthesia.* The

douche often has the effect to transfer the anesthesia to the opposite side.

The cold douche is equally useful in *hysterical hyperesthesias*, though in such cases the application should be made to the symmetrical part of the opposite side of the body ; as, for example, if the hyperesthesia is in the right leg, the douche should be applied to the left leg. It is well to apply the hot douche or fomentation to the affected limb at the same time that the cold application is being made to the sound part.

The general cold douche administered while an ice-bag is applied to the throat is a valuable measure in *hysterical aphonia*. In *hysterical paralysis* of the lower extremities the cold douche at 50° may be applied to the dorsal and lumbar spine with advantage. Strong pressure may be used, but the stream should be small. The parts should be well rubbed with flannel after the application.

Contraindications.— Care must be taken to avoid the 1023
employment of the cold douche in all cases in which an active inflammation exists, and especially in cases of inflammation of the *uterus*, *ovaries*, *kidneys*, *stomach*, *liver*, *bladder*, or *bowels*.

In many cases of so-called *chronic inflammation*, as *intestinal catarrh*, *myelitis*, *chronic gastritis*, *cystitis*, and *general neuritis*, the cold douche *must be avoided.* The cold douche is of high value, however, in cases of *passive congestion* of the *liver*, *stomach*, *spleen*, and *other viscera*.

In *acute rheumatism* the cold douche is contraindicated, and may even be dangerous; but in *chronic rheumatism*, after proper training, it may be employed with benefit for constitutional effects. Special care must be taken to avoid the use of the cold douche in cases of *arteriosclerosis*, *apoplexy*, *valvular disease* of the *heart* with *deficient compensation*, *cardiac insufficiency* from *fatty degeneration*, *renal disease*, or from any other cause when marked in degree. In *acute* or *chronic nephritis;* in *painful nervous affections*, as *sciatica*, *locomotor ataxia*, *multiple neuritis*, in *hyperpepsia*,

and in *gastric ulcer;* in *varicose* conditions of the *portal* or *mesenteric veins,* such as sometimes accompany *hepatic sclerosis;* and in cases of extreme general *nervous irritability,* the cold douche must be avoided. The douche at all temperatures is contraindicated in *eruptive disorders* of the *skin,* and in *hyperesthesia* and *neuralgia* of the *skin.* Heggelin has pointed out the danger of pulmonary hemorrhage during the cold douche in persons liable to this accident, on account of the temporary rise of pressure in the left auricle, and stasis of blood in the lungs. General cold applications of all sorts must on this account be avoided in these cases, but such partial applications as cold friction and the cold-towel rub may be employed at any desired temperature.

THE HOT DOUCHE.

024 The temperature of the water employed may vary from 100° to 130°. The duration varies from 15 or 30 seconds to 4 or 5 minutes. Very strong pressure is less essential than with the cold douche, as its effects depend almost wholly upon the thermic impression. As the hot douche is very largely used for the relief of pain, little pressure is commonly employed. When water at a very high temperature is used, as 120° to 125°, care must be taken to keep the nozzle in constant motion, so that the stream shall not fall constantly upon the same spot. By this means the accumulation of heat at any one point is prevented, and a most powerful sensory impression is made without injury to the tissues.

In the use of the very hot douche the application should be begun at a nearly neutral temperature, as 100° to 102°, the temperature being gradually but rapidly increased, reaching the highest point in from 30 to 60 seconds. Too much time must not be lost in the graduation, otherwise the maximum effect for the time specified will not be obtained. The patient's sensations are a reliable guide. The temperature should be raised as rapidly as possible without producing a

decidedly painful sensation, thus causing excessive nervous excitation. In order to give the best effects in relieving deep-seated pain, the temperature must at the end be high enough to cause a slightly painful sensation.

Physiological Effects.— The general hot douche is a very 1025
exciting procedure. Its physiological effects are very similar to those of the hot immersion bath, with the addition of mechanical effects. Excitation of the vasomotor centers is produced by the impact of the water when considerable pressure is employed. The blood pressure is on this account increased instead of being lowered, as in the hot immersion bath. The immediate effects of a *very hot* douche are in many respects similar to those of a cold douche, except that they are transient, and followed by an atonic reaction. The hot douche is thus at first excitant, later relaxing, depressant, or sedative.

The very hot douche is one of the most exciting of all hydrotherapeutic measures. The nature of the application permits of the employment of a temperature higher than can be employed with the immersion or other forms of the bath in which a thermic impression is made upon the entire surface at the same instant, so that the nervous impression produced is greater.

The duration of the hot douche is usually too brief to produce any very marked effect upon metabolic processes, but it produces very prompt and decided effects upon the circulatory and nervous systems. When the temperature is sufficiently high to cause slight pain, a very brief contraction of the small vessels occurs at the beginning of the application. This effect is the more pronounced the greater the pressure employed. This contraction is almost instantly followed by dilatation of the vessels, causing a very pronounced passive congestion of the skin, which at once assumes a dusky or cherry-red hue. If the application is very short, this redness quickly disappears, but if prolonged and at a high temperature, there is paralysis of the vessels, which persists for a very consider-

able length of time after the conclusion of the application. This is not an active but a passive or paralytic dilatation of the vessels, and is quite different from the active dilatation produced by a cold douche.

1026 At the beginning of a very hot douche, the heart action is slowed; later, it is quickened. This preliminary slowing of the heart is due to the contraction of the surface vessels, which is greater in proportion as the pressure of the douche is increased. This quickened action results from the powerful sensory impression made upon the cutaneous nerves, and the storm of reflex impulses sent in upon the nerve centers in consequence. The heart shares in the general excitation, and by its greatly increased activity the blood pressure is temporarily raised by the rapid filling of the arteries, in spite of the passive dilatation of the small vessels. There is a rapid fall of pressure, however, soon after the conclusion of the application (Exp. 57).

Simultaneously with the passive dilatation of the surface vessels there is a mechanical contraction of the vessels of the interior of the body. The withdrawal of one third to one half of the entire blood of the body into the vessels of the skin necessarily leaves the vessels of the brain and the viscera in a depleted condition.

1027 It should be remembered, however, that when very hot applications are made to the skin, the excitant effects upon the heart and brain are such as to cause at the first a very decided cerebral congestion. This was well shown by Max Schüller in his experiments upon trephined rabbits in 1874. In his experiments the very hot immersion bath was employed. This congestive effect is doubtless due in part to the preliminary contraction of the cutaneous vessels, but that it is not wholly due to this cause is evidenced by the fact that it continues much longer than does the vasoconstriction referred to, and disappears only when the temperature of the application has been very considerably lowered. The cerebral congestion accompanying a very hot application must

be due, then, to the reflex excitation of the brain and heart and the elevation of blood pressure.

A knowledge of these facts sufficiently emphasizes the necessity for protecting the head when a very hot douche or other general application is to be made by a thorough cooling of the head, face, and neck, and the application of a cold towel to the head or neck, or both.

The effect of the hot douche upon the central nervous system is at first excitant, but this state is quickly followed by a very pronounced sedation and relaxation.

Therapeutic Applications.— For simple revulsive effects 1028
by excitation of the circulation of the skin, the hot douche from 1 to 5 minutes at a temperature of 100° to 125° gives excellent results. Ordinarily, water at a temperature from 104° to 110° should be employed, the duration being 3 to 5 minutes.

The most vigorous effects of which the hot douche is capable are produced by raising the temperature until the limit of endurance is reached. Few persons can bear a temperature much above 120°, but by taking care not to allow the column of water to fall for more than an instant upon the same spot, a temperature of 124° or 125° may be reached in most cases, and 130° may sometimes be attained. Applied in this manner, the hot douche acts vigorously upon both the blood-vessels and the nerves of the structures subjected to its action, and produces most powerful revulsive and derivative effects.

The general hot douche is most frequently used as a preparation for the cold douche, as in the general Scotch douche and the alternating douche. It should be employed before the cold douche whenever the patient feels an instinctive dread of the contact of cold water, when the skin is cold or the patient inclined to shiver, and especially when the patient has had a prolonged cold application, or when a hot application has been made and the skin has afterward been cooled by evaporation, as during an accidental delay.

The general hot douche, with very slight pressure, is exceedingly useful as a means of relieving *general superficial pain*, *hyperesthesia*, *neuralgia*, and *paresthesia*. It is, in some cases, valuable in relieving the distressing irritation of *pruritis*, *urticaria*, and *jaundice*. A very hot general douche (110° to 122°, 15 to 30 secs., 30 to 40 lbs.) may also be used with advantage in a relaxed condition of the skin accompanied by general and copious perspiration occurring without excitation by heat or exercise, as frequently observed in *neurasthenics*.

1029 The hot douche applied at a very high temperature and of very short duration, may sometimes be employed with excellent advantage in cases which can not tolerate cold applications because of unpleasant after effects. For an application of this sort, a temperature of 110° to 122° is required, and the duration should not be more than 5 to 10 seconds (30 to 40 lbs.). This application is useful in depressed conditions, such as occur in *advanced cardiac* and *renal disease*. Care should be taken to avoid the precordial region in cardiac cases, and the application must not be extended much beyond the time named.

1030 Lemarchand * maintains that equally as good tonic effects may be obtained with the very hot douche (122° F.) as with the cold douche, and notes that it may be tolerated in a great number of cases in which cold water can not be employed, and without the inconvenience of the laborious process of training the patient to the use of cold water. He finds the very hot douche always well borne, and declares that it "concedes nothing to the cold douche" in its value and efficiency. For tonic effects the highest pressure available should be employed. For the best results, a pressure of 35 to 45 pounds is required.

The very hot douche is an excellent excitant measure in cases of *exhaustion* from prolonged or violent exertion. For

* Lemarchand, *Ann. Soc. d' Hydrol. Med.*, Paris, Compt. rend. 1892–93, XXXVIII, 247–275.

such a purpose the application must be greatly prolonged, and should be administered with a considerable degree of pressure (30 to 40 lbs., 1 or 2 secs.).

The general hot douche, as well as the hot-blanket pack, the hot full bath, and other general hot applications, is an *antidote* for an *excessive* application of *cold* which may have been made through inadvertence or as the result of lack of acquaintance with the exact physical condition of the patient or his individual susceptibility. This fact may be borne in mind with great profit by those who are inexperienced in the employment of hydriatic procedures.

In connection with the cold douche, the hot douche may be employed in such a manner as to relieve *pain* or *congestion*, to excite *physiological activity*, or to control a *morbid process* which may be present, according to the methods of application, which will be explained under the respective headings, "The Revulsive Douche" (**1041**) and "The Alternating Douche" (**1044**).

THE NEUTRAL DOUCHE.

Temperature, 92° to 97°; duration, 2 to 30 minutes; **1031** pressure, from 2 to 20 pounds, according to the effect desired. The ordinary duration of the general neutral douche is from 3 to 15 minutes, pressure, 5 to 20 pounds. Care must be taken to cover the whole surface as completely as possible, so as to prevent cooling by evaporation. When used for simple quieting or sedative effects, the pressure should not be more than 5 to 10 pounds; when employed for derivative effects, that is, to dilate the surface vessels, and so contract the vessels of the brain by displacement of blood to the surface, considerable pressure may be employed; but the pressure should not be so strong in irritable cases as to produce an undesirable excitant effect.

For purely sedative effects, the rain or fan douche should be employed; for derivative effects, the stronger mechanical properties of the full jet may be utilized with advantage.

1032 **Physiological Effects.**— The mechanical effect upon the skin causes widening of the cutaneous vessels, an effect resembling ordinary circulatory reaction from other hydric applications, but without thermic effects either tonic or atonic, and without marked reflex influence, so that the central nervous system is little influenced. The congested brain is thus drained of blood, and at the same time not disturbed by a storm of sensory impressions, as in the hot or the cold douche. The physiological effects of the prolonged neutral douche are essentially the same as those of the neutral immersion bath. This procedure, like other applications of the same temperature, decidedly lessens the muscular tone and capacity. It is on this account well adapted to cases in which there is a decided tendency to muscular cramp or convulsions.

1033 The effects of the neutral douche differ from those of the neutral immersion bath chiefly in the fact that the decided mechanical effect serves to increase the efficiency of the application as a means of increasing the volume and movement of blood in the skin, thus relieving the brain and the thoracic, abdominal, and pelvic viscera. Another advantage of the neutral douche over the neutral full bath is the fact that its action is considerably more rapid than that of the full bath, so that the same results may be obtained by a shorter application. This is a decided advantage in many cases of insomnia, and especially in the treatment of cases of seminal weakness and other forms of genito-urinary irritation of spinal origin. This increased rapidity of effect is doubtless due to its power to decongest the central nervous system. A neutral douche of 5 minutes' duration is equal in effect to a full bath of 30 minutes.

The neutral douche offers an advantage over the hot and the cold douche as a derivative measure in that it is capable of producing physiological congestion of the skin without provoking a preliminary congestion of the brain and internal viscera, and without exciting thermic reaction.

1034 **Therapeutic Applications.**— The application of the neutral

douche (92° to 97°) to the back, along either side of the spinal column, is one of the most effective means of quieting *reflex excitability of the spinal centers*. For this purpose, the application should be somewhat prolonged, usually from 4 to 6 minutes, or even 2 or 3 minutes longer. This effect of the neutral douche renders it of great service in the treatment of *St. Vitus's dance*, *locomotor ataxia*, the irritable spine of *neurasthenia*, certain genito-urinary disorders due to irritation of the genito-urinary center, as *nocturnal enuresis*, *seminal weakness*, *vesical irritation*, some cases of *vaginismus*, and *erotomania* in both sexes.

The neutral douche is very useful in general *nervous irritability* as a means of relieving *hyperesthesia* of the skin, *dermalgia*, the itching of *pruritis* or *jaundice*, and general *paresthesias* of various sorts. In all cases in which excessive nervous irritability is present to a marked extent, the application should be made with as little pressure as possible.

(See paragraphs **614** and **1130** for further remarks upon the neutral bath, one of the most useful and interesting of hydriatic measures.)

THE PERCUSSION DOUCHE.

1035 As the special characteristic of the douche is the percutient effect produced by it, it occurred to the author some years ago (1883) to undertake to improve this hydriatic measure by the development of means whereby its one special characteristic property might be intensified so as to increase the range of its capabilities, especially in cases in which only a low or at most a moderately strong pressure can be obtained from the general water supply. As the result of a dozen years' experimentation, at intervals, an apparatus was perfected which accomplishes this in an admirable manner. An air current under pressure is led into a specially constructed nozzle, near the orifice. This device is shown in the accompanying cut (Fig. 35). The effect of the combination of air

and water is to break up the single column of water into a series of short columns, which are projected upon the surface of the skin with any degree of force desired, each separate mass of water receiving from the expanding mass of air behind it an addition to its initial pressure, just as it issues from the mouth of the nozzle. By regulating the relative pressures of the air and the water, any desired form of the water column may be obtained, from a widely scattered shower, with large drops, or even the *fog douche* to a compact stream, which, falling upon the skin, creates the impression of a fusillade of water bullets, which may be compared to the stream of lead bullets from a Gatling-gun (Fig. 36).

The solid stream of the ordinary horizontal jet produces a more or less constant pressure. If means are adopted to diminish this solidarity, as in the so-called broken jet, the result is greatly to diminish the force with which the water is projected upon the surface; but in the percussion douche, the stream is broken, while at the same time its force is augmented to such an extent as to produce, if desired, a decided stinging sensation as the flying particles of water impinge upon the skin.

1036 The observations which have been made respecting the modes of application and the physiological effects of the horizontal jet in ordinary form, apply equally to the percussion douche. The special advantages which it offers are these:—

1. More powerful effects can be obtained with the ordinary form of douche at the pressure available because of the stronger percutient effects. This remark applies especially to the circulatory reaction produced. Strong percussion of the skin alone will produce strong circulatory reaction, as in slapping the skin with the hand. When the percussion douche is applied with sufficient force, a marked tingling or smarting sensation is produced, as in dry percussion, and the skin is very quickly reddened. Thus the blood supply of the skin is increased, the thermic impression is accordingly

intensified as more heat is abstracted, while the evil effects of the prolonged retrostasis resulting from a nonpercutient general cold application are almost altogether avoided. As the application progresses from one part of the body to another, a reddened, congested skin surface is left behind.

2. The stunning effects of the hydriatic fusillade, which, by means of the percussion douche is made to play upon the skin, render it possible to employ water at a lower temperature than can be employed with the ordinary form of the douche with the same water pressure, thus securing better reaction and more pronounced tonic effects.

3. The very pronounced percutient action renders it possible to obtain by this means excellent and decided effects with water at a higher temperature than is required with the ordinary jet douche,—a fact of great value in the treatment of a very large class of neurasthenics, who, not having been accustomed to cold bathing, are exceedingly rebellious to the application of very cold water.

4. The force and form of the douche can be instantly controlled to suit the will of the operator, without modifying the volume of the water column, by slight adjustment of the nozzle itself held in the hand of the operator.

Therapeutic Applications.—The percussion douche is useful and is indicated in all cases in which the full jet douche can be employed. It is the author's practice to employ it in connection with other forms of the douche in general applications, administering the percussion douche to the back and legs.

The percussion douche to the spine at a temperature of 65° F. is a most admirable tonic measure for phlegmatic neurasthenics. The percussion douche at 45° to 55° is one of the most powerful of all means whereby the central nervous system may be energized. The tissues of the back are supplied with nerves from each of the ganglia of the spinal cord, so that the entire cord is represented in this small portion of the body surface. The area of skin covering the back

being small compared with the entire cutaneous surface, applications at a much lower temperature and at a much higher pressure can be made than when the entire skin surface is involved. The general retrostasis which results from the application of cold to the entire body surface and the resulting internal congestion are avoided, and reaction is assisted by the activity of the circulation in the general cutaneous surface. It is thus possible by means of the cold percussion douche to the spine not only to influence the entire spinal cord, but to bring to bear more intense applications than can be tolerated by the general surface. This fact gives to the dorsal percussion douche a high value in the treatment of all forms of disease in which it is important to energize the motor or vasomotor centers of the spinal cord. It is especially useful in *neurasthenia* and *hysteria*, in paralytic forms of *writers' cramp*, in *Raynaud's disease*, in *chronic intoxications*, and in *hypopepsia*, *enteroptosis*, and *constipation*.

The *neutral* percussion douche is valuable as an application to the hips for producing collateral hyperemia to relieve neuralgia of the pelvic viscera when hot or cold applications are too exciting.

By the use of water at a neutral temperature (92° to 96°) powerful circulatory reaction can be produced with no thermic reaction, a point of great value in the treatment of affections requiring suppression of thermic effects, such as the lightning pains of *locomotor ataxia*, *spinal neuralgia*, and the *hyperesthetic* states of the *sympathetic ganglia*, which are responsible for a host of obscure *reflex pains* and *paresthesias*.

The *hot* percussion douche is less often of service than the same procedure applied at a temperature of 55° to 70°; but it may be very useful in cases in which it is desirable to produce analgesic and derivative effects with strong circulatory reaction, as in applications to the legs in *asthma*, to the lumbar spine in *lumbago*, to the thigh in *sciatica*, over

the liver in the passive *hepatic congestion* accompanying the malarial cachexias and so-called bilious dyspepsia, ascites, rheumatic joints not sensitive to pressure, loss of normal sensibility in *paraplegia*, *hemiplegia*, and *spinal sclerosis*, and to relieve the lightning pains of *locomotor ataxia*.

The hot percussion douche may also serve a most excellent purpose in the treatment of a certain class of neurasthenics who have a natural dread of contact with cold water. It is true that this dread can in most cases be overcome by a little patient training and systematic lowering of the temperature of the bath from day to day; but many patients have neither the patience nor the fortitude to endure this training process, and are likely to break down in the midst of it, and suspend their visits before the point has been reached at which tangible good results may be expected to appear. In such cases the *very hot* general percussion douche (110° to 125°) may be employed for tonic effects, and with most satisfactory results. After a few days or weeks, the graduated Scotch, and finally the cold douche may be employed.

THE SCOTCH DOUCHE.

The Scotch douche consists in the application of hot 1037
water followed by a short cold application. Any desired form of douche may be employed. The hot application must be relatively long (1 to 4 min.), and the cold application must be short (3 to 30 secs.). Employed in this way, the effect of the cold application is to greatly intensify the derivative or revulsive effect of the hot water, and to increase its duration. The application may be general; that is, applied to the whole surface, or it may localized, according to the effect desired.

The Scotch douche in many cases follows a sweating application of some sort, especially in dealing with cases of sciatica, rheumatism, gout, dropsy, and neuralgia, particularly when accompanied by general toxemia or obesity. The vapor, Turkish, Russian, or electric-light bath may be used for the preliminary heating of the skin, or a general hot rain

douche may be employed. The best of all means is the electric-light bath so arranged as to permit the employment of the douche while the patient is exposed to the heat rays (**832**). Next to this in efficiency is the Russian bath and the cold rain douche in combination (**831**).

In the Scotch douche the stream may assume any form, as the jet, fan, spray, rain, or percussion douche; usually the fan or spray douche is employed.

The cold application should follow the hot instantly, with no interval whatever, as a wet surface is rapidly cooled by evaporation, so that the heating effect produced by the hot application may be in large part destroyed in an interval of exposure lasting only a few seconds.

When employed for general tonic effects,—its most common application,—the purpose of the Scotch douche is to serve as a means of training the patient to the application of the cold douche. The purpose of the hot application is in many cases to warm the skin so as to prepare it for the succeeding cold application. It is especially useful in cases of feeble persons who are not able to take a sufficient amount of exercise to accumulate the heat necessary to secure prompt and complete reaction. The warm or hot rain douche (98° to 106°) is admirably adapted for this purpose. The duration should be 1 to 3 minutes, as may be required. The patient's sensations must generally determine the duration. The temperature and duration should be such that the patient becomes thoroughly warm, and feels that the contact of the cold water will be agreeable.

Care should be taken to allow the water to fall upon the arms and legs, as well as upon the shoulders, so as to thoroughly warm the extremities. To avoid overheating the head, the hair should be thoroughly saturated with cold water, and the head protected by a thick towel saturated with water at 60°. In neurotic patients who have a decided tendency to cerebral congestion, it is in some cases necessary to place about the neck a towel wet with cold water (60°).

For the cold application the best effects are obtained by the full jet to the arms and legs, the broken or fan jet over the chest and abdomen, and the percussion douche to the back. In very sensitive patients, the spray or the fan douche may be employed instead of the horizontal jet until the patient has been trained to more vigorous measures. The temperature of the cold application must be adapted to the patient's condition. When purely tonic effects are desired, the temperature should be as low as the patient can endure,— from 65° to 50°, duration 5 to 20 seconds. In cases in which very cold applications are contraindicated (**636**, **803**, **1023**), higher temperatures may be employed (70° to 85°), and the duration must be extended from 20 to 60 seconds. The higher the temperature, the longer should be the duration of the cooling application. It is also important, when the temperature is elevated, to increase the presure, in order to secure good circulatory reaction.

The Graduated Scotch Douche. Although the Scotch douche depends for its effectiveness upon the transition from heat to cold, it is not essential that this change should be abrupt; yet the more sudden the change, and the greater the extremes of temperature employed, the more pronounced will be the effects. In persons who can not endure a sudden change from heat to cold, the temperature may be gradually lowered, occupying from half a minute to a minute in the transition.

In some cases in which there is great susceptibility to thermic changes, the application should begin at a temperature near that of the body (100°). The heat of the application is gradually increased until a temperature of 110° to 120° is reached, held at this point for 2 or 3 minutes, or longer if necessary, then gradually but rapidly reduced to the minimum temperature desired.

With very sensitive patients it is better at first to make the extremes of temperature not greater than 20° to 30°; but this limit may be gradually extended from day to day until a difference of 40° or even 50° is reached.

The most pronounced effects are produced by managing in such a manner as to make the applications to the skin at extremes of temperature as great as possible. The method of gradual transition is to be employed only in cases in which this less vigorous measure is positively indicated.

The Simultaneous Scotch Douche.

The simultaneous application of hot and cold water possesses, in certain cases, very decided advantages, as has been mentioned elsewhere in the discussion of the hot and cold compress (**1290, 1356**). The principles defined in the paragraphs referred to apply equally well to the simultaneous application of the douche. This mode of applying the douche, which, so far as the writer knows, he was the first to employ and call attention to, is especially applicable to cases in which ordinary cold applications are badly borne or wholly intolerable because of some individual idiosyncrasy. In certain neurasthenics, the dread and apprehension of cold water is so great that the patient will not allow an application at a sufficiently low temperature to produce any decided tonic effects, even after a hot application. This is especially true of neurasthenics in whom paresthesias of various sorts are particularly common, affecting chiefly the temperature of the nerves, and manifested by subjective chilliness or coldness of the arms and legs, of the skin between the shoulders, and of other parts. In such cases it is often possible to administer with benefit a strong percussion dorsal douche simultaneously with a rain douche at 100° to 102°. By a little training the general cold douche may, with careful management, be administered in these cases. While receiving the warm rain douche, the patient projects from the area of the falling streams, different parts of the body in succession, to receive the cold application, until the whole body has been gone over. The duration of the application upon each part should be 2 to 5 seconds, and if desirable, the intensity of the application may be increased by rapidly going over the whole surface two or even more times. By

this method the entire surface of the body, with the exception of the part to which the cold application is being made, is under the influence of the warm douche. This renders impossible general chilliness with retrostasis and the resulting general vascular and nervous disturbances connected therewith, which follow general cold applications to the surface, and which in sensitive persons follow the application of cold to a small area even, as the chest, abdomen, back, or a hand or foot. At the same time the whole surface is acted upon by the cold douche, and thus each nerve center in the body is successively excited by reflex influence through the impressions made upon the skin, and so a general tonic and restorative effect may be secured.

This method may be adopted as a means of training sensitive patients to the application of cold water. It resembles in principle the combined cold shower and Russian bath (**831**), and the combined cold douche and electric-light bath (**832**).

Special forms of the simultaneous Scotch douche which may be advantageously employed are the following: —

1. *The Dorsal Cold Douche (65° to 80°) Combined with the Abdominal Hot Douche (106° to 125°).*— This measure is chiefly useful in the treatment of chronic congestive conditions of the stomach, liver, intestines, and spleen, accompanied by pain. The duration of the application should be 5 to 20 minutes. The prolonged cold application to the spine causes contraction of the visceral vessels by reflex stimulation of the vasomotor centers, while the hot application to the abdominal wall produces a collateral hyperemia, whereby the amount of blood entering the mesenteric vessels and the portal circulation is diminished, thus simultaneously bringing to bear upon the congested viscera two powerful means of relieving the morbid condition present. The analgesic effect of the hot application renders tolerable the cold dorsal douche in cases in which its use would otherwise be inadmissible. Applications of this sort should be made with the patient sitting

upon a stool. The pressure should be moderate, 5 to 15 pounds. This application may be usefully employed in cases of *chronic gastric catarrh*, *chronic intestinal catarrh*, *hyperesthesia* of the *lumbar ganglia* of the abdominal sympathetic, *hepatic congestion*, *splenic congestion*, *renal congestion*, and *enteroptosis*, especially if pain is present.

2. *The Cold Lumbar and Hot Hypogastric Douche.*— The method of application of this douche is the same as that described for the preceding, except that it is localized upon the lumbar and sacral spine and the hypogastrium. This procedure is especially useful in cases of *chronic pelvic congestion*, so-called *metritis*, *ovarian congestion*, *chronic inflammation* of the *tubes*, and atonic conditions of the pelvic viscera accompanied by *passive congestion* and *pain*. It is contraindicated in cases in which acute inflammation or suppurative processes are present.

3. *The Combined Spinal Douche and Hot Douche to the Feet.*— The cold percussion douche is applied to the spine simultaneously with the hot douche (110°–122°) to the feet and legs. The fan or spray douche may be employed for the hot douche to the feet. By this procedure, it is possible to apply a very cold (50°–60°) percussion douche to the spine, even continuing it 30 to 60 seconds, in cases of very sensitive persons who have little power to react and yet who require the powerful nerve stimulating effect of the cold spinal douche. This is one of the most effective measures which can be employed in many cases of neurasthenia. It is especially applicable to cases in which the general cold douche alone can not be tolerated. The application should end with two or three quick applications of cold water over the entire surface of the body, and the application of the cold spray to the feet and legs for two or three seconds.

4. *The Symmetrical Combined Scotch Douche.*— In certain hysterical cases, especially in *hyperesthesias* affecting one side of the body, a transference of the affection to the opposite side and a rapid mitigation of the symptoms may be effected

by the simultaneous application of the hot douche to the affected part and of the cold douche to the symmetrical part of the opposite side of the body. By the daily application of this measure, the nutrition of the affected part may be improved, and with the improvement of the general health secured by general tonic measures, the symptom may be made gradually to disappear.

Physiological Effects.— The physiological effects produced **1038** by the Scotch douche combine those of both the very hot and the cold douche, though not in their entirety. The hot application causes passive dilatation of the cutaneous vessels, with increased heart action and elevation of blood pressure, with a reflex influence in general tending to atonic reaction. The cold application slows the heart, augments the blood pressure, converts the passive dilatation of the surface vessels into an active dilatation, and by reflex influence produces a tonic reaction in which every cell and fiber of the whole body participates, provided the intensity of the cold application is such that the tonic effect produced by it more than counterbalances any atonic effects of the hot application.

It thus appears that very versatile effects may be produced by the Scotch douche, according as the hot or the cold impression is dominant. Upon the exact balancing or regulation of the effects of heat and cold this bath depends for its special physiological and therapeutic properties. If so managed that the cold application is dominant, the preliminary heating being just sufficient to warm the skin and prepare it to react to the cold douche, the effects are excitant, or tonic, and correspond exactly to those of the cold douche. The brain and viscera are, however, protected to some degree by the preliminary congestion of the skin, so that the retrostatic congestion of these organs which immediately follows an ordinary cold application, is less marked and of much shorter duration,— a fact of great practical importance in dealing with cases requiring tonic cold applications, while complicated with chronic cerebral, hepatic, articular, and other

internal congestions. The physiological effects of cold are dominant when the concluding cold application is continued for a sufficient length of time to cause pallor of the skin, chilliness, and the thermic reaction of cold. To produce such effects, the cold application must continue for 30 or 40 seconds, or even longer, unless very cold water is employed.

When the cold application is brief (5 to 10 secs.), producing neither shivering nor other evidence of refrigeration, no tonic thermic reaction occurs. The reaction is purely circulatory, and hence derivative or sedative rather than tonic in character. A very brief cold application (1 to 3 secs.) after a hot application of ordinary length may leave the body under the atonic or depressing influence of the hot application. Such an effect as this is rarely desirable, except when it may be necessary to counteract to a partial extent the depressing effect of a long hot application employed for analgesic or derivative effects, but in which the excitant effects of cold are undesirable, as in acute or subacute sciatica, ovarian neuralgia, enteralgia, or spinal neuralgia.

In many cases it is desirable to balance exactly the hot and cold effects; the method of accomplishing this will be explained under the heading, "Revulsive Douche."

1039 **Therapeutic Applications.**— The therapeutic uses of the Scotch douche are even more general than those of the cold douche. It may be used in all cases to which the cold douche is applicable, as the hot douche preceding the cold only intensifies the effect of the latter, when rightly managed, and can be employed in many cases in which the cold douche could not be utilized, either because the patient will not submit to the application or because his system is unable to react to cold without the preparation afforded by the preceding heating procedure.

The merits of the Scotch douche in a variety of morbid states have been energetically championed in France by Lemarchand.* The author has found the Scotch douche

* Lemarchand, *Ann. de la Soc. d' Hydrol. Med.*, Paris, 1893.

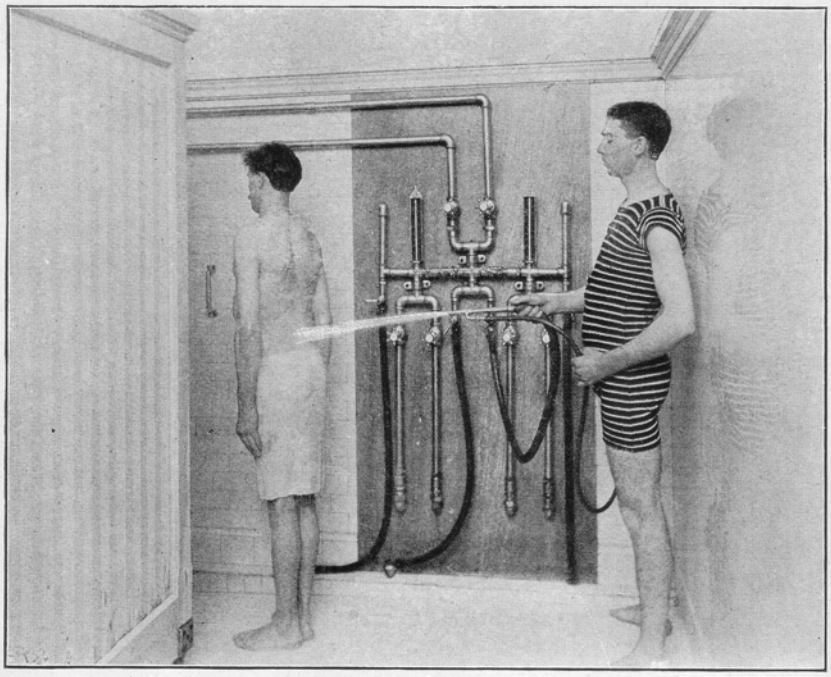


FIG. 36. PERCUSSION DOUCHE (p. 454).

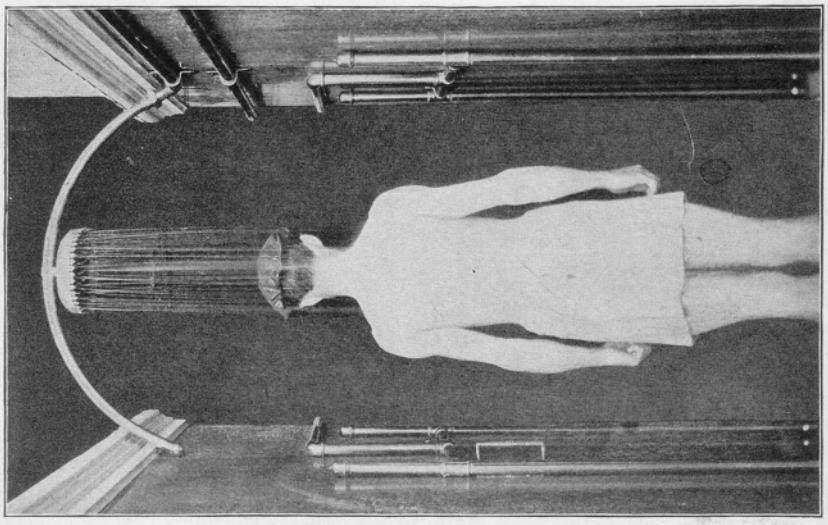


FIG. 37. RAIN DOUCHE (p. 472).

especially useful in cases in which the skin is very inactive, or is relaxed, as indicated by *profuse and frequent sweatings*. It renders valuable service in the sweatings which are characteristic of the climacteric period, and which are frequently encountered in neurasthenic cases, both men and women. When employed for this purpose, the hot application should be at as high a temperature as can be borne (115° to 125°), duration, 1 to 2 minutes; and the cold application should be short (2 to 6 secs.), and of as cold water as is obtainable — from 55° to 65° if possible. Patients generally require considerable training to enable them to tolerate with benefit the lowest temperature mentioned.

The Scotch douche is one of the best of all means of energizing relaxed or *paralyzed muscles*. Short and very hot applications are powerfully restorative in cases of *muscular fatigue*, while cold applications increase muscular irritability and contractile power. By a combination of these two measures, we have the most effective means known for the invigoration of weakened muscular structures.

The Scotch douche is of great value, not only in actual *paresis* or *paralysis*, but in the cases of neurasthenics and dyspeptics who suffer constantly from *malaise* and a sensation of muscular fatigue and an actual inability to exercise on account of the extreme exhaustion following. In such cases the Scotch douche, consisting of a rain douche at 106° for 1 minute, followed by a general fan or broken jet and full jet or percussion douche to the spine and legs at 60°, for 20 to 30 seconds, is a most admirable measure, producing, almost immediately, noticeable good effects.

The localized Scotch douche is of very great service in **1040** cases of *lumbago, crural neuralgia, sciatica, enteralgia, gastralgia, uterine* and *ovarian neuralgia, pleuritic pains, intercostal neuralgia, gastric ulcer, "spinal irritation,"* and *chronic "backache."*

This procedure is often of exceeding value in the treatment of chronic cases requiring general tonic treatment while suffering from painful local affections of the sort mentioned, and in connection with the neutral douche in *insomnia* and other affections requiring sedative effects. In *cerebral congestion*, the Scotch douche to the legs is an invaluable derivative measure, and should precede the general cold douche in cases of *cerebral congestion*, *hepatic* or *splenic congestion*, *hyperpepsia*, and severe *visceral congestions* of all sorts. It is also a valuable measure in *asthma*, especially the form known as *nervous asthma*, in which the Scotch douche to the legs will often cut short an attack with most satisfactory promptness.

Bougarel utilized the Scotch revulsive douche to the feet in *nasal catarrh* and *bronchitis*, as well as in *asthma*.*

Glatz † maintains that there is no better means for combating *chronic muscular rheumatism* than the Scotch douche, and that it is invaluable in the treatment of *sciatica*,— statements which the author has been able to verify in a multitude of cases.

THE REVULSIVE DOUCHE.

1041 The revulsive douche is simply the Scotch douche employed in such a manner as entirely to suppress the thermic reaction which follows the ordinary cold douche. The principles underlying the application are precisely the same as those which have been fully explained under the heading "The Revulsive Compress" (**1341**). The hot douche is at first administered at a temperature as high as the patient can bear, the temperature being gradually increased as tolerance is established until it reaches a maximum of 122° or even 130°, when the area to which the application is made is small. The duration of the application should usually be 2 to 4 minutes, or

* Bougarel, *Ann. de la Soc. d'Hydrol Med.*, Paris.

† Glatz, "L'Hydrotherapie Tonique et Revulsive," Cong. Period, internal, d. sc. med. Compt. rend. Geneve, 1878, page 524.

until the skin acquires a dusky-red or cherry color. The cold application is then administered for 2 to 15 seconds, according to the temperature of the water employed, and the degree of irritability of the parts. Very irritable conditions require very brief cold applications. With water at 50°, 3 or 4 seconds will usually be sufficient; at 60° to 70°, from 5 to 30 seconds will be required.

As the purpose of the cold application is to remove the heat which has been absorbed by the skin during the hot douche, and thus to convert the paralytic dilatation of the vessels into an active dilatation by securing the circulatory reaction of cold without the thermic effect, if the cold application is continued too long, thermic reaction will be produced, and the effect of the application will be spoiled. The exact length of the cold application may be regulated by watching the color of the skin.

When the change from passive to active dilatation occurs, it is indicated by a change in color from dusky-red to scarlet. In most cases no serious harm will result if the cold application be carried a little farther than necessary, as the thermic reaction will be too slight to produce any noticeable effect; but decided chilling of the surface produces, especially in those cases in which severe pain is present, a very unpleasant aggravation of the patient's sufferings. Considerable practice is required to administer the revulsive douche with skill.

For a precise application of this douche it is necessary to employ a pressure gauge as an indicator of the amount of mechanical energy brought to bear in the case. The physician skilled in hydriatry is not, however, necessarily dependent upon the pressure gauge when the application is administered under his own eye, which is the almost universal practice in the scientific hydriatic establishments of Germany and France.

To the well-trained hydriatrist the immediate effect of the application is the best possible means of regulating the procedure. As a rule, the pressure ought to be strong enough to produce prompt reaction. In general, the reaction should

begin to appear before the application has ended. The pressure can of course be perfectly regulated when the horizontal jet is employed, by placing the tip of the finger over the end of the nozzle, thus breaking the force of the stream more or less.

In the employment of the author's percussion douche the force of the stream may also be regulated at the nozzle by the small valve which controls the air current. When employed for relief of pain, the fan douche should be used.

1042 **Physiological Effects.**— The revulsive douche is perhaps the most powerful means of producing vascular revulsion. The nervous impressions made may be less profound than those which result from the cold or alternate douche, but the circulatory effect is intense and lasting. The temporary congestion produced by the hot douche is rendered much more permanent or prolonged by the procedure described, as the circulatory reaction of cold fixes the blood in the skin, this effect becoming more and more pronounced as the treatment is repeated from day to day. The physiological effects of the procedure are thus confined almost exclusively to the circulatory system, and if not wholly mechanical, are certainly to a large extent due to the storing of blood in the skin and the drawing of blood from internal parts.

The revulsive douche unquestionably quickens the movement of blood throughout the whole body when employed either as a general procedure or through associated parts when the application is confined to reflex cutaneous areas.

The revulsive douche differs radically from the alternate douche, in that the latter is especially potent as a means of quickening metabolic and other vital activities; whereas the revulsive douche, by eliminating thermic reaction, has no effect upon metabolic processes other than such modifications as result from circulatory changes.

1043 **Therapeutic Applications.**— The general effect of the revulsive douche is precisely the same as that of the Scotch douche, except that it is less exciting to the general nervous

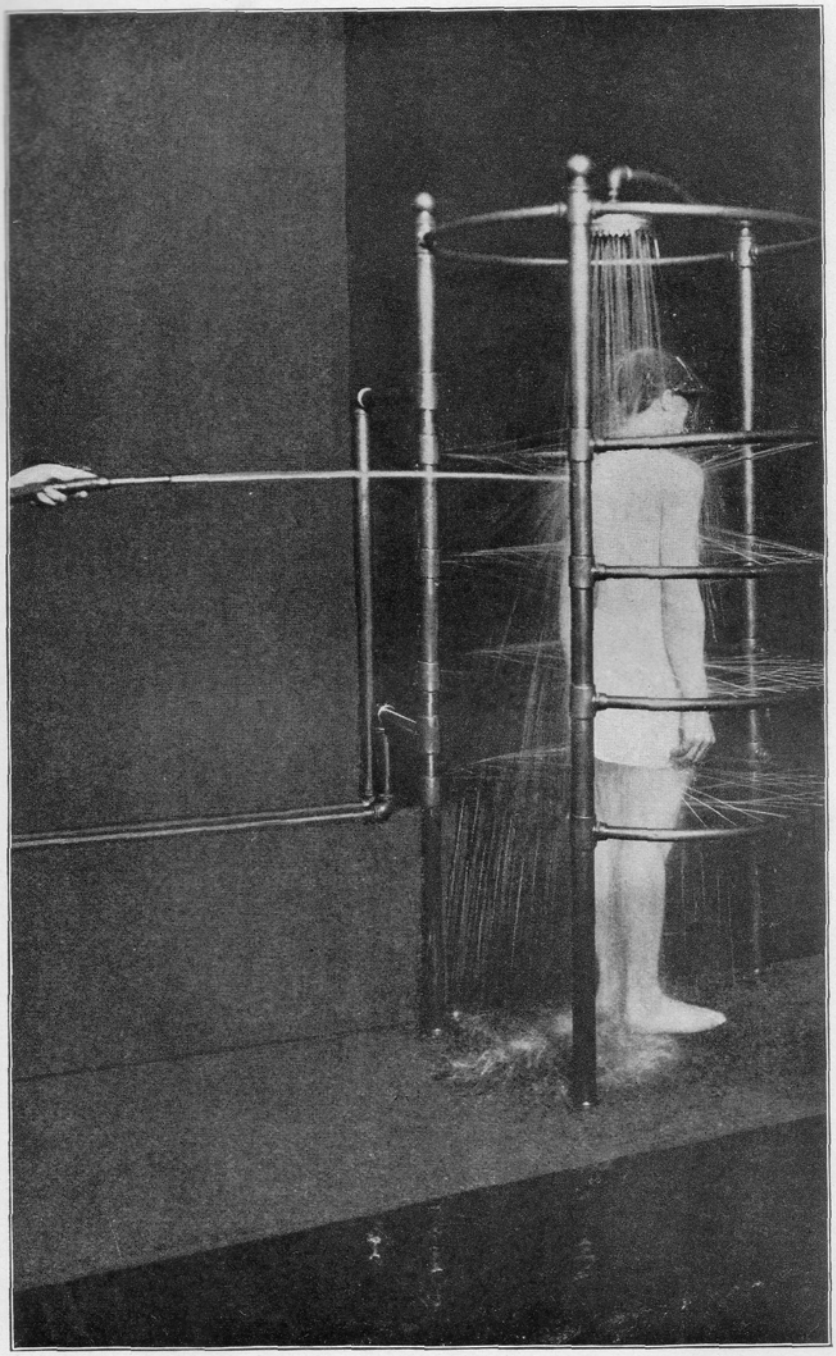


FIG. 38. COMBINED RAIN DOUCHE, HORIZONTAL JET, AND MULTIPLE CIRCLE DOUCHE (p. 473).

system, and is not to so great an extent productive of metabolic changes, owing to the absence of thermic reaction. The atonic reaction of heat, as well as the tonic reaction of cold, are both prevented by the antidotal influence above described. The effect is practically nothing more than a dilatation of the surface vessels exercising a derivative effect upon the deeper structures of the body, but without producing the preliminary congestion of the internal structures which precedes the reaction when the cold douche alone is employed. This renders the revulsive Scotch douche an exceedingly valuable measure for use in cases of *cardiac insufficiency*, *cerebral hyperemia*, *chronic gastritis*, *chronic gastro-intestinal catarrh*, *chronic congestion of the liver and spleen*, *acute and subacute nephritis*, *hyperemia of the spinal cord*, *acute congestion and inflammation of the uterus and its adnexa*, and *subacute rheumatism*. By careful observance of the technique described it is possible to employ the douche with great advantage in the cases here mentioned, in which the cold douche must necessarily be interdicted, and in many allied conditions.

The revulsive douche is a valuable measure in cases of both *profuse sweating* and *excessive dryness* of the skin. Its effect is to produce an increase of tone in the tissues of the skin, and thus to bring about normal cutaneous activity. In *dysmenorrhea* with scanty flow it may be applied to the hips, thighs, and legs. The same measure is useful in *congestive headache* and *pulmonary congestion*, provided care be taken that the jet does not fall upon any portion of the body above the umbilicus. The revulsive douche to the legs is also useful in cases of *hyperpepsia*, the hot douche being at the same time applied to the epigastrium and the spine opposite. In *gastric catarrh*, *gastralgia*, or in the acute crises of *locomotor ataxia*, it may be employed in the same manner as for hyperpepsia.

The revulsive douche affords great relief as a local application to the painful joints of *acute* and *chronic rheumatism*, also in *myalgia*, *dermalgia*, *intercostal neuralgia*, *pleuro-*

dynia, and the lightning pains of *locomotor ataxia*. In cases in which the douche (fan) is used for the relief of pain, the pressure must be light, not more than 3 to 15 pounds.

THE ALTERNATE DOUCHE.

1044 The alternate douche resembles the Scotch douche in that it employs both hot and cold water; it differs from it in that the Scotch douche consists of a single application of water at each temperature,—first hot, then cold,—while in the alternate douche hot and cold water are repeatedly applied in alternation. The alternation may be repeated as many times as is considered desirable in the particular case. The alternate douche also differs from the Scotch douche in that the hot application as well as the cold is short. Ordinarily the applications of heat and of cold are of equal length, each of about 15 seconds' duration. It is obvious, however, that there is opportunity for an infinite variety of modifications in this regard. The longer the hot application and the shorter the cold application, relatively, the less pronounced and characteristic will be the excitant effects produced. The temperatures employed must be suited to the individual case. The greater the extremes of temperature and the more sudden the transition, the more decided will be the excitant effects.

1045 **Physiological Effects.**—The alternate douche is perhaps the most exciting of all hydric procedures. It combines with the primary excitant effects of heat the secondary excitant effects of cold, and through the removal of the heat accumulated by the skin during the hot application by means of the preceding cold application, the susceptibility of the skin is renewed, and its reflex activities maintained, and thus the excitant effect of the hot application is intensified and extended.

With persons who are very sensitive to thermic applications, and especially to sudden changes, the alternate douche

may be modified in a variety of ways, the most important of which may be indicated as follows: —

1. Beginning with a lower temperature for the hot application, and a higher temperature for the cold application, thus lessening the extremes of temperature employed, and by progressive graduation, from day to day increasing the extremes, raising the temperature of the hot application and lowering the temperature of the cold, the most powerful effects may after a time be realized.

2. Graduating the procedure during the application, beginning at a temperature near that of the body, raising to the highest limit, then gradually lowering to the lowest extreme, repeating this as many times as necessary to produce the effect desired.

3. Increasing the relative time of the hot application, or lessening the time of the cold application, thus diminishing the thermic effect.

Therapeutic Applications. — The alternate douche is to 1046
be employed in cases in which powerfully excitant effects are desirable; that is, in cases of *old exudations*, *enlargement of the liver*, the so-called "*liver of dyspeptics*," *enlarged spleen*, and *stiffened joints* in which active inflammatory processes have ceased. It may also be employed wherever increased functional activity is desired, as in cases of *atony of the genito-urinary organs*, unaccompanied by irritability, in *paresis or paralysis* of a group of muscles, in certain inveterate cases of *sciatic neuralgia* in which the pain is due to chronic inflammation of the nerve sheath, and in *pleuritic effusions* and *dropsical accumulations* in other cavities, in the joints, or in the tissues, as in swellings of the limbs due to *anemia*, *chronic Bright's disease*, *erythema nodosum*, and the muscular soreness and rigidity left behind by an attack of *muscular rheumatism*. The local alternate douche should be systematically employed two or three times daily as a means of preventing *bed-sores* in low fevers, to prevent *sloughing* after prolonged exposure to the X-ray, in *chilblains*, in

chronic ulcer of the leg, and in *eczema* with thickening of the skin. Indeed, this is a procedure of wide applicability and utility.

The localized alternating douche is exceedingly valuable in cases of *hypopepsia* (the epigastric douche), *constipation* (lumbar and abdominal), *amenorrhea* (lumbar spine, thighs, and feet), *chronic renal insufficiency* (the lower third of the sternum), *neurasthenia* (dorsal), *cold feet and legs.* It may be applied internally to the prostate in chronic enlargement of this organ, to the rectum in cases in which normal sensibility is lost, and to the stomach by means of the stomach-tube in cases of *dilatation of the stomach* with motor insufficiency.

The general alternate douche is useful for dryness and inactivity of the skin, a condition commonly present in *diabetes mellitus* and many cases of *chronic dyspepsia.*

The alternating douche is especially indicated in cases in which local stimulation is required. The extreme temperatures necessary to secure the best effects render it unsuited to general application.

THE RAIN DOUCHE OR SHOWER BATH.

1047 In this form of douche (Fig. 37) the water is projected through a "rose," or perforated disc, falling upon the patient in a number of fine streams. When the disc is placed above the patient, the procedure is termed the *rain* or *shower douche;* when held in the hand or fixed beneath a seat, it is termed a *spray.* In the rain douche the size of the openings is usually somewhat larger than in the movable hand spray, and the disc is also larger and the apertures more numerous.

In administering the rain douche, the same general principles apply as in the use of the horizontal jet. The procedure is somewhat more vigorous than the jet, as both the quantity of water falling upon the patient at each instant and the amount of surface exposed to contact with the water are

greater. The pressure is less, hence the mechanical effect is less and the reaction more difficult, so that great care must be observed to prepare the patient for the application by a preliminary heating, and to take all necessary precautions to secure reaction afterward.

The shower bath was much used by Priessnitz and in the numerous water-cures which were established upon essentially the same plan as that at Graefenberg, in various parts of the United States and England during the first half of the present century. Bell, of Philadelphia, in his admirable work on "Baths" (1850) mentioned the shower bath, and it was also described by Dr. Joel Shew and other early writers on hydrotherapy in this country.

The author has been familiar with the rain douche or shower bath for over forty years, having been introduced to it while a boy in his father's house, where it was a part of the household furnishing, and its use one of the routine duties of each member of the family; and during an experience of more than twenty-five years with this douche in the treatment of chronic invalids of all classes, he has come to regard it as an indispensable part of a completely equipped establishment for the scientific use of water as a curative agent.

The accompanying cut (Fig. 38) represents one of the large rain douches constructed under the author's direction for use in the Battle Creek Sanitarium. The apparatus is also arranged for giving the multiple circle spray, or so-called needle bath, and the horizontal jet. The apparatus is supplied by two inch pipes, and gives a shower of sixty streams through as many openings with diameters of one sixteenth of an inch. The horizontal jet supplies an inch stream under a pressure of 45 pounds.

On account of the powerful impression made upon the shoulders and the upper part of the trunk, the skin covering these parts being in intimate reflex relation with the brain and heart, the disc of the rain douche should be placed not

more than two or three feet above the head of the patient. In general, the perforations should be large enough so that the water will fall with no great force aside from that given to it by gravity. As a further precaution, to prevent too great concentration of the effect upon the organs of the chest, it is well to begin the application by allowing the water to fall first upon the feet, first one and then the other being held in proper position for this purpose for a few seconds each, the water then being allowed to fall upon the hands, arms, shoulders, back, and, lastly, upon the chest and abdomen. Or, the same end may be attained by administering to the feet and legs a horizontal jet at the same time that the rain douche falls upon the upper part of the body.

The head should always be covered, in the rain bath, by a thick towel folded to several thicknesses, or by a rubber cap. The patient should keep in lively motion during the application, flexing the limbs by raising the feet alternately, turning around first in one direction then in the other, and rubbing the chest with the hands. At the beginning of the application the hands should be applied to the chest to protect it, and especially the precordial region, from the impact of the water. This exercise aids reaction, and thus mitigates the effect upon the heart and lungs.

The combined cold horizontal douche and the vertical rain douche are certainly the most energetic excitants of all hydrotherapeutic measures. Cases are not infrequently encountered in which the effect of this vigorous combination can not be tolerated, and it is not ordinarily required.

1048 **Physiological Effects.**— The cold rain douche is one of the most exciting of all hydriatic procedures. A large amount of cold water under moderate pressure falls upon the most highly sensitive and reflexly active portions of the cutaneous surface, causing a perfect cyclone, so to speak, of nerve impulses to be sent in upon the cerebrospinal axis; and, naturally, most extensive reflex actions are set up. At first, the respiratory movements are almost suspended; the breathing is in quick, gasping

efforts, the heart is powerfully excited, the blood pressure is raised, and all the phenomena resulting from other general external applications of cold are presented in an intense degree. General metabolic activity is stimulated; the brain and nervous system are intensely aroused, and all the vital movements are accelerated. According to the observations of Schüller, the powerful respiratory movements produced by the cold rain douche must exercise a salutary effect of the highest importance in stimulating the lymph currents of the brain and spinal cord, and in aiding the hepatic and portal circulations.

The sudden inrush of blood from the surface causes dilatation of the vessels of the brain, but the brain is to some extent protected by the powerful vasomotor reflexes sent inward from the face, neck, and upper cervical regions.

In the majority of cases in which the cold rain douche is employed, a preliminary heating should be applied. This measure is, on this account, exceedingly convenient, for the reason that the heating and cooling may be effected by the same apparatus. When required, the rain douche at 100° to 104° is applied for 1 to 3 minutes before the cold application.

The *cool* rain douche (75° to 65°) is an excellent training measure for persons who are so sensitive as to prohibit the employment of water at a lower temperature, also for gradual cooling after a sweating bath.

The effect of the *hot* rain douche is likewise powerfully **1049**
exciting, causing intense cerebral congestion, and first slowing, then quickening, of the heart, which continues for some time after the bath. The duration of the hot shower should be from one-half minute to 2 minutes; temperature, 100° to 112°.

The *neutral* rain douche (92° to 97°) causes immediate **1050**
contraction of the cerebral vessels (Schüller), and produces a general calm in the storm of nerve reflexes continually playing between the periphery and the brain and cord. Its effects are essentially the same as those of the neutral immersion bath (**1130**), but are much more quickly attained.

The usual duration of the neutral shower bath is from 3 to 5 minutes.

051 **Therapeutic Applications.**— The rain douche has the disadvantage of being far less perfectly controllable than the horizontal jet or the spray, which may be regulated to a nicety during administration by one skilled in their use. The *cold* shower is practically a fixed procedure, and hence is not adapted to feeble persons. The *neutral* and *graduated* rain douche have a much more general application than the cold or hot douche in this form. However, the rain douche is an exceedingly useful measure at all temperatures.

The cold shower fell into discredit in this country more than forty years ago, because of its excessive and unwise use by empirics as a panacea, and by the laity as a daily morning bath for prophylactic and hygienic purposes. Within the last twenty years, however, this measure has been steadily returning to favor, and at present every well-furnished private bath-room is supplied with a fairly good rain douche apparatus. The accompanying cut (Fig. 39) shows a style of shower bath such as may be obtained at any large plumbing establishment of this country or Europe.

052 The cold shower may be used with advantage as a tonic measure for *anemics* who are fairly strong, also in *obesity* where the heart is not seriously involved, and with the *chlorotic* and *plethoric*. It should be preceded by some appropriate heating procedure, as the heating pack, the dry pack, or a sweating process of short duration.

The short cold rain douche (60° to 70°, for 5 to 30 secs.) is to be employed in cases in which moderate stimulation is required, with little withdrawal of heat, as in *anemia* and *chlorosis* with emaciation, and in *neurasthenia* and *dyspepsia* when the height-weight coefficient is low. When considerable heat elimination is required, the douche is prolonged to 1 or 2 minutes. This procedure is especially useful in *phlegmatic neurasthenics*, *sedentary persons* in whom the general metabolic activity is diminished, in *obesity*, and in all cases

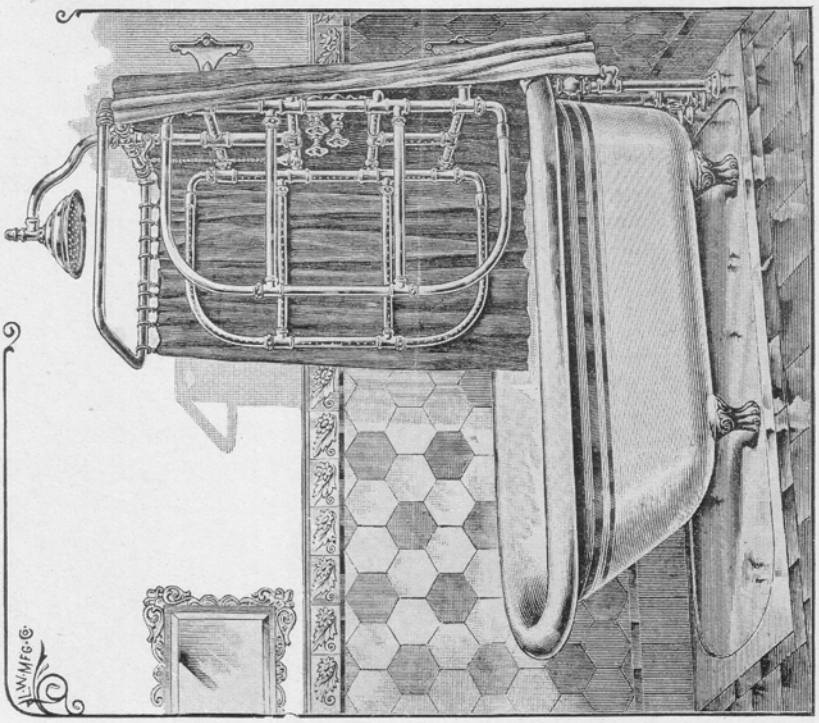


FIG. 39. COMBINED DOUCHE APPARATUS AND BATH TUB (p. 476).

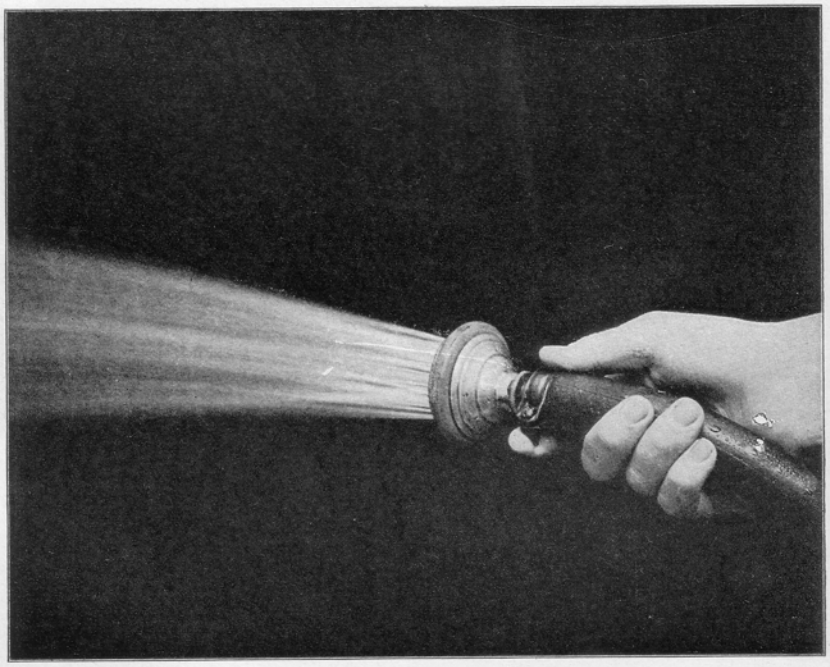


FIG. 40. HORIZONTAL RAIN DOUCHE OR SPRAY (p. 479).

in which after a long sweating process a gradual and very thorough cooling is necessary to prevent continued perspiration.

The cold shower may be combined with the Russian bath with good effects. By standing in the hot vapor, the patient tolerates the cold shower much more readily than when exposed to the chilling effect of evaporation and currents of cool air. Still better effects may be obtained from the combination of the shower and the electric-light bath, as shown in Fig. 139 (page 709).

While the *cold* shower bath perhaps offers some disadvantages over the jet or spray douche, the *warm* or *neutral* shower presents distinct advantages. As a hygienic measure, it offers a most agreeable and rapid method of cleansing the whole surface of the body, a most important consideration when large numbers of persons are to be bathed in a short time, as in military barracks, charitable institutions, schools, and public baths. The warm shower bath has long been extensively used in prisons, reformatories, and other public institutions as a convenient form of bath for cleanliness.

The author a few years ago (1893) introduced this bath into a charitable home under his direction located in Chicago, (the Chicago Medical Mission) especially designed for the benefit of waifs, tramps, discharged prisoners, and other classes of homeless men. Of the one hundred thousand and more men who have made use of the bath in this institution, a large proportion have testified to the benefit derived from its use, not only as a means of cleansing the skin, but as a tonic and invigorating measure. In dealing with this class of persons, the neutral or warm bath followed by a cold shower bath has incidentally been found to be a most effective means of sobering men under the influence of alcoholic liquors. The cold rain douche of 1 to 3 minutes' duration is generally sufficient to restore the mental equilibrium and muscular co-ordinating power of a man so fully under the influence of alcohol as to be unable to walk or even stand without support.

1053 The *neutral* rain douche (93° to 96°) is one of the most effective measures which can be employed for the relief of *insomnia* due to irritability of the cerebrospinal nervous system, *cerebral congestion*, and *general nervous excitability*. The application should be made with little force, special attention being given to the legs and back. The application of the broken jet, with light aspersions at intervals of a few seconds to the back of the neck and the occipital region of the head, during the rain douche, has a remarkably soothing and soporific effect.

The action of the neutral douche is quicker than that of the neutral immersion bath, and in some cases its application may be preferred. A neutral rain douche of 3 to 5 minutes' duration often produces the same quieting effect obtainable from a neutral immersion bath of 40 to 60 minutes. The neutral rain douche may be used in cases in which patients complain of the necessary length of the full bath. The latter, however, is preferable for many cases requiring the sedative effect of a neutral temperature, owing to the recumbent position, which permits the patient to fall asleep in the bath.

The neutral rain bath may be used to great advantage in cases of *mania* with cerebral congestion. Care should be taken to protect the head by a thick cold compress after a previous thorough cooling. This method is of course applicable only to cases in which the patient may be readily controlled.

1054 The *hot* shower serves a useful purpose as a ready and convenient means of heating the skin in preparation for a cold jet or spray. The duration may be from one-half minute to 2 minutes when used for this purpose, or long enough to heat the skin and cause the patient to long for the refreshing effect of the cold douche or spray. Care must be taken to protect the head by a rubber cap or a thick towel well saturated with ice-water, and the hot water must not be allowed to fall directly upon the head.

THE HORIZONTAL RAIN DOUCHE OR SPRAY.

This form of douche (Fig. 40) is identical with the hori- 1055
zontal jet in its mode of application, with the exception that, instead of a single jet, the water issues from a perforated head in a considerable number of small streams. The diameter of the head is commonly about three inches, and the size of the perforations one millimeter (Fig. 41).

Method.— The horizontal rain douche or spray is applied in precisely the same manner as the horizontal jet, the directions and observations relating to which need not be repeated here.

Physiological Effects.— The spray douche produces effects 1056
analogous to those of the horizontal jet, but less intense, for the reason that the impression made is so generalized, and the several streams are so small in size, that the mechanical effect is very much less than that of the horizontal jet.

The horizontal jet, when broken, may be made to produce much the same effects as the spray; while the spray, applied at high pressure, may produce effects essentially the same as those of the broken horizontal jet or the full jet at lower pressure.

Therapeutic Applications.— The spray is to be used in 1057
cases in which the mechanical effects of the douche are required as a means of encouraging circulatory reaction, and yet the horizontal jet is for some reason regarded as too severe a measure to be safely employed. It is indicated in any case in which the broken jet is applicable. The broken jet is most conveniently employed in cases in which the full jet may be received with advantage upon some portions of the body, while the broken jet alone is admissible upon other parts. When no portion of the body can safely receive the full or horizontal jet, the spray douche may be advantageously employed.

The hot spray is especially indicated in the treatment of *neuralgia* with *hyperesthesia* of the overlying skin, *swol-*

len, painful rheumatic joints, spinal neuralgia, and *spinal irritation* with *hyperesthesia;* at *neutral* temperature, with little pressure, for the relief of the lightning pains of *locomotor ataxia; very hot* (106° to 120°) in alternation with very cold water, for producing powerful revulsive or derivative effects, as an application to the feet and legs for the relief of *asthma,* for the Scotch douche (**1037**), and in cases in which the douche is indicated, but the horizontal jet douche is found too exciting.

The spray has the advantage over the vertical rain douche in that it is very readily adjustable to all parts of the body. It does not affect disproportionately the upper part of the body, and especially the chest, as does the vertical douche. It may be made a very exciting procedure, although at its maximum of intensity it is much less exciting than is the full horizontal jet.

The *neutral* spray is an excellent measure for *insomnia.* For this purpose it should be continued for 4 or 5 minutes at moderate pressure (10 to 15 lbs.), special attention being given to the back and legs.

THE ASCENDING DOUCHE.

1058 This ordinarily consists of a jet or spray directed upward from a nozzle placed near the level of the floor (Fig. 42). It is chiefly useful for applications to the soles of the feet, the perineum, and the anal region.

The ascending douche is usually applied at a very low temperature (60° to 45°), with a duration of half a minute to one minute. It is especially valuable in cases of *atony* of the *bladder* without dilatation, and in cases of *weakness* of the *genital organs* not accompanied by irritation or pain. It is evident that in cases of chronic dilatation of the bladder the cold douche will prove of no value, as the muscular walls of the organ are so relaxed as to be unable to respond to the stimulus of the douche. The *cold* ascending douche is also

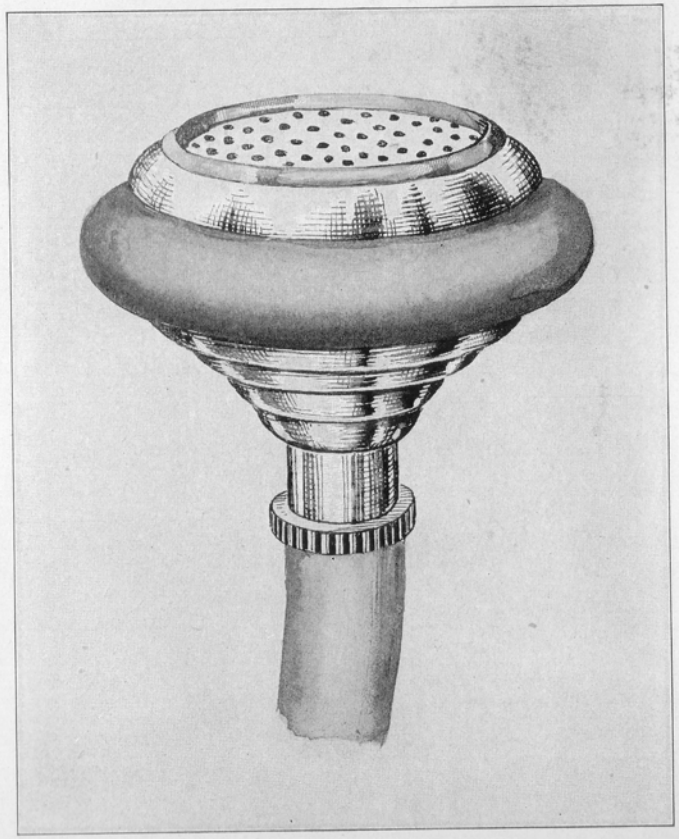


FIG. 41. SPRAY NOZZLE (p. 479).

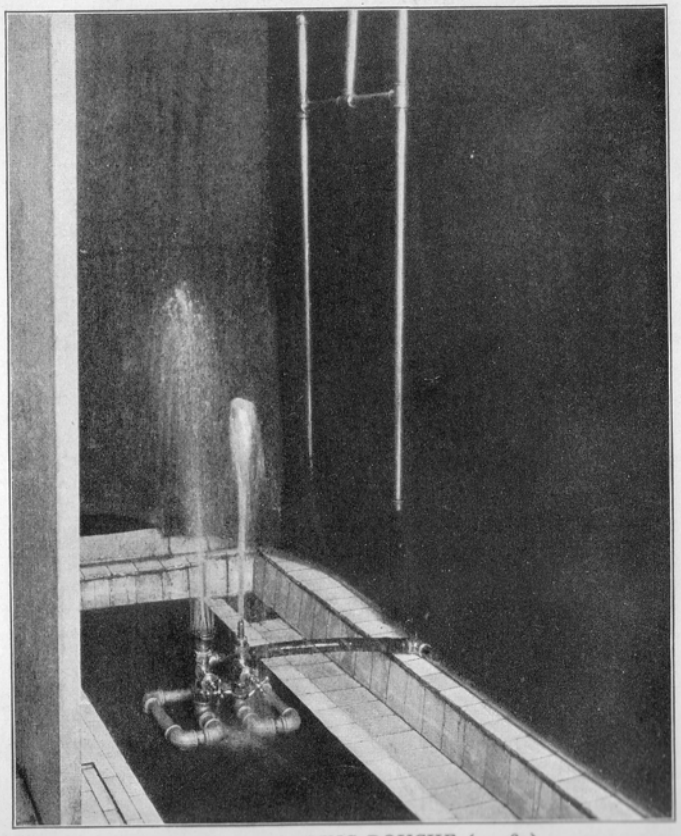


FIG. 42. ASCENDING DOUCHE (p. 480).

of great service in cases of *hemorrhoids*, *constipation*, and *uterine* and *rectal prolapse*.

The *short cold* ascending douche is very useful in rectal prolapse and anal insufficiency, also in flatulence due to constipation.

The *neutral* ascending douche is applicable when hyperesthesia with excessive irritability of the bladder and genital organs exists.

The *warm* ascending douche is very useful as a means of relieving the pain of anal fissure and irritable rectum.

The *hot ascending* douche is one of the most efficacious remedies for the relief of *pruritus ani* and *pruritus vulvæ*. When employed for this purpose, the temperature should be as high as can be borne.

The *alternate* ascending douche is to be employed in cases of *vesical paresis*, *chronic hypertrophy* of the *prostate*, and exudates resulting from inflammation of the testicles or cord.

The *revulsive* (**1041**) ascending douche may be used in most affections of the genito-urinary organs and rectum, accompanied by pain.

THE CALIPER DOUCHE.

1059 This apparatus,* which was devised by the author, and is in daily use at the Battle Creek Sanitarium, consists, as shown in the accompanying cut (Fig. 43), of two semicircular tubular arms, joined to a support at one end in such a manner that the opposite ends can be separated for the admission of the patient within the circle. Being portable, the apparatus may be adjusted to any portion of the body, as the chest, the neck, the waist, the hips, and one or both legs.

The arms are perforated on the inner side, the openings all pointing slightly downward and toward the center, so that when in use, the water is directed upon a narrow circular area

* Since the above was written, the author has learned that a similar device had previously been made by a Chicago plumber, but so far as known, no practical use was ever made of it.

of the skin. Two forms are in use, one in which the tubes are perforated with small openings, the other in which a narrow slit extends from one end to the other of each circular tube. The latter form allows the water to issue in a thin, unbroken sheet, instead of a large number of small streams.

This apparatus is exceedingly convenient for localizing the douche upon a certain area of the body, in cases in which prolonged applications of this sort are desirable.

The caliper douche serves the same purpose as the spray sitz bath so much used in France, when adjusted for application just above the hips, with the patient in a sitting position. The ascending douche may be applied to the anus and the perineum at the same time, thus influencing at once all the voluntary and involuntary muscular structures involved in defecation, and affording one of the most valuable means of combating constipation.

The caliper douche is especially useful for the application of the *cold* douche to relieve *constipation*, *hypopepsia*, *amenorrhea*, and *flatulence* of the stomach and bowels, for which purposes it is applied to the trunk at the different levels indicated.

The *hot* caliper douche is of equal value in cases of *hyperpepsia*, *hyperesthesia* of the lumbar ganglia of the abdominal sympathetic, some cases of *menorrhagia*, *chronic intestinal catarrh* with *diarrhea*, *chronic gastritis*, and *infectious jaundice*.

THE CIRCLE DOUCHE.

1060 The device employed in this douche (Fig. 44) consists of a hollow ring perforated in such a manner that the streams of water emitted converge on a line passing vertically through the center of the circle. In use, the ring, connected with the douche apparatus by a rubber tube, is passed over the head. By directing movements the water may be made to pass chiefly over the front and back, or over one shoulder or the other, passing down over the entire body. The circle douche may be administered to an arm or leg by passing the limb

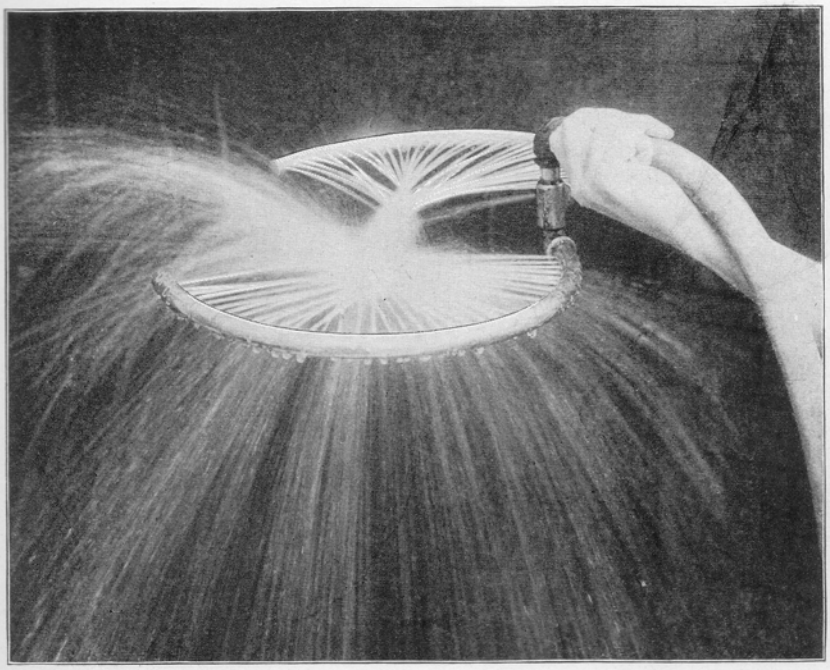


FIG. 43. CALIPER DOUCHE (p. 481).



FIG. 44. COLLAR DOUCHE (p. 492).

through the center, and moving the ring back and forth. The circle douche is a very convenient instrument for home use in a common bath-tub, as the convergence of the streams renders it possible to employ it without wetting the walls or furniture of the room. It has the disadvantage, however, that when utilized for general purposes, it produces too strong reaction to the head, especially if very strong pressure is employed.

The circle douche appliance may be used for administering the circle douche to an arm or a leg, and with excellent results, when a localized effect in these parts is for any reason desirable.

THE FAN DOUCHE.

1061 This consists of a horizontal jet from a nozzle of such form that the water issues in a broad, thin stream (Fig. 45). The friction at the narrow orifice through which the water is projected greatly diminishes the pressure.

In the absence of a special nozzle the fan douche may be produced by holding a piece of metal or wood with a smooth surface against the stream of a jet douche, close to the end of the nozzle.

1062 **Physiological Effects.**— The weight of the thin blade of water falling upon the skin is very slight, so that the mechanical effect of the fan douche is reduced to a minimum.

The physiological effects of the fan douche are essentially the same as those of other forms of the douche, but less intense than the full jet, or the rain or spray douche.

1063 **Therapeutic Applications.**—The fan douche is generally employed in the same class of cases in which the rain douche is indicated. It has a wider and more varied application than almost any other hydriatic procedure.

This form of douche is used in cases in which strong percutient effects are undesirable, as in the application of very cold water to sensitive surfaces, over painful nerves, hysterogenous zones, inflamed structures, and such especially

sensitive portions of the body as the precordial region, the genitals, and the head and neck.

The *cold* fan douche may be employed to great advantage in the following cases: Over the course of the paralyzed nerve trunk in *paralysis;* to the dorsal region in *neurasthenia* with marked muscular weakness and general feebleness; to the dorsal and epigastric regions in *hypopepsia;* over the stomach, bowels, and bladder in *enteroptosis* and *atony* of the organs named.

The *alternating* fan douche is useful in *rheumatism* with *exudates*, but accompanied by little pain.

The *revulsive* fan douche renders invaluable service in *lumbago*, *sciatica*, *painful joints*, *neuritis;* to the spine in *spinal irritation;* to the feet and legs in *asthma;* over the liver in inactivity of this organ; and in *chronic icterus.*

When pain is not present, the cold douche may be substituted in applications to the hepatic region.

The *hot* fan douche is exceedingly valuable in *neuralgia* over an affected nerve, and to the dorsal and epigastric regions in *hyperpepsia*, and over the affected organ in cases of visceral pain, whether due to neuralgia, congestion, or inflammation.

The *neutral* fan douche renders signal service when applied to the limbs as a relief for the lightning pains of *locomotor ataxia*, and to the spine and back of the neck in *insomnia.*

The *short cold* fan douche to the upper part of the dorsal region and the neck stimulates the respiration and circulation, and is often useful in certain cases of *asthma.*

The fan douche at a temperature of 80° to 90° (50 to 60 secs.) is useful in the treatment of irritable neurasthenics who can not endure the douche in any other form. Employed in this way, a good circulatory reaction may be produced without much excitation of the central nervous system, and a sedative effect may thus be secured without the incon-

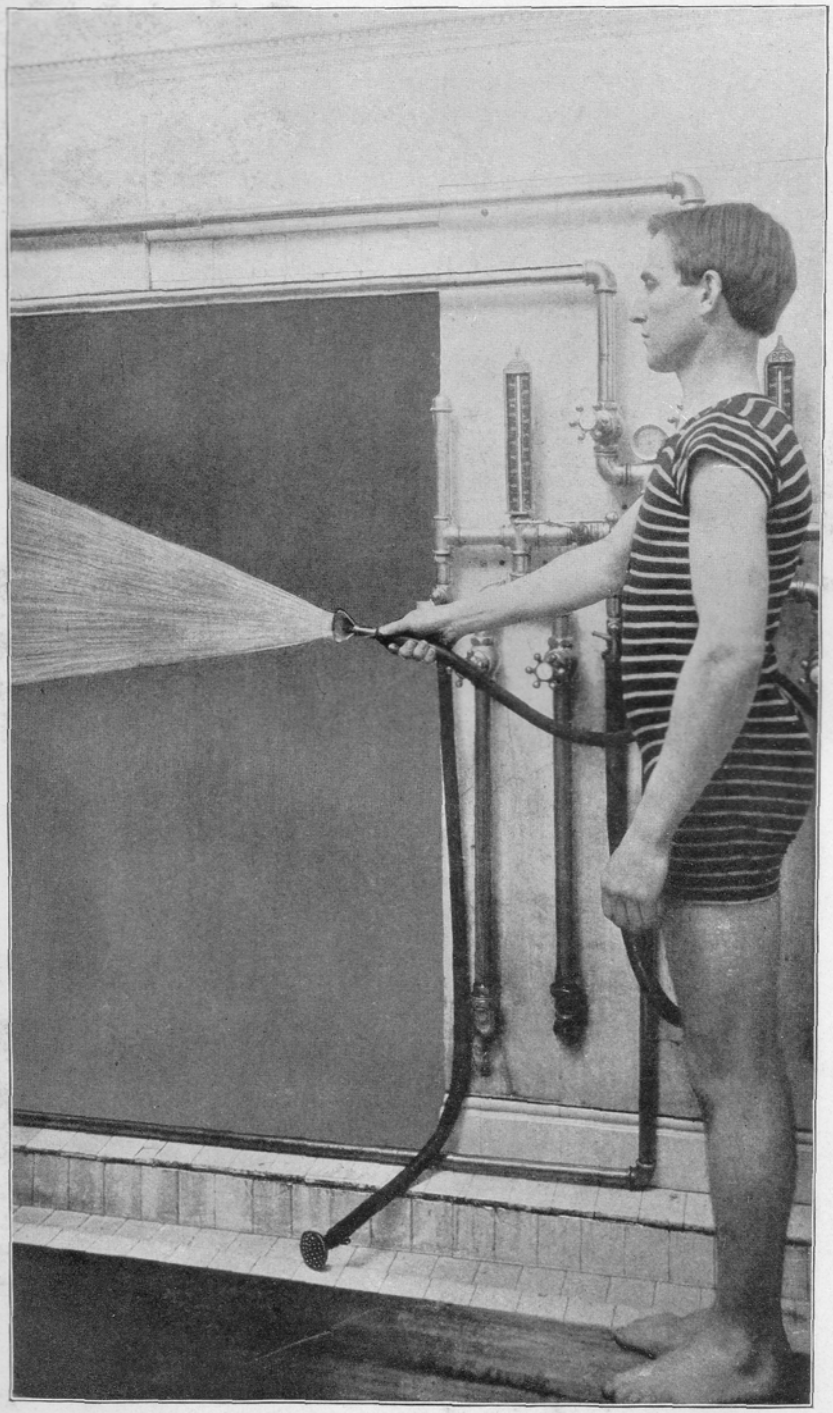


FIG. 45. FAN DOUCHE (p. 483).

veniences accompanying the cold douche. The cold jet or spray, even the percussion douche, may be employed later.

The fan douche has the advantage over other baths having approximately the same temperature, in that equal effects are secured by applications of much shorter duration.

THE FILIFORM DOUCHE.

This is a form of horizontal jet in which the water 1064
issues from an exceedingly small opening. It was devised by de Laurè. In France the filiform jet is produced by a nozzle terminating in a piece of agate perforated by a capillary opening through which the water is forced with such great pressure that it becomes a cloud a short distance from the apparatus. The duration is from 1 to 10 minutes.

Physiological Effects.— The effects of the filiform douche are those of strong counter-irritation, suggesting the effect of mustard. It is capable of producing most powerful irritation of the skin, even bleeding through rupture of the small vessels. Exceedingly strong circulatory reaction is produced with little or no thermic activity.

Therapeutic Applications. — Bernard* extols the filiform douche as a means of producing powerful counter-irritation for the relief of pain. He describes the effect of this douche as being very painful for the first two minutes, but after that period producing very agreeable sensations. This procedure is usually reserved for rebellious cases, as obstinate *sciaticas*, and other forms of neuralgia which do not yield to ordinary measures. It has been used successfully in *hemicrania*, *diphtheritic* and *hysterical paralysis*, *chronic rheumatism*, and *lumbago*. The first applications must be very brief. Gradually, as tolerance is established, they may be extended to 8 or 10 minutes.

* P. Bernard, *Ann. de la Société d' Hydrol.*, 1894, p. 147.

THE FOG DOUCHE.

1065 This douche, known by the French as the *douche d'eau pulvérisé*, is produced by the same device as that employed for the percussion douche. A current of air under pressure is admitted to the nozzle of the douche apparatus at such a point that the water is made to issue from the orifice of the nozzle in the form of a fine mist driven with great velocity. The percussion douche is produced in precisely the same way, except that a smaller amount of air is admitted. The refrigerant effect of an application of this sort is very great, while the percutient or mechanical effect is less than that of the percussion douche proper (Fig. 46).

Therapeutic Applications.— The fog douche is a most excellent measure to be substituted for the Scotch douche, used in combination with the vapor douche in cases in which refrigeration without mechanical effect is desired, especially in general *hyperesthesia* of the skin, *spinal irritation*, *painful joints*, and *sciatica* with tenderness of the tissues. The Scotch douche to the legs, produced by means of the vapor bath combined with the fog douche, produces most powerful derivative effects in favor of the brain and other organs of the upper portion of the body.

THE MASSAGE DOUCHE.

1066 This is a mixed procedure, in which the kneading movements of massage are executed at the same time that a stream of water is allowed to play upon the surface (Fig. 47). The kneading movement consists of strong intermittent pressure with the palms of the hands, as in palmar kneading and kneading with the thumb and fingers. The movement should be so applied as to affect the blood-vessels of the muscular structures as well as those of the subcutaneous tissue.

The parts to which the massage douche is especially applicable are the back, the limbs, and the abdomen. Particular attention is given to the joints when stiffened by chronic rheumatism. Two attendants are required to secure the best

effects, one applying the douche while the other manipulates the parts.

Physiological Effects.—The massage douche, water at a 1067
low temperature being employed, is without doubt the most powerful of all hydriatic procedures, especially with the use of the horizontal douche at high pressure, or the percussion douche.

The massage douche adds to the thermic and mechanical effects of the ordinary douche the mechanical effects of massage, thus bringing to bear at the same time and place two most powerful procedures. The ordinary douche acts directly upon the skin only, producing effects in the deeper structures by reflex nervous action and by retrostasis, or mechanical displacement of the blood inward. The douche renders the skin anemic, while it produces collateral hyperemia of the muscles. In the reaction which follows, the skin becomes hyperemic, while the blood supply of the muscles is to an equal extent diminished. By the combination of massage with the douche this reaction of the circulation in the muscles is stimulated, thus at first creating collateral hyperemia and the stimulation of heat production which results from the increased supply of blood and heat to the thermogenic tissues located in the muscles.

On the other hand, by hastening the return of blood to the skin and intensifying the cutaneous hyperemia, the secondary effect of the combination of massage with the douche is to increase the cooling process, thus offsetting its influence in stimulating heat production.

The intimate connection of general metabolism with heat production renders the massage douche a most powerful tonic and alterative measure. It is, indeed, but one of the diversified forms of the ordinary douche the various therapeutic effects of which it intensifies; and by acting upon the deeper structures, it may be said to carry the effect of the douche inward as far as the internal structures can be influenced by external manipulations.

The massage douche may be employed with either very hot or very cold water, and at all intermediate temperatures. The most important applications are in connection with the very cold douche at high pressure, or the percussion douche, the very hot douche (104° and upwards) and the neutral douche (92° to 98°).

The effects of the *hot* massage douche are powerfully revulsive, by adding to the profound circulatory reaction following the ordinary hot douche the active congestion of the deep muscular and cellular structures. The hot douche congests the skin only; while the hot massage douche congests the entire soft parts of the limb to which the application is made.

The effect of the hot massage douche upon the local temperature is somewhat peculiar. A certain amount of heat is of course absorbed from the water, and at the same time the manipulation of the muscles and increased flow of blood through them stimulates heat production. Both these influences, however, are antagonized and their effect quickly annulled by the atonic thermic reaction following the application, and the rapid loss of heat from the widely dilated vessels.

Both the hot and the cold massage douche produce a more intense circulatory reaction in the part to which the application is made than does the ordinary douche, either hot or cold. The effect of the cold douche without massage is to produce anemia of the skin with collateral congestion of the muscles, but without materially influencing the total amount of blood supplied to the part; while the hot douche produces hyperemia of the skin with a corresponding anemia of the muscles, likewise without great influence upon the total blood supply. In both cases, however, the combination of massage with the hydric application, by independently stimulating the circulation of the blood-vessels of the deeper structures, has the effect to increase to a marked degree the total blood supply. It is this fact which gives to the massage douche its powerful derivative effects. Indeed, it may be justly said that there is no other known means by which

such powerful revulsive and fluxion effects may be produced as by the massage douche.

The massage douche employed at *neutral* temperatures or a temperature near the neutral point, produces little or no thermic effects, but does produce most decided circulatory reaction, not only upon the surface, but in the deeper structures as well. Thus its action is almost wholly local. The douche at a neutral temperature annuls the effect of the massage as a cutaneous irritant by lessening the sensibility of the nerves of the skin, thus giving to this form of the application peculiar properties, and adapting it to meet special therapeutic indications.

Therapeutic Applications.—The *cold* massage douche is **1068** the most powerful alterative and tonic of all hydriatic procedures. It at the same time has the decided advantage of being much more easily tolerated than the ordinary cold douche. The shallow bath can be tolerated by persons who can not endure the cold immersion, for the reason that the constant friction of the skin maintains the surface circulation, and prevents chilling of the cutaneous nerves to such a degree as to produce injurious internal congestion, shivering, and thermic reaction. The Brand bath is by the same means rendered tolerable and beneficial in cases in which the immersion bath without friction would produce dangerous and even fatal effects. During the application of the vigorous kneading which accompanies the massage douche, the ordinary unpleasant impression produced by a stream of cold water is lessened to such a degree as to be easily tolerable. The cold massage douche may thus be employed with persons who are keenly susceptible to cold impressions, and may also be of service as a means of training them to the use of cold water in other ways.

In many cases the *tepid* douche may be employed with the best effects, the temperature being lowered from day to day as tolerance is established. The general cold massage douche will naturally be employed with persons of good strength, and particularly in cases in which emaciation is not

present, and is especially useful in cases in which spoliative effects are desirable, as in obesity, fleshy rheumatics, and diabetics in whom there is no loss of flesh.

The massage douche to the lower extremities furnishes a useful means of producing derivative effects in favor of the head and chest. It has the advantage over the ordinary cold douche that the local anemia and the resulting retrostasis and increased congestion of the already overfilled vessels of the head or chest are lessened in duration and in degree by the stimulating effect of the massage upon the whole circulation of the parts.

The cold massage douche also possesses great value as a means of stimulating the circulation in joints which have been the seat at some previous time of inflammatory processes which have left behind exudation products with rigidity of the joint structures and limited movement, but in which pain and other indications of congestion are absent. The powerful fluxion effects produced by the massage douche in these cases is a most efficient means of producing an increased flow of healthy blood through the parts, thus bringing to bear upon them the healing influence of the vital fluid, the most potent of all curative means. In cases of this sort the application should not be confined wholly to the joint, but should extend to the soft structures of the limb, both above and below the joint. In the case of the knee, for example, the muscles of both the calf and the thigh should be manipulated in alternation with the joint itself. The effects of the massage douche to the joint may be extended by applying the heating compress, to be changed as often as dried, and to be worn until the application of the next douche.

The local cold massage douche is equally efficient as a means of stimulating the removal of old *inflammatory exudates* in other accessible parts as well as the joints.

The cold massage douche likewise renders great service in cases of intractable *lumbago* and *sciatica* in which the parts are not sensitive to pressure.

The *hot* massage douche may be advantageously applied to the joints in connection with a cold application of some sort, for the purpose of heightening the effect of the latter or rendering the joint less sensitive to thermic and mechanical stimulation. The analgesic effects of the hot massage douche are likewise effective in cases of *sciatica* in which cold applications prove too stimulating.

The *neutral* massage douche to the legs, with strong pressure, is an excellent derivative measure for use in cases of *insomnia* in which the neutral douche alone applied to the legs or to the whole surface fails to accomplish the desired result.

Contraindications.—The contraindications of the cold massage douche are essentially the same as those mentioned in relation to the ordinary cold douche (**1023**). It may be mentioned, however, that by making the application partial in character,—that is, confining it to a small area, as a single limb, until a good reaction has been produced, then extending to another part, and so on until the whole body has been gone over,—the untoward effects resulting from a general cold douche may be obviated without sacrificing any of its good effects. When employed in this way, the cold massage douche produces effects similar to those of cold friction or the cold towel rub, but very greatly intensified. The cold massage douche should not be applied to joints when inflamed, congested, or painful to pressure. In certain cases, however, the application may be made to the soft parts above the joints, as a means of producing powerful derivative effects. **1069**

LOCALIZED DOUCHES.

One of the most valuable uses of the douche (jet, spray, percussion, fan, filiform) is in applications to certain well-defined, cutaneous areas with special reference to the internal organs connected with them. The douche is also sometimes localized in the treatment of certain superficial parts without **1070**

reference to internal parts which may be reflexly influenced. The names by which the principal of these localized douches are designated are the following: *Cephalic, dorsal, lumbar, thoracic, shoulder, sternal, epigastric, abdominal, hypogastric, douche to feet, plantar, anal, perineal.*

Physiological Effects.—The effect of localized douches depends not only upon the duration, temperature, pressure, and mass of water employed, but upon the particular surface to which the application is made. The fact that every portion of the cutaneous surface is reflexly related through the central nervous system with some special internal vascular area, has elsewhere been sufficiently dwelt upon (**353–382**); it is only necessary here to call attention to the fact that a certain number of clearly defined reflex arcs have been worked out by various investigators, and it is with these that localized douches are chiefly concerned.

Without undertaking to review the general principles which have been previously explained, it may be said, briefly, that —

1. *Short applications* of cold water with strong pressure *are strongly exciting*, producing powerful circulatory reaction with dilatation of the blood-vessels and increased activity of the small arteries, veins, capillaries, and lymphatics, both in the cutaneous surface to which they are applied and in the internal vascular area reflexly connected with it.

2. *Prolonged cold applications without pressure produce contraction* of the small arteries, capillaries, veins, and lymphatics of the cutaneous area to which the application is made, and of the reflexly associated internal vascular areas.

3. *Hot applications produce analgesic effects.*

4. *Neutral applications* to these areas *produce local and reflex sedative effects.*

5. *Alternate applications produce* most powerful and valuable *exciting and fluxion effects.*

6. *Revulsive applications produce powerful derivative and analgesic effects* by causing collateral hyperemia of the skin.

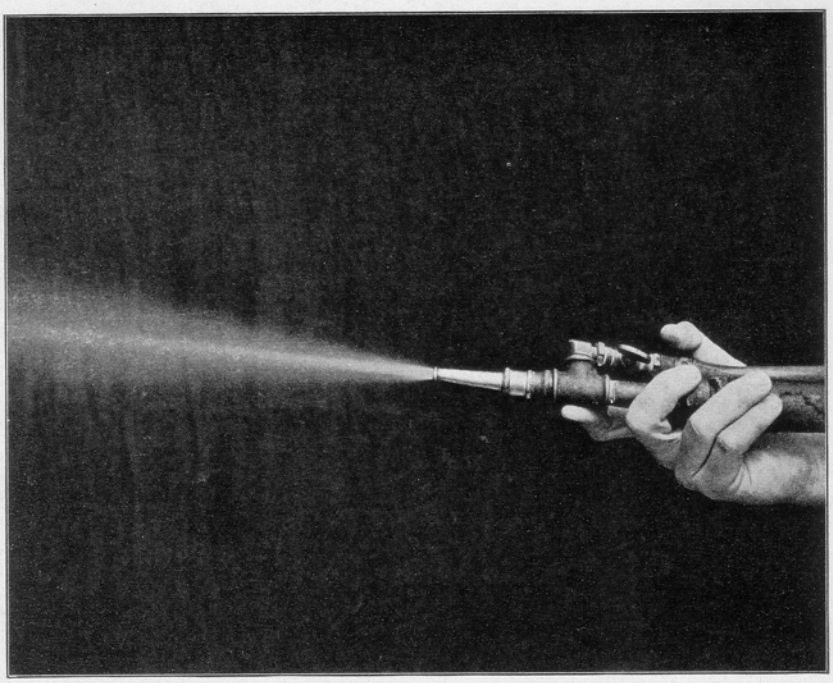


FIG. 46. FOG DOUCHE (p. 486).

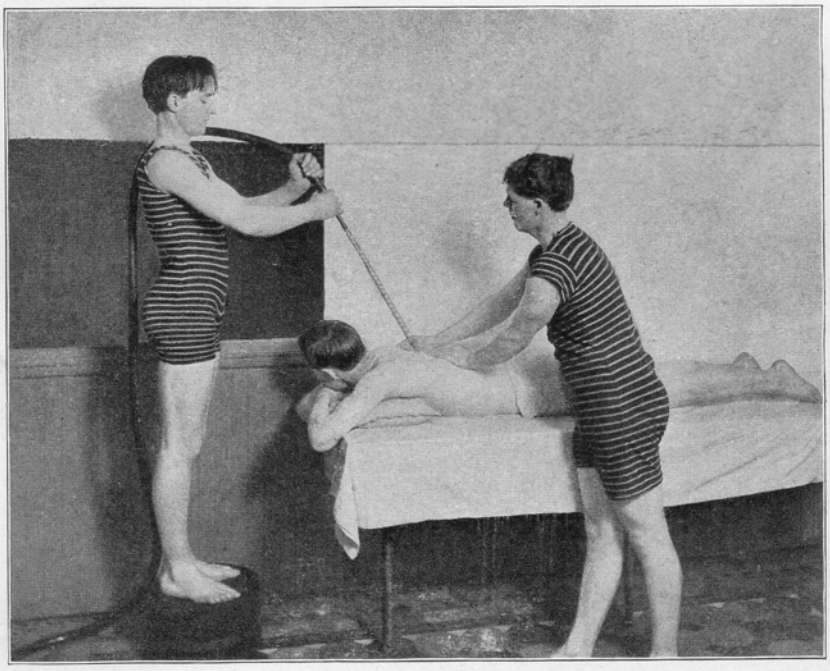


FIG. 47. MASSAGE DOUCHE (p. 486).

THE CEPHALIC DOUCHE.

1071 The cephalic douche, or the application of a stream of water to the head, is a procedure whereby the central nervous system is powerfully influenced (Fig. 48).

Method.— There are two methods of applying the cephalic douche. In one the patient lies on his face, the head projecting over the end of the couch, and depressed sufficiently so that the stream of water poured upon the back of the neck runs down over the head. Cold water may be poured from a dipper or pitcher held at a distance of a few inches to two or three feet above the patient's head; or if preferred, the patient may sit in a tub of water at a temperature of 100° to 102° while water is poured upon the top of the head and allowed to run down the back of the neck. It is an excellent plan to pin a towel about the head in such a way as to protect the ears and shoulders, and direct the stream of water upon the neck and spine. The pressure must always be slight. The fan douche may be used, but not the full jet.

In the general neutral douche for insomnia, the broken jet may be allowed to play upon the back of the head and the neck with gentle aspersions for a few seconds at the end of the application.

1072 **Physiological Effects.**— A short cold application to the head causes dilatation of the blood-vessels of the brain. Prolonged cold applications cause contraction, especially if the application be continued long enough to produce chilling (Schüller).

1073 **Therapeutic Applications.**— The *cold* cephalic douche is well-nigh obsolete, being rarely employed except in connection with typhoid or some other grave fever, in which the cold bath is used. In these cases, affusion to the head or the fan douche to the head is a means of highest value to rouse the activity of the brain, and through it to quicken all the bodily activities. In these cases the cephalic douche is administered in connection with the cold immersion friction

bath (Brand, **1150**), and is repeated at intervals of five minutes during the bath. The temperature should be a few degrees lower than that of the general bath (60° to 50°).

Great care must always be taken in the application of douches or affusions to the head. A *short cold* application excites the brain, and is useful in *melancholia*, in *cerebral anemia*, and in *sunstroke with pallor*. It is especially applicable in cases of *melancholia with stupor*, in which the cerebral anemia is usually very marked. The *prolonged cold* douche to the head is one of the most powerful of all depressing measures; unless very short, the effect may be too profound; hence the cold affusion is safer.

Long cold applications to the head are exceedingly depressing, but may be used in fever, in *cerebral congestion*, and in *sunstroke with congestion* of the skin.

Affusion, the ice compress, and the evaporating compress are usually more convenient for application to the head than the douche, and safer because less likely to be overdone.

A cold douche to the back of the neck stimulates the respiratory centers. If too cold or too prolonged, suffocation or arrest of the heart may result. The hot or cold compress, alternate compresses, or sponging are milder measures which produce similar effects, and are in general to be preferred.

A short *tepid* douche to the head or a tepid affusion will allay cerebral excitement. It may be usefully employed in *insomnia*, *maniacal excitement*, and *cerebral irritation*. The temperature should be from 80° to 92°, duration from 3 to 5 minutes. Affusion is to be preferred to the douche in most cases.

The *neutral fan* douche to the occipital region and the back of the neck, in connection with the general neutral douche, is a remarkably useful measure in procuring sleep in *insomnia*.

Hot affusions to the head are useful in *syncope* and *collapse*, and in cases of *migraine* with low arterial tension, but should be employed with great caution.

In cases of *cerebral anemia*, *alternate* applications may be employed instead of the short cold douche, the hot douche, or hot or cold compresses.

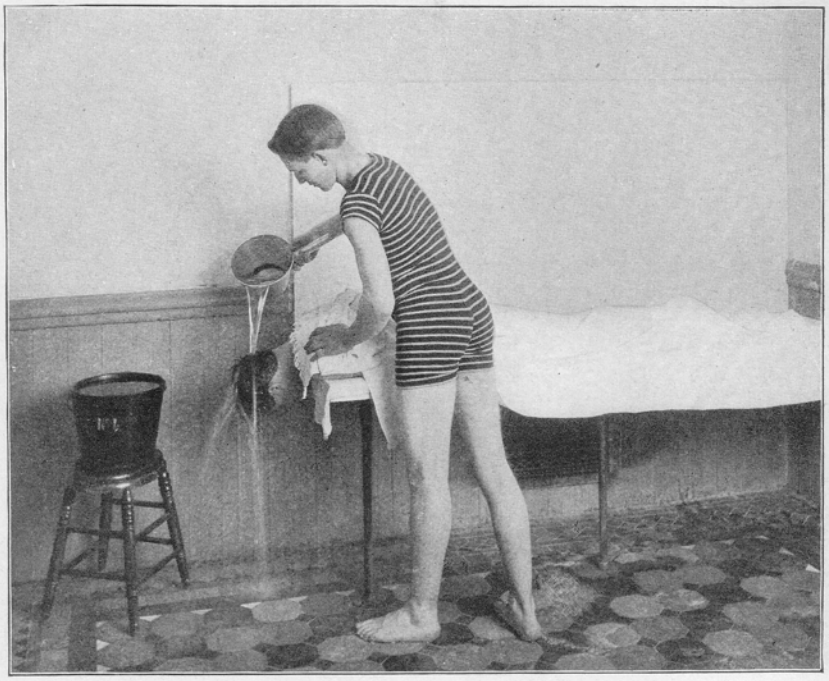


FIG. 48. CEPHALIC DOUCHE (p. 493).

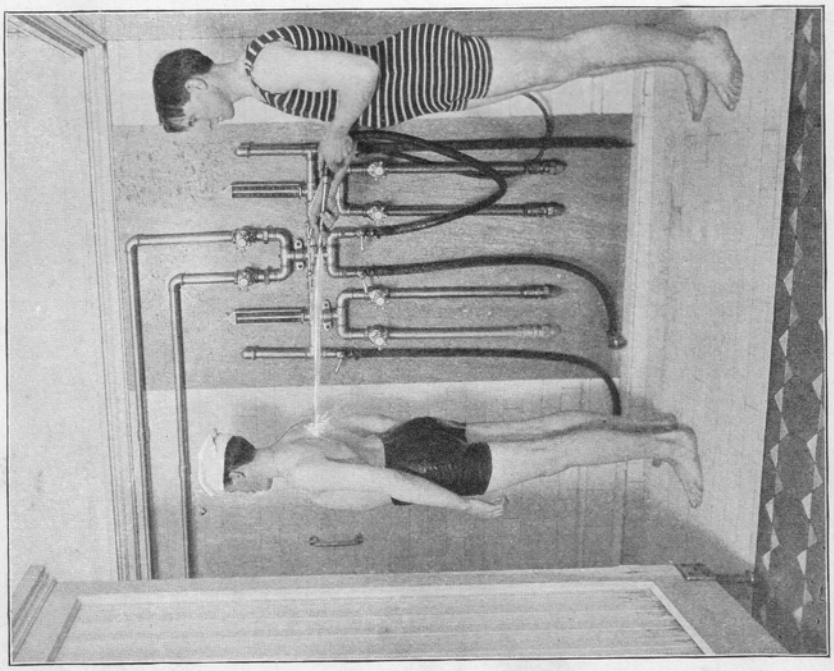


FIG. 49. DORSAL DOUCHE (p. 495).

Applications to the head should be managed with great care, and should at first be employed in a tentative manner, the effects being carefully noted.

THE DORSAL OR SPINAL DOUCHE (Fig. 49).

1074 In this procedure either the full or the broken horizontal jet, the percussion douche, the fan douche, or the spray may be employed. The skin of the back is less sensitive than that of most other portions of the body, and hence intense applications may be made without unpleasant excitant effects in most cases in which percutient effects are at all admissible.

The stream of water should not be confined to the median line, but should be allowed to play rapidly up and down over a surface extending three or four inches on either side of the spinal column. As a rule, the pressure employed should be as great as the patient can bear. The percussion douche should be employed when available.

1075 **Physiological Effects.**— The purpose of the dorsal douche is to influence the central nervous system, and through its effects upon the vasomotor nerves to influence the system at large. That most pronounced effects are obtainable by this procedure is clearly evidenced by the sense of buoyancy and increased energy experienced as the result of a vigorous application, especially of the cold percussion douche, in cases of either temporary or chronic nervous exhaustion.

Therapeutic Applications.— The *tepid* douche calms excitability of spinal origin, as in *hysteria* and *spinal irritation*, *hypercesthesia* of the *lumbar ganglia* of the abdominal sympathetic connected with *irritation* of the *splanchnics*, *irritability* of the *bladder* of spinal origin, and *irritability* of the *genito-urinary center;* and relieves *incontinence* in children.

The *cold* dorsal douche should be employed in *spinal anemia*, in functional *locomotor ataxia*, in *motor insufficiency of the bladder* resulting in *urinary incontinence* or *retention*, in

nervous vomiting, in *diminished renal activity*, and in *melancholia*, but must be carefully avoided in cases of insanity of organic origin and all forms of structural disease of the spine. The cold percussion douche to the spine produces a most wonderfully beneficial effect in cases of *chronic neurasthenia*. By the daily application of this procedure the patient sees himself steadily lifted up to a higher level, his mental and nervous tone improving, the trembling, languor, mental confusion, and indecision disappearing; indeed, the effect of a single application is so pronounced that the patient himself at once recognizes the benefit derived from this simple procedure. Great care must be taken to avoid overdoing the application. The result will be headache, depression, and nervousness following a feeling of buoyancy.

The very *hot* dorsal douche should be applied in *gastralgia*, in connection with the hot douche to the hypogastrium; and the *warm* spinal douche (92° to 98°) is of great value in *locomotor ataxia* with lightning pains, and in *spinal sclerosis*.

The *Scotch* douche to the back may be employed in *lumbago*, in cases of *diabetes insipidus*, in the *irritation* of the *renal plexus* of the sympathetic so often encountered in *movable* or *floating kidney* in connection with *enteroptosis*, and in *neuralgia of the kidney*.

THE LUMBAR DOUCHE (Fig. 50).

1076 Either the full, the broken, the percussion, or the fan douche may be applied to the lumbar region; and, except in cases of painful affections, full pressure may be employed. Powerful reflex effects are produced by the lumbar douche upon the organs of the lower abdomen, the pelvic viscera, and the lower extremities.

The *cold* lumbar douche is especially useful in cases of *constipation*, in *motor insufficiency of the bladder* resulting in *incontinence* or *retention*, in *amenorrhea*, in *renal insufficiency*, and in *infantile uterus*, or *delayed development* of the

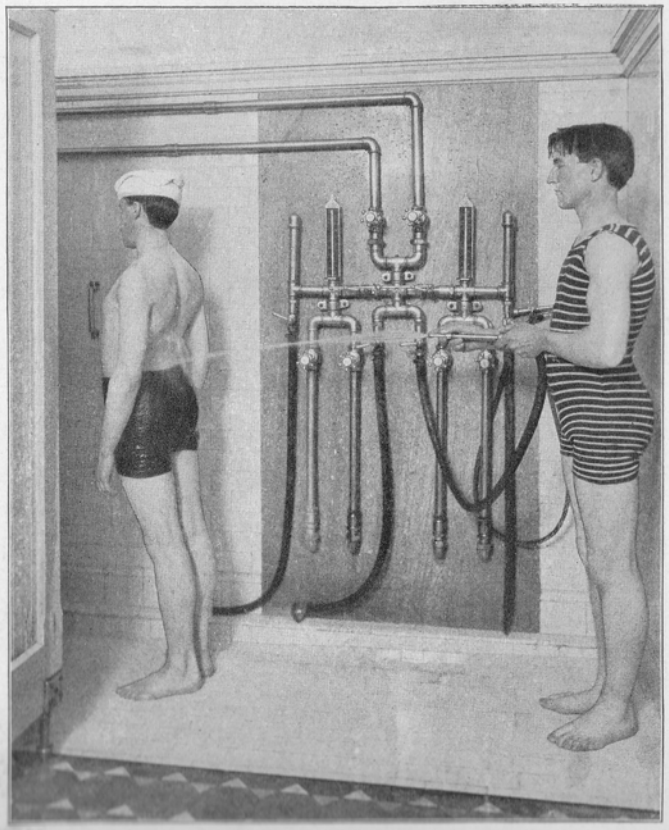


FIG. 50. LUMBAR DOUCHE (p. 496).

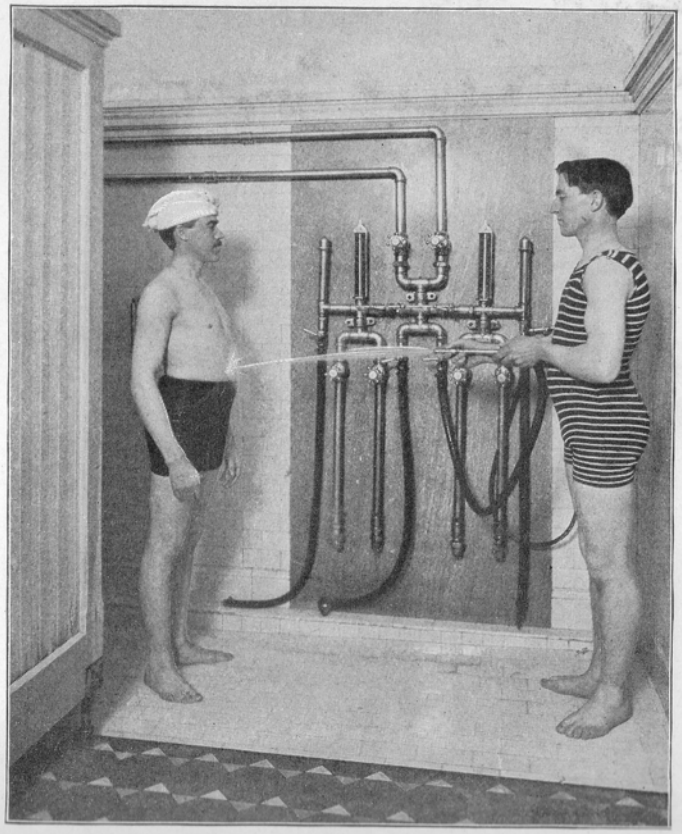


FIG. 51. ABDOMINAL DOUCHE (p. 500).

pelvic viscera or functions. It should be borne in mind that a douche to this region, to obtain the effect above described, must be administered with a considerable degree of pressure, at a low temperature, and very short.

The *Scotch* lumbar douche is a most excellent remedy in ***neuralgia of the uterus and ovaries***, in *renal congestion*, in ***urinary retention*** due to spasm of the neck of the bladder, and especially in *lumbago*. It is a sovereign remedy also for the ***backache*** so common in women suffering from pelvic displacements, although of course in these cases its effects are chiefly palliative. But when employed in connection with the use of the abdominal supporter, relief is nearly always prompt and permanent, when no inflammation exists.

In connection with the Scotch fan douche to the lumbar region for the relief of congestion, revulsive applications should be made to the feet and legs. Sometimes a better effect is obtained by applying the revulsive douche to the shoulders and upper part of the back.

THE SHOULDER DOUCHE.

1077 Either the full or the broken jet may be applied to the shoulders, special care being taken to avoid the neck and the chest surfaces. A very short *cold* application to the shoulders and arms, followed by a hot application at 113° to 120°, produces strong derivative effects in favor of the pelvic viscera. When employed for this purpose, the cold application should be made with the percussion douche. The *hot* or the *Scotch fan* douche generally affords prompt relief in cases of rheumatic pains in the shoulder joints.

THE THORACIC DOUCHE.

1078 In this procedure, the application of the douche is confined to that portion of the trunk above the diaphragm, or practically the area of the skin covering the ribs, sternum, and vertebræ. The application should include not only the throat, sides, and back of the chest, but the tops of the

shoulders as well. The broken or the fan douche should be employed. The full jet is likely to produce too powerful an impression.

Physiological Effects.— A *short cold* application, with high pressure, made to this region increases the amount of blood not only in the dermal and muscular coverings of the chest wall, but within the lungs and pleura.

Prolonged cold applications, with little pressure (65° to 80°, 6 to 10 lbs., 1 to 3 min.), contract the blood-vessels, and lessen the amount of blood in the lungs and other organs contained within the chest cavity.

A *short, very cold* douche to the breasts stimulates the circulation in the pelvic viscera, and causes contraction of the uterine muscle (50° to 45°, 4 to 10 secs.).

Prolonged cold applications to the breasts with little pressure cause contraction of the blood-vessels of the uterus, and thus relieve uterine congestion (75° to 65°, 1 to 3 min.). The application of the cold douche to the lower third of the sternum causes contraction of the vessels of the kidney, and increases the flow of the urine. Applied over the heart, the douche powerfully excites cardiac activity.

Prolonged application, with little pressure, slows and energizes the heart.

THE EPIGASTRIC DOUCHE.

1079 The broken jet, the fan douche, or the spray should be employed rather than the full jet in the application of the epigastric douche.

Therapeutic Applications.— The *cold* epigastric douche is of the greatest value in the treatment of *hypopepsia*, *apepsia*, *gastroptosis*, *dilatation* and *atony* of the stomach, and in gastric *flatulence*. It stimulates both the glandular and the muscular activities of the stomach through its influence upon the plexuses of Meissner and Auerbach.

The *very hot* epigastric douche (115° to 122°) is equally valuable in cases of *hyperpepsia*, *gastrorrhea*, so-called *gastric rheumatism*, *gastric crises*, *gastralgia*, *subacute gas-*

tritis, *gastro-duodenitis*, or *gastric* and *duodenal catarrh*, *infectious jaundice*, and the distressing pain accompanying *chronic ulcer* of the stomach.

The *tepid thoracic* douche (fan) without pressure relieves nervous asthma when applied to the back and sides of the chest, and quiets palpitation from irritability of the heart when applied over the cardiac region. It is rare that very cold water can be employed at first in these cases; hence it is better to begin with a temperature of 80° to 92°, lowering the temperature at successive applications if the patient is found able to tolerate colder water.

The Scotch douche may be employed with excellent success for the relief of *intercostal neuralgia*, *pleurodynia* from chronic pleuritic adhesions, *brachial neuralgia*, and *reflex irritations* arising from *hyperesthesia* of the solar plexus.

In all painful affections of the stomach the *Scotch* douche generally affords marvelous relief. The hot applications should be at as high a temperature as can be borne (120° to 125°), and the cold application should be very cold and very short, 50° to 60°, for 6 to 12 seconds. When pain is produced by slight pressure of the hand upon the epigastrium, the douche should be applied with the least pressure possible. *Hyperesthesia* of the solar plexus, a condition usually present as a fundamental cause of *intercostal neuralgia*, *pain between the shoulders*, *spinal irritation*, so-called *painful dyspepsia* and *nervous asthma*, is wonderfully relieved by the Scotch epigastric douche.

THE HYPOGASTRIC DOUCHE.

This application, in which only the broken jet, the fan, **1080**
or the spray douche may be employed, is confined to the hypogastric region. For its application the patient sits upon a stool with the knees separated, the head erect, and the trunk inclined backward.

Physiological Effects.— Through the influence of this procedure, most powerful reflex effects may be produced upon

the organs of the lower abdomen and pelvis. It acts especially upon the bladder, the uterus, and the ovaries.

Therapeutic Applications.— The *cold* douche to the hypogastrium, with little pressure, and continued for a half minute to one minute, causes contraction of the bladder and the uterus, and of the vessels of all the pelvic viscera; hence this procedure is of great value in conditions of both *active* and *passive congestion*, and in all chronic morbid conditions of the pelvic viscera in which congestion is a prominent factor, such as so-called *chronic inflammation* of the *uterus*, and *endometritis*. It is likewise very useful in *subinvolution*, in *displacements* due to relaxation of the supporting structures, in *atony* of the *bladder*, and in *enteroptosis* due to weakness of the abdominal muscles.

The *revulsive Scotch* douche to the hypogastrium affords prompt relief in *neuralgia* of the *uterus*, the *bladder*, or the *ovaries*, in *uterine pain* due to contraction of the cervix, in *vaginismus*, *vesicle tenesmus*, and in *hyperesthesia* of the sympathetic ganglia of the pelvis, as shown by pressure upon the lumbo-aortic plexus and the sympathetic nodes of the pelvis.

THE ABDOMINAL DOUCHE (Fig. 51).

1081 This local application of the douche is properly confined to the anterior abdominal surface. It influences the small intestines, the colon, and the lumbar ganglia of the abdominal sympathetic. Through these nerve centers important general effects are produced.

A *cold* douche applied to the abdomen is highly useful in *constipation*, especially when it is due to *dilatation* of the *colon*, and *enteroptosis*.

The *cold abdominal* douche is of service in *atony* of the *bladder*, in *enteroptosis* due to relaxation of the abdominal muscles, and in *pelvic displacements* due to atony, when not accompanied by uterine or ovarian congestions.

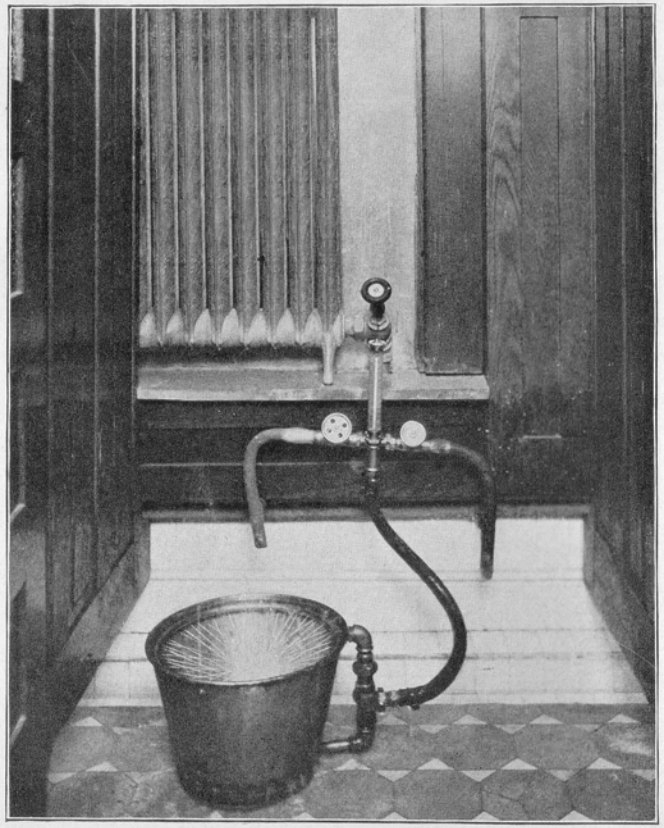


FIG. 52. PLANTAR DOUCHE APPARATUS (p. 502).

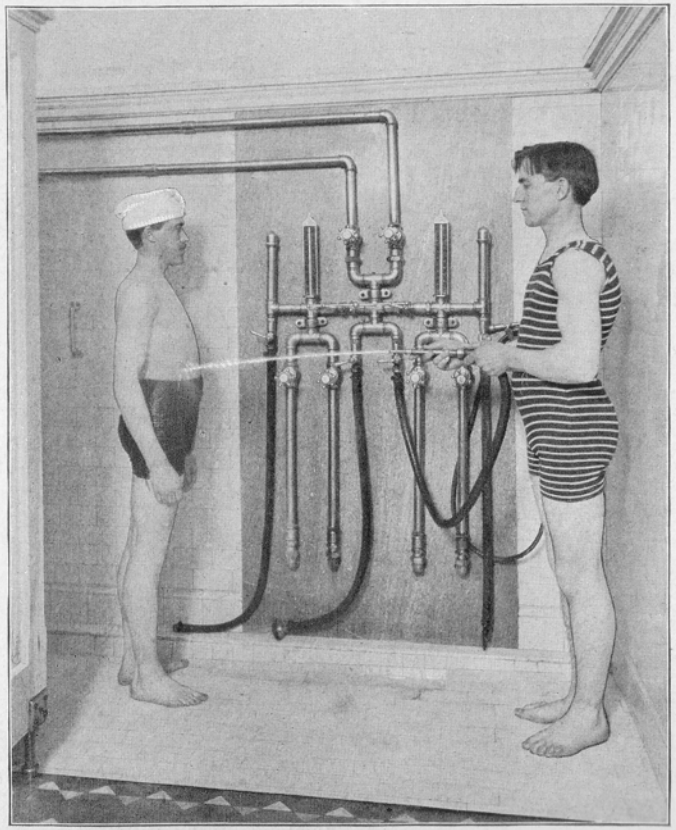


FIG. 53. HEPATIC DOUCHE (p. 510).

The *warm* or *hot* douche should be employed when *pain* or *irritability* exists in the *bladder*, the *uterus*, the *ovaries*, or other pelvic viscera.

The *Scotch* douche is most valuable for the relief of the pain due to *irritation* of the *splanchnic nerves* or of the *lumbar ganglia* of the abdominal sympathetic, a condition recognized by pressure upon the ganglia situated about two inches to the right and the left of the umbilicus, on the inner surface of the posterior wall of the abdominal cavity.

The Scotch douche gives excellent results in *chronic diarrhea*, *chronic dysentery*, and *enteralgia*.

DOUCHE TO THE FEET.

1082 In this application the broken jet or the spray is commonly employed, as the fleshy covering of the foot is so thin as to make the percussion douche or even the full jet too painful to be borne in most cases. The stream is directed upon the feet and ankles, the patient sitting in such a position that the largest amount of surface may be readily reached. It is the usual practice to apply the *cold* douche to the feet for a few seconds at the end of general applications of the douche, for the purpose of producing a certain amount of revulsive effect in this region of the body. In very susceptible persons the douche may be applied to the feet only, until the patient has been trained to bear a more general application. This is especially necessary in cases of patients subject to painful affections of the head or nervous affections of the chest and heart, as in *cerebral hyperemia*, *nervous asthma*, *palpitation* of the heart of sympathetic origin, *pulmonary congestion*, *exophthalmic goiter* and *chronic migraine*. By taking the precaution to allow the stream of cold water to fall upon the feet at the beginning or end of the general cold douche, the headache which often follows the douche (sometimes called the "hydropathic headache") may generally be prevented.

The *cold spray* douche prolonged until the skin is reddened, produces contraction of the cerebral vessels, and hence exerts a most useful derivative effect in cerebral hyperemia.

The *Scotch* douche and the *very hot* douche may be applied to the feet with advantage as a means of relieving cerebral congestion.

THE PLANTAR DOUCHE.

1083 The plantar douche consists in the application of water under strong pressure to the soles of the feet. Either the single jet or the spray douche may be employed. The author has for many years used the apparatus shown in the accompanying cut (Fig. 52), which he had especially constructed for the purpose. It consists of a copper tub with double bottom, the uppermost one of which is perforated over a surface equal in area to that of the average foot, and with an outline adapted to the foot. Several openings around the side permit the ready escape of the water. A perforated pipe placed around the side of the inner surface of the vessel at a higher level permits the application of water to the upper surface of the foot when desired.

The *cold* plantar douche, continued for one half minute to 2 minutes, or until strong reaction occurs, produces powerful reflex impressions upon the organs of the abdomen and pelvis. Both the blood-vessels and the muscular walls of the hollow organs of the pelvis and the abdomen are brought into strong contraction by this procedure.

Burgonzio has also shown that the vessels of the brain may be caused to contract by this application, rendering it useful in *chronic headache* from congestion. The duration of the applications for this purpose should be one and one-half to 2 minutes.

The cold plantar douche may likewise render service in *anemia* of the brain, in which case the application should be much shorter (4 to 10 sec.). This douche affords one of the very best means for overcoming habitual *coldness* of

the *feet*, a condition which is exceedingly common in *gastric neurasthenia*, in *hyperesthesia* of the *lumbar ganglia*, and especially in *enteroptosis*. It is chiefly in these cases of vascular spasm due to reflex irritation, that the plantar douche is useful as a means of warming cold extremities. It is not applicable when the coldness is due to general feebleness of the circulation. In cases of the latter sort, general cold frictions, the cold precordial compress, the general Scotch douche, and other measures for stimulating the circulation are required.

The cold plantar douche renders valuable service in *hematuria*, *atony* of the *bladder*, *incontinence* of urine in old men, in *spermatorrhea* from relaxation of the ejaculatory ducts, in *neurasthenia*, the result of excessive cerebral activity, in cases in which the *urinary secretion* is *scanty*, and in *chronic epistaxis* not due to ulceration of the nasal mucous membrane.

THE PERINEAL DOUCHE.

In this douche the application is confined to the cutaneous region in front of the anus or the perineum, its purpose being to affect the organs of the pelvis, especially the rectum, the prostate, the vesiculæ seminales, the deep urethra, the ejaculatory ducts, the testicles, and the bladder, in men; and the rectum, the uterus, the ovaries, the Fallopian tubes, and the bladder, in women. The perineum has an exceedingly rich vascular and nervous supply, and strong reflex effects may be produced by suitable applications to this region. The application is made with the ascending douche, as much pressure being used as is possible without pain. **1084**

Therapeutic Applications.— The *very cold* perineal douche is useful in *constipation*, *atony* of the *bladder*, *chronic urethritis*, *prostatorrhea*, *prostatitis*, *hypertrophy* of the *prostate* with *induration*, *spermatorrhea* with *atony* of the *ejaculatory ducts*, and especially the diurnal form of the disease, *inflammation* of the *uterus*, *subinvolution* of the *uterus* with relaxation of the supporting structures of the uterus and *displacements*, as well as other chronic disorders of the pelvic region characterized **1085**

by lowered tone. It must be remembered, however, that this application should never be employed in cases in which pain is a marked symptom, as the powerful thermic reaction set up is likely to increase the pain ; spasmodic affections, as *vesical*, *rectal*, or *vaginal tenesmus*, are also aggravated by cold applications. The duration of the cold application should be 2 to 3 minutes.

1086 The *very hot* perineal douche is useful in most affections of the prostate, the rectum, the uterus, the bladder, and associated organs. It is especially valuable in cases of *spermatorrhea* with great *irritability* of the *deep urethra* and *hyperesthesia* in the region of the *vesiculæ seminales* and *ejaculatory ducts*. The duration of the hot perineal douche should be 1 to 3 minutes (115° to 122°). The hot perineal douche is very useful as a means of relaxing a *rigid perineum* in preparation for childbirth when rigidity of the perineum is known to be present. Little pressure should be employed in these cases. *Vaginal*, *rectal*, and *vesical tenesmus* are relieved by the hot anal douche with moderate pressure.

It is generally useful to terminate the application with cold for 2 or 3 seconds.

THE ANAL DOUCHE.

1087 This application, administered by means of the rising or ascending douche, allowed to fall upon the anus, is of great value in the treatment of hemorrhoids, especially in external hemorrhoids and in the mixed variety, in which the internal and external structures are both involved, and joined by extension of the morbid process across the anal margin.

Galtz produced evacuation of the bladder in dogs having paraphlegia from division of the spinal cord, by placing a sponge saturated with cold water against the anus.

The *cold* anal douche is of special service in the treatment of *constipation*, reflexly exciting normal peristaltic movements, and is especially useful in restoring normal sensibility of the rectum which has become lost by neglect to answer

promptly the calls of nature, resulting in an abnormal accumulation of hardened fecal matters in the rectum, and consequent constipation. It is also of great service to persons who have suffered from the unwise application of surgical procedures to this portion of the body, resulting in *weakening of the anal muscle* to such an extent as to prevent the proper retention of fluid fecal matters and gas. By the use of this simple measure such few fibers of the sphincter as may remain intact may be stimulated to vigorous action.

The cold douche may be advantageously employed in cases in which internal hemorrhoids have become inflamed, and are prolapsed.

The very cold anal douche will generally cause a contraction of the hemorrhoids to such an extent that they may be easily replaced.

The *very hot* anal douche is useful in cases of *rectal ulcer* and *fissure*, *vaginismus*, and *spasm* of the *sphincter muscle*.

This application is contraindicated in cases of *ovarian neuralgia*, *enteralgia*, *vesical irritability*, and other painful affections of the pelvic and abdominal viscera.

VISCERAL DOUCHES.

By the general term "visceral douche" it is intended **1088** to designate a douche administered in such a manner as to influence an internal organ. It should be understood, however, that, with one or two exceptions, it is impossible to make an application directly to the organ itself, but that the desired effect is obtained through the medium of an application to the cutaneous area or areas reflexly associated with the organ, the condition of which it is desired to influence.

General Physiological Effects.—The visceral douche oper- **1089** ates through the sympathetic or vasomotor centers and nerves upon internal associated organs. There are good grounds for believing that in many instances the good effects experienced are the result of a collateral anemia or hyperemia

produced in the affected parts by retrostasis or the opposite action, as the case may be. The active fluxion in internal parts set up by exciting applications of the douche upon the surface is also a powerful factor in the therapeutic results produced by these simple but wonderfully potent procedures.

The *visceral douche* differs from the *localized douche* in that the latter involves but a single circumscribed area, while the former often involves a number of areas, which, though in some instances widely separated anatomically, are intimately associated physiologically through a common relation with the internal viscus which it is desired to influence.

The principal visceral douches may be designated as follows: *Cerebral*, *cerebrospinal*, *pulmonary*, *cardiac*, *gastric*, *enteric*, *hepatic*, *splenic*, *renal*, *genito-urinary*.

In the description of these several forms of douche it will be unnecessary to repeat such details of method as have already been given in connection with the several forms of localized douches; it is sufficient to indicate the surfaces which are to be acted upon, with suggestions respecting the therapeutic indications.

THE CEREBRAL DOUCHE.

1090 The cerebrum is influenced by applications to the head itself, to the back of the neck, the face, the hands, and the soles of the feet. Next to the applications to the head itself, the most powerful impressions may be made by applications to the soles of the feet, the so-called "plantar douche." A *prolonged cold* application to these surfaces produces powerful contraction of the blood-vessels of the brain by reflex action. In applications to the plantar region the thermic effects of extreme cold are supplemented by the percussion effects of water at high pressure. Powerful circulatory reaction is produced in the feet and lower extremities, especially if the application be extended to the feet and legs, thus producing a derivative effect in favor of the brain, in addition to the reflex influence exerted.

Short cold applications to the face, neck, and scalp are quickly followed by reaction, with dilatation of the cerebral vessels, and increased activity of all the cerebral functions. This is also true of general cold applications.

Prolonged cold applications to the reflex surfaces named produce more permanent contraction of the vessels, and secure relief when *cerebral congestion* is present, especially if the applications are renewed every few minutes so as to repeat the reflex effect upon the vessels.

Warm applications to the face, neck, and scalp tend to congest the brain.

Very hot applications, on the other hand, cause temporary contraction, and relieve *congestion.*

Neutral applications (92° to 94°) to the occiput and the back of the neck relieve *cerebral excitability.*

Very cold or *very hot* applications to any portion of the dermal surface produce an exciting effect upon the cerebrum.

THE CEREBROSPINAL DOUCHE.

The purpose of this douche is to influence the whole 1091
cerebrospinal system, and through it the body at large. All the spinal nerves send out branches, which are distributed to the skin covering the back; so that by applications made to the dorsal surface of the trunk, in addition to the applications which have been described under the head of "the cerebral douche," all the cerebrospinal centers may be acted upon. The method consists essentially in that described for the cerebral douche, with the addition of an application to the back. The several steps of the procedure are as follows: —

1. Affusion, or douche without pressure, to the head, as described for the cerebral douche.

2. The application of the douche to the feet for 15 or 20 seconds, at a temperature as low as possible, usually at least as low as 60° to 50° F.

3. The percussion douche to the spine from 20 to 30 seconds, the stream being rapidly moved up and down and across the back in every direction.

4. The broken jet to the dorsum and soles of the feet for 30 to 60 seconds.

The cerebrospinal douche is indicated in cases of neurasthenia with cerebral congestion. Care should be taken to see that the patient's skin is warmed before the application of this douche, so that the internal congestion, including congestion of the brain, which always occurs when the surface is chilled, may be avoided. The electric-light bath, the vapor bath, the hot-air bath, or the warm rain douche (care being taken to protect the head) are all excellent means of heating the skin preparatory to the cerebrospinal douche. In patients who chill easily, the spray douche at 102° to 104° may be applied for 1 minute to the feet and spine, before the cold application to these parts.

The *tepid* or *neutral* cerebrospinal douche is useful in cases of *spinal sclerosis*, *general feebleness*, *sexual dementia*, *exhaustion* from *alcoholism* and other forms of dissipation, as well as in an *enfeebled condition* resulting from loss of sleep and prolonged mental anxiety.

In certain cases, as in *irritable* and *feeble neurasthenics* with *cerebral congestion*, the neutral douche to the back of the neck may be combined with the cold percussion douche to the spine and feet. In cases of *cerebral anemia* associated with chronic nervous exhaustion, the prolonged cold douche to the spine, legs, and feet may be advantageously associated with the warm douche or affusion to the head.

THE PULMONARY DOUCHE.

1092 The pulmonary circulation may be influenced by applications made to any portion of the cutaneous covering of the chest, but especially to the vertebra prominens. Askatchensky showed that a *cold* application to the hands is capable of controlling epistaxis, and the writer has clinically shown that

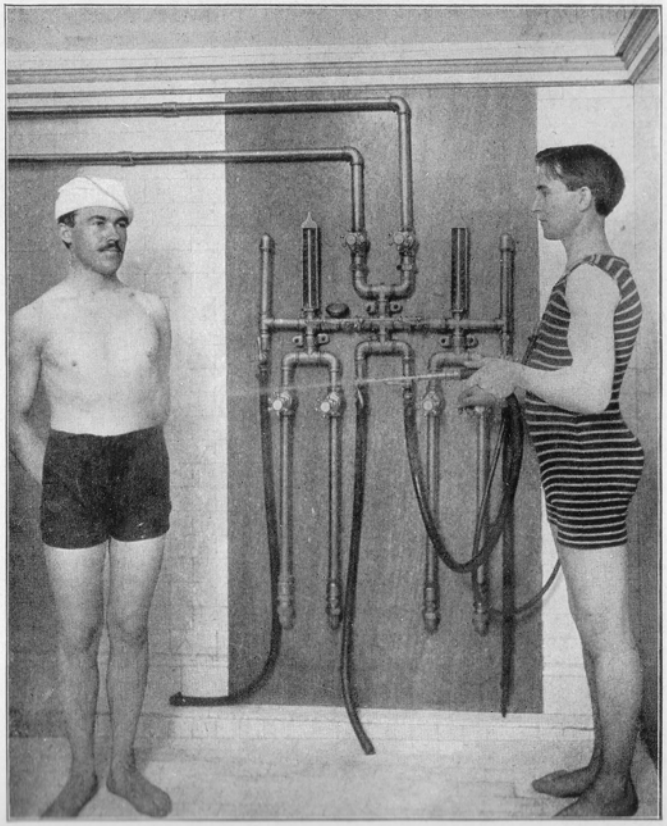


FIG. 54. SPLENIC DOUCHE (p. 511).

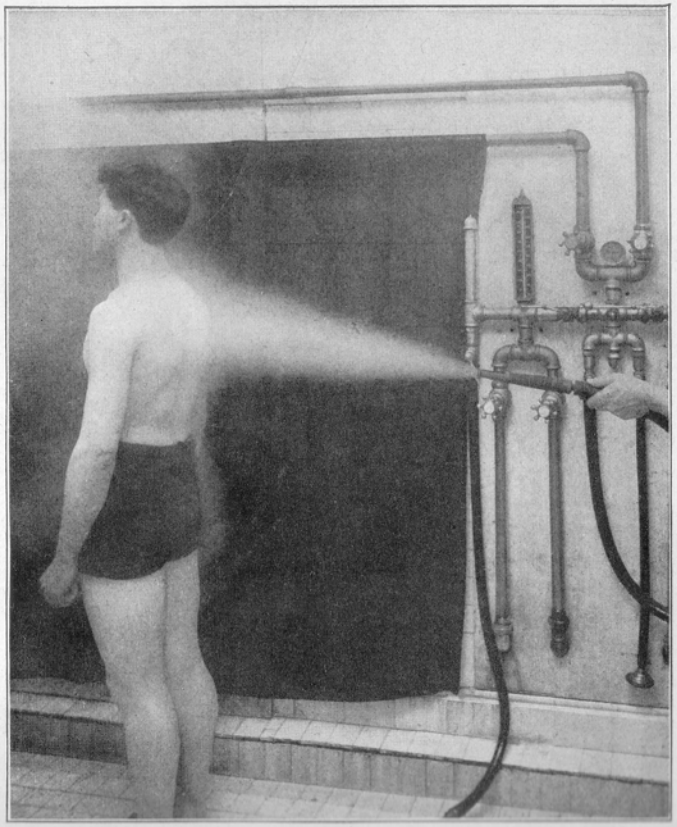


FIG. 57. VAPOR DOUCHE (p. 515).

pulmonary hemorrhage may likewise be favorably influenced by this procedure. That *very cold* applications to the hands and feet, with strong pressure, are also capable of influencing the pulmonary circulation to a marked degree, has been shown by the experiments of Vasilieff. Winternitz has noted a similar relation between the thighs and the lungs. The application should be considerably prolonged, and with little pressure. The procedure in the pulmonary douche should be as follows: —

A rapid percussion douche, or horizontal jet with strong pressure, at 60°, to the arms and shoulders; then the broken jet to the front and sides of the chest; ending with the percussion douche to the back and vertebra prominens; the duration being from 10 to 15 seconds to each part. The *neutral* douche to the back of the chest is of value in cases of asthma, especially if accompanied by the *Scotch* douche to the feet and legs.

The pulmonary douche has a somewhat limited sphere of usefulness, but may be employed in cases which require either quieting or exciting of the respiratory movements. Thus the *hot* pulmonary douche applied to the back may be used with advantage in asthma; while the *cold* douche is equally useful for sedentary neurasthenics who need increased pulmonary activity to supply an increased amount of oxygen and to encourage the portal circulation.

THE CARDIAC DOUCHE.

1093 A *cold* douche, with slight pressure over the heart, first quickens, then slows, its action, increasing arterial tension. Prolonged application of cold to the hands has the effect to slow and energize the heart. Only the broken or the fan douche should be employed in applications over the heart. The douche is less useful as a local measure for influencing the heart than is the ice-bag or the cold compress.

THE GASTRIC DOUCHE.

1094 The *very hot* douche (115° to 122°) applied over the epigastrium and the spine opposite often gives relief in

painful affections of the stomach. It has the effect to diminish the secretion of gastric juice; hence is applicable in *chronic gastritis*, *gastric ulcer*, *gastralgia*, *gastrorrhea*, *gastroduodenitis*, *infectious jaundice*, *hyperesthesia* of the *solar plexus*, and especially in *hyperpepsia*.

A *cold* douche applied to the same areas increases the production of HCl, and increases the muscular tone of the stomach. It is of especial service in *apepsia*, *hypopepsia*, *dilatation* of the *stomach*, and *gastric flatulence*.

The *Scotch* douche is in some cases more successful in relieving pain than the hot douche. The hot application should be prolonged to 3 or 4 minutes. The duration of the concluding cold application should not be more than 15 to 20 seconds. The fan or broken jet should be used, and with little pressure.

THE ENTERIC DOUCHE.

1095 The blood-vessels of the muscular walls of the small intestines are powerfully influenced by applications to the umbilical region, the hypogastric region, the lumbar region of the spine, and the feet. A cold douche to these parts powerfully stimulates peristalsis, and increases the tone of the muscular walls. A short application with considerable pressure increases the secretion and vascular activity, while more prolonged applications with little pressure lessen *congestion* when present.

The Scotch douche relieves painful affections, such as *enteralgia*, *colic*, and the pain of *chronic peritonitis*. In applying this douche for *constipation*, the cold application should be made first to the feet, then to the lumbar region, then to the umbilical and hypogastric regions, and lastly another short application to the feet, with strong pressure.

THE HEPATIC DOUCHE (Fig. 53).

1096 Administered with proper care, there is no therapeutic measure which secures better or more definite results than does the hepatic douche. Lying close to the surface, and

having an exceedingly vascular structure, the liver may be most profoundly affected by a douche properly administered; but for this reason, great care must be employed in applications of this sort. The douche is applied over the region of the liver; that is, the lower part of the right chest and the epigastrium. The fan douche or the broken jet at a low temperature is employed for excitant effects.

To relieve *congestion*, the application should be cold and with moderate pressure (65° to 75°, 15 to 20 lbs, 5 to 10 min.); and the internal reaction should be suppressed by a general douche to the whole surface immediately following the hepatic douche, or by some other of the several means elsewhere described. If considerable pain is present, the general douche may be employed first, the local application following immediately. In cases of *chronic enlargement* of the *liver*, the alternate douche should be employed. In *acute congestion* of the *liver* accompanied by pain, the tepid douche should be used. In cases of extreme *pain*, as in *gall-stones*, *infectious jaundice*, and *inflammation* of the *liver*, the Scotch douche is indicated. The hepatic douche is of especial value in the disorders of the liver encountered in hot countries, particularly those resulting from malarial infection.

THE SPLENIC DOUCHE (Fig. 54).

By means of the fan douche or the broken jet an application of cold water of moderate pressure is made over the lower portion of the left chest, the cutaneous surface overlying the spleen. 1097

The cold or alternate douche constitutes the most effective of all means for combating an enlarged spleen, especially in cases in which the hypertrophy is due to chronic malarial infection. Not infrequently, a considerable degree of diminution in the size of the spleen may be recognized immediately after an application of this sort. In general, the observations made in reference to the hepatic douche apply equally well to the splenic douche.

If pain or tenderness is present, the *very hot* or *Scotch* douche should be employed. In the administration of the splenic douche, short applications should be made to the feet both before and after the application to the spleen. In cases in which the general cold douche can be tolerated, it is well to make such an application in connection with the splenic or hepatic douche; but in cases of congestion of these organs care should be taken to make a short cold local application first, so as to avoid an increase of the congestion by the inrush of blood produced by the general application.

THE RENAL DOUCHE.

1098 The kidneys are influenced by the douche to the lumbar region, as also to the cutaneous surface covering the lower third of the sternum. The interesting fact that the sternal area is reflexly connected with the kidneys, was first pointed out by Beni-Barde, of Paris. Prolonged *cold* applications with little pressure to these areas produce contraction of the vessels of the kidneys, especially influencing the small vessels of the parenchyma of the organ, thus increasing the pressure in the glomerules, and so favoring the outflow of urine. This interesting explanation of the action of the cold douche upon the kidney was first offered by Bottey, and makes clear how the urinary excretion is increased by the action of the cold douche, while at the same time congestion is relieved. The renal douche is especially serviceable in the treatment of *renal congestion*, which is frequently associated with *chronic alcoholism* and *malarial infection*. It also serves a useful purpose in *diabetes* and in some cases of *Bright's disease;* but when albumin is present in the urine, the *Scotch* douche should be substituted for the cold application.

In *painful affections* of the *kidneys*, as in *pain* due to *movable* or *floating kidney*, *hydronephrosis*, *neuralgia*, and *renal calculus*, the *very hot* douche or the *Scotch* douche applied to the lumbar region is indicated.

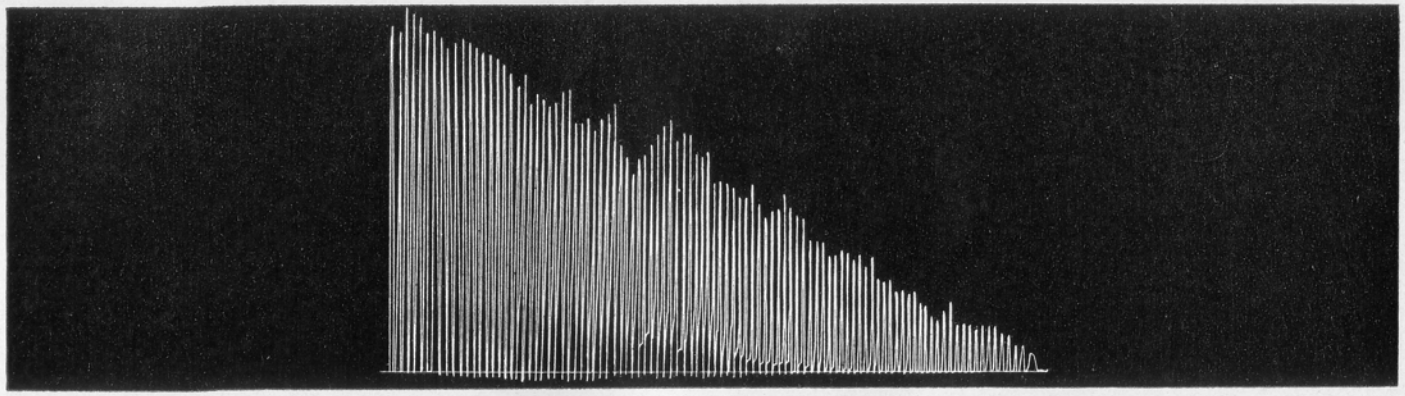


Fig. 55. Normal Fatigue Curve of Man Aged Twenty-four Years. Total work, 6.703 kgm. (p. 514).

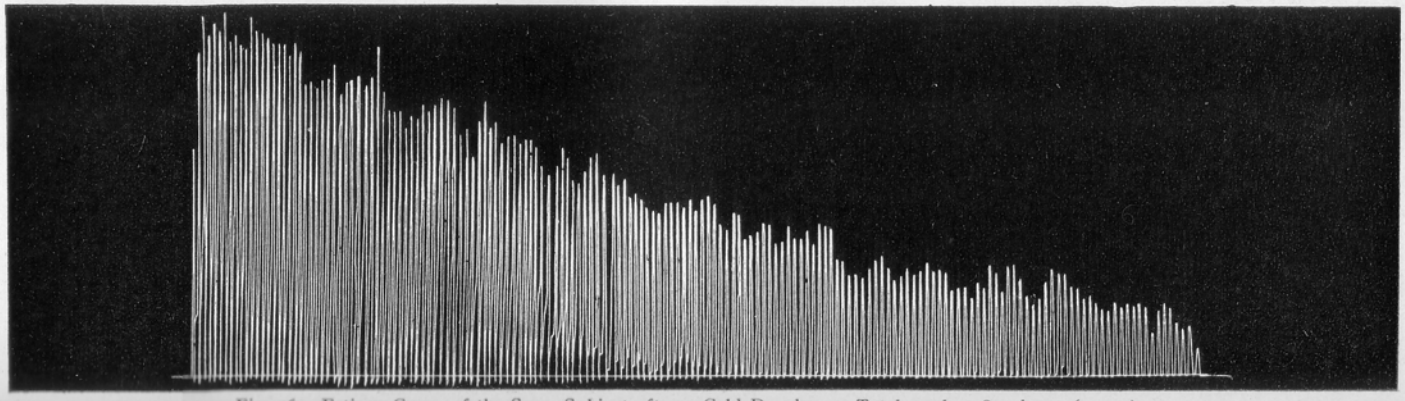


Fig. 56. Fatigue Curve of the Same Subject after a Cold Douche. Total work, 9.805 kgm. (p. 514).

THE GENITO-URINARY DOUCHE.

1099 The uterus, the ovaries, and the bladder in women, and the prostate, the bladder, and the testicles in men, are powerfully influenced by the application of heat to the lumbo-sacral and hypogastric regions, and to the inner surfaces of the thighs in both sexes, and to the breasts in women. There is also marked evidence of a close relationship between the feet and the pelvic viscera. In the application of the genito-urinary douche the stream of water is allowed to fall first upon the feet, then upon the lumbar region, then upon the inside of the thighs, and finally upon the breasts and hypogastrium. Strong pressure may be used in applications to the lumbar region and the feet, but the broken jet or the fan jet only should be applied to the breasts and the hypogastrium, and with little pressure.

The *short cold* genito-urinary douche is applicable in cases of *amenorrhea*, *relaxed abdominal muscles* and *uterine deviations*, *subinvolutions*, *seminal weakness* in men, especially the form known as *diurnal emissions*, *enlarged prostate* in men, and *atony* of the *bladder* in both sexes. The cold douche should never be employed in painful or spasmodic affections of the pelvic viscera. In the last-named disorders, such as *vesical tenesmus*, *vaginismus*, and *coccygodynia*, *ovarian neuralgia*, *uterine neuralgia*, and, in men, *neuralgia of the testicles* and *spermatic cord*, the *very hot* or the *Scotch* douche may be employed with advantage.

THE ARTICULAR DOUCHE.

1100 This douche and the one following differ from others of this class only in the fact that the internal parts concerned are outside the abdominal cavity. The fan, the broken jet, or the spray may be employed with advantage in many affections of the joint, though in painful affections of this kind the *Scotch* douche is preferable. The *prolonged cold* douche with little pressure may be used to advantage for antiphlogistic effects in cases in which heat or swelling are present.

The position of the patient while receiving the application may be either sitting or standing, whichever will render the affected part most easily accessible. By producing hyperemia of the skin by means of the hot douche, collateral anemia of the joint may be produced in conditions of congestion and inflammation. On the other hand, when it is desirable to congest the joint as a therapeutic measure, an anemic condition may be readily produced by a prolonged cold application to the knee with little pressure.

Therapeutic Applications.— In chronic affections in which exudates exist, with limitation of movement, absorption may be promoted by the *alternate* douche. Extreme temperatures and as high pressure as can be conveniently borne must be employed. The alternate douche is of course contraindicated by local pain or tenderness. The *short, very cold* douche produces powerful alterative effects, and is of value in cases in which the joint structures are relaxed.

THE MUSCLE DOUCHE.

1101 By means of the douche at different temperatures applied to the skin overlying a muscle or group of muscles, almost absolute control may be exercised over the circulation and functions of the part. This control depends upon the principles of fluxion considered elsewhere (**698**). The douche may accordingly be utilized with advantage in most affections of the muscles. When *inflammation* exists, the prolonged *cool* douche with little pressure may be employed at intervals of two or three hours, or until the acute stage is past; later, for the relief of pain, the *Scotch* douche may be used. For relieving the pain of *muscular rheumatism*, the Scotch douche or the *hot* douche may be advantageously utilized, also in painful conditions of the muscles accompanying so-called *muscular strain*, and in the condition known as *secondary fatigue.*

The *cold* douche applied over a muscle wonderfully increases its working capacity, as shown by the tracings easily obtainable with Mosso's ergograph (Figs. 55, 56). This effect

is produced, however, only with the short cold douche at high pressure (50° to 65°, 3 to 6 secs., 25 to 40 lbs.). The prolonged douche at low temperature, without pressure, is capable of completely annihilating muscular excitability. The *hot* douche and the *Scotch* douche diminish muscular excitability, and render valuable service in the treatment of contractures and muscular spasm, as well as in painful conditions of the muscle.

THE VAPOR DOUCHE.

1102 This douche (Fig. 57) consists of a jet of steam projected upon the patient in a manner precisely analogous to that in which water is employed in the horizontal jet douche. The apparatus should be so constructed that hot water can never be ejected from the nozzle, and the controlling valve so arranged that the maximum amount of steam admitted to the nozzle shall not be sufficient to carry an injurious amount of heat to a distance of more than a few inches from the nozzle. The temperature of the application may be perfectly regulated by the distance at which the nozzle is held from the surface of the body.

The advantage of the vapor douche is that it produces the most powerful thermic effects with practically no percutient effects, which renders it extremely useful as a means of producing revulsion in cases of neuralgia, as in *sciatica, lumbago, spinal neuralgia,* and also in cases of *painful joints, muscular* and *articular rheumatism,* and joints affected by *fibrous ankylosis* and *local* or *general hyperesthesia.* A most excellent revulsive measure consists in alternate applications of the vapor douche in connection with the cold percussion douche. The vapor douche is one of the most effective means of heating the skin preparatory to or in connection with a cold rain douche or a horizontal jet.

THE AFFUSION, PAIL DOUCHE, OR POURING BATH.

1103 This bath (Fig. 58) resembles the douche in that the water falls upon the body in a stream. It at the same time

resembles the immersion bath in that the water is simultaneously applied to a large portion of the entire surface, and with very slight mechanical effect. As a pail is often used in administering this bath, it is frequently called the "pail pour." Like the douche, the application may involve the whole or any portion of the surface.

Method.—The requisites are, a tub, which may be an ordinary wash-tub if the patient is able to stand, or if it is preferable to sit, a full-bath tub. If the patient is unable either to sit or to stand, he may lie upon his face on a cot or stretcher, over which a large piece of rubber has been spread. The head of the cot should be so raised that the water will run off its lower end into a tub properly placed for the purpose.

Several pails of water (three to ten) should be conveniently placed for use; a wet towel for the head, a Turkish towel, and a large linen or Turkish sheet are also required. The temperature of the water employed may vary from 50° or 60° to 105° or 110°, according to the effect desired. The application may extend to the whole body or to a portion only. When employed as a general application, the sitting position in a full-bath tub is usually to be preferred.

Before the bath the patient's head, face, and neck should be thoroughly cooled with water a few degrees lower than that to be employed in the affusion. A towel wet in very cold water is then wrapped about his head; he seats himself, with legs extended, in an empty full-bath tub with the plug left out the requisite number of pails of water are then quickly poured over him. The water should not be simply poured upon the patient, but should be dashed upon him from as great a height and distance as arrangements will permit. The attendant grasping the pail to be emptied upon the patient, gives it a little swing backward, then tilts it in such a way as to empty its contents upon the patient as the pail swings forward and upward (Fig. 58). The patient sits with his hands folded over his chest in such a manner as to protect the precordial region. The first pailful of water is thrown upon the folded hands; the



FIG. 58. AFFUSION (p. 515).

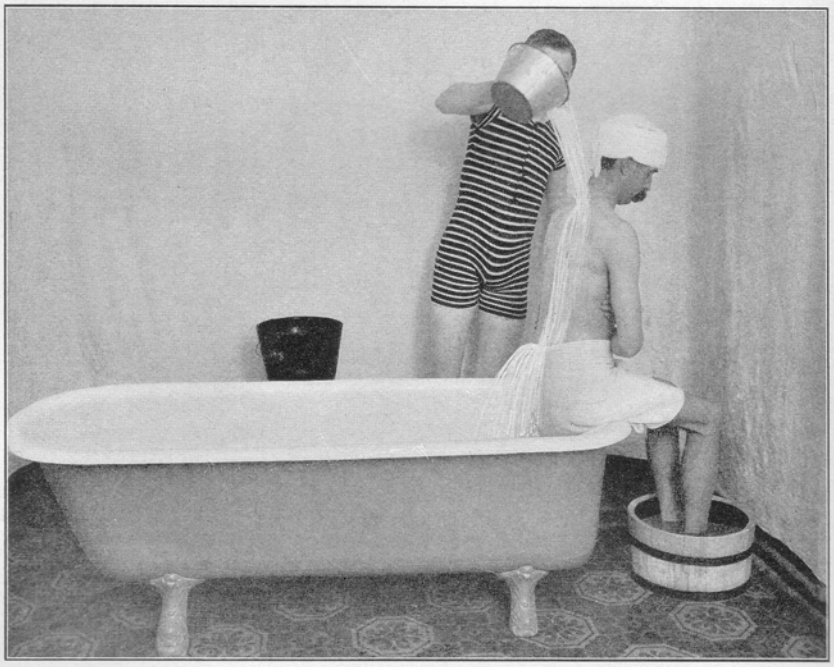


FIG. 59. LOCAL AFFUSION (p. 517).

next is dashed upon the upper part of the back. The front and back of the body are thus treated in alternation until the required number of pails of water have been employed. After the last pail is emptied, the attendant vigorously rubs the trunk and limbs of the patient for 20 to 30 seconds, then removes him from the bath, wraps the sheet about him, and rubs him dry. Special attention should be given by the attendant to the back, legs, and feet, while the patient, if able, is rubbing the arms and the anterior portions of the trunk.

Local affusions are made to the spine, head, extremities, and other parts. When it is desired to confine the application to the spine, the patient sits on the edge of a bath-tub while the water is allowed to flow from as great a height as the pail can be held by the attendant, down the whole length of the spine.

When the application is to be made to the arm, leg, or foot, the part is simply held over the bath-tub and the water poured over it from the desired height. The quantity of water employed, the temperature, the duration of the application, and the size of the stream must be regulated to suit the patient and the conditions present. Numerous effects may be obtained by variation of the several factors named (Fig. 59).

In patients who dread the contact of cold water, and in whom reaction does not readily occur, the feet may be immersed in water as hot as can be borne. If too feeble to stand, the patient may sit in a chair while affusion is applied, or in case of great feebleness, he may lie in a horizontal position upon a cot covered with rubber cloth, so arranged that the water will run off at the bottom, being caught in a tub or some other proper vessel.

In the treatment of chronic cases it is best to prepare the patient for this bath by heating the skin by means of fomentations or hot bags to the spine and limbs, while his body is wrapped in warm blankets, or by the vapor bath, the electric-light bath, the wet sheet, the hot-blanket pack, the hot bath, and other appropriate means.

The author has had constructed a pail, shown in the accompanying cut (Fig. 60), which has been found very convenient for the administration of this bath. When the water is poured from one side of this pail, a broad, thin stream is obtained; when poured from the opposite side, it flows in a solid column somewhat smaller than the arm.

The affusion may be employed as a substitute for the douche when the latter is not available. It may also be combined with various other baths, as the Brand bath (**712**), the dripping sheet (**1216**), and as a cooling process after hot baths.

Physiological Effects.—The French divide baths into two classes, according to whether the water employed is in motion or quiescent. Affusion is the simplest form of the bath in which the water employed is in motion, and may be regarded as a sort of transition from the full or immersion bath to the douche, the favorite hydriatic procedure of the French hydrotherapeutists.

Both the thermic and the circulatory reactions are very pronounced as the result of an affusion bath at a temperature of 55° to 75°, and as a result, the evidences of tissue change are marked.

The effects upon a healthy person are chiefly the following: Cardiac and pulmonary excitation, with an increase of CO_2 excretion; slowing of the pulse and increase of arterial tension; increase in the amount of cutaneous excretion; increased assimilation of albumin; improved oxidation of nitrogenous wastes; slight lowering of the temperature. The circulatory effects of the cold affusion are essentially the same as those of the douche, except that they are less pronounced, as the mechanical effect is less.

The *hot* affusion is at first powerfully exciting, but is quickly followed by atonic reaction. The *neutral* affusion, if so managed as to secure as little mechanical effects as possible, is quieting or sedative. The *prolonged* local *cool* affusion (15 to 60 min.) is a measure of value in combating subacute inflammation in large joints, through its powerfully

sedative effects. The temperature should be 70° to 80°. This application has the advantage over the cold compress in that the temperature of the application is constant, so that reaction is altogether suppressed, and thus the desired sedative effects are more quickly and decidedly developed.

The *neutral* pour to the spine is a powerful sedative to the nervous system. It is highly useful in cases of locomotor ataxia accompanied by lightning pains, or when the disease is making rapid advancement. The *hot* local pour is powerfully revulsive. The local alternate pour is a strongly excitant measure, and may be employed in such a way as to produce the most powerful revulsive effects.

Therapeutic Applications.— This is one of the oldest of **1104** hydriatic procedures. It was employed by Hippocrates in the treatment of *syncope*, *puerperal fever*, *delirium*, and in *swollen joints*, as well as in other affections, and at different temperatures.

Sir John Chardin, the noted English traveler, found it in use for fevers in Persia in the seventeenth century; and it is said to be still a custom in Persia to keep pails of cold water standing upon the street corners during a cholera epidemic. The natives so thoroughly understand the use of water in these cases that when a man falls with cholera, the cold water is immediately poured over him by the bystanders, who afterward rub him vigorously until thorough reaction is produced.

This hydriatric procedure was introduced to the medical profession of England by Dr. Wright more than one hundred years ago. Dr. James Currie, of Liverpool, became acquainted with Dr. Wright's practice, and introduced it into the infirmary of which he had charge, where he made a careful study of its physiological and therapeutic effects. It may be said, in fact, that scientific hydrotherapy began with the study of this bath by Currie, who made careful use of the thermometer for the purpose both of regulating the temperature of the water employed and of determining its effect upon the patient.

Currie proved that the affusion bath is a most excellent means of reducing the temperature in fevers. He also observed, as recorded in his "Medical Reports,"[1] that a tepid affusion is more effective in reducing temperature than a very cold application. Some modern writers who have called attention to this same effect seem not to be aware of this observation by Currie, though all who have had any considerable amount of experience in the use of water in fever, must have noted, as did Currie, that the temperature not infrequently rises after a short cold bath to a point higher than before the bath.

Currie was also the first scientific physician to call attention to the great value of affusion as a means of combating the morbid process in infectious fevers. He noted that the most important effect produced by the application was its tonic influence, whereby the vital resistance of the patient may be increased.

1105 General affusion is of very great value, especially in fever cases in which pulmonary or cerebral congestion or cardiac weakness is a prominent symptom. Applied to the whole surface of the body, and especially to the chest and shoulders, cold affusion furnishes a powerful means of stimulating the nervous mechanism of the heart, and may well replace the drugs recommended for this purpose. Similar effects may be produced by heat and cold to the spine, and by cold wet rubbing, as elsewhere described; but the effects thus produced are less vigorous than those of the affusion bath. Affusion is an essential feature of the Brand bath, water at a lower temperature than the water of the bath being poured upon the back of the patient's head at intervals during the bath (**712**). Employed in this way, it lessens the delirium, and greatly improves the heart's action in continuous fevers.

The stimulation of the respiratory movements induced by the pouring of cold water over the chest is a most powerful

[1] Currie, "Medical Reports," page 64.

means of combating the tendency to *hypostatic congestion*, a very grave complication in fevers of severe type. In the management of low fevers, affusion may be employed in conditions of *depression* in which the prolonged cold bath would seem to be contraindicated. In cases of this sort, the patient should be prepared for the bath by a hot-blanket pack, a fomentation to the back, or by the application of heat in a tub of water at 100° to 102° for 2 or 3 minutes, until the skin is warm, when he may be removed from the warm bath, and cold water poured upon the head and shoulders.

In *capillary bronchitis* in children, when the air-passages are clogged with mucus and the respiratory centers so overwhelmed by the retained CO_2 that there is insufficient power to expel the accumulation, cold affusion to the chest, by stimulating the respiratory center, and thus provoking powerful breathing movements, renders valuable service.

In the case of young children suffering from *capillary bronchitis* or *broncho-pneumonia*, the patient may be seated in a tub partially filled with water at 102°, and cold water poured over the chest and shoulders. After two or three pailfuls of water have been thus poured upon the patient, a Turkish sheet and warm blankets should be quickly wrapped about him; he should be thoroughly dried, and the surface circulation stimulated by rubbing.

The combined hot full bath and cold affusion may be used in the various forms of *collapse* as well as in *prolonged* cases of *fever* in which the skin is cyanotic. The last-named measure is of great service in the treatment of *cerebrospinal meningitis*. The patient should be placed in a hot full bath at 100°, and while in the bath very cold water may be poured over the head, hot water being added to the bath as required to maintain the temperature.

Cold affusion is one of the most efficient means of combating the cardiac and general vascular depression present in alcoholism. Nothing will more quickly arouse the patient from a drunken stupor than affusion with a half dozen buck-

ets of water at 60°. This application should not be made without a preceding hot application if the skin is cold or the temperature subnormal, and must be followed by rubbing and other means necessary to secure complete reaction.

A *very short hot* affusion following a cold bath has been shown to increase its antipyretic effect by atonic reaction, whereby heat production is diminished.

Affusion, preceded, when possible, by a short hot application, is one of the most powerful of all means for rallying the vital forces in case of *collapse*, *surgical shock*, *asphyxia*, and even in *drowning*. It should be noted, however, that the skin is often quite cold in cases of this sort, and that the cold application must be at a temperature considerably below that of the skin, in order that the revulsive effect may be produced.

In cases in which the elevation of the body temperature is due to some local infection, the *tepid* affusion is to be preferred, as also in other febrile cases in which the patient is very young or very feeble.

Currie's greatest successes with the use of the cold affusion were in the treatment of *scarlet* and *typhus fevers;* but this measure is equally effective in chronic as in acute affections. In private practice it may take the place of the douche, which requires a special apparatus and a hydriatic establishment for its successful administration.

1106 **Contraindications.**— Cold affusion must be avoided in cases of *cardiac disease* with *degeneration* of the *heart muscle*, in *asthma*, in *hemorrhagic* cases of tuberculosis, and in cases of *typhoid fever* complicated with *myocarditis*, *acute nephritis*, *intestinal perforation*, *peritonitis*, and in *hemorrhages* from *uterine fibroids*. It need not be avoided in cases of typhoid fever in which slow hemorrhage occurs from congestion, but the patient must be managed carefully in such cases.

THE IMMERSION BATH.

1107 This bath (see also **712**) presents itself in the different forms of the full bath, the plunge bath, and the swimming or

surf bath in fresh or salt water. Bathing in natural sources, as in the sea and in fresh water lakes and rivers, is a most healthful exercise and a powerful prophylactic, and may be employed with advantage by semi-invalids, although this form of bathing can not be controlled with the accuracy necessary to secure definite and reliable therapeutic results.

THE COLD PLUNGE.

This bath (Fig. 61) requires a water-tight tank to which **1108** water of a proper temperature is regularly supplied. The depth is ordinarily about five feet. The temperature is varied in different establishments from 48° to 68°.

Method.— The plunge bath should never be entered when the skin is cold or a chilly sensation is present. The body should be well warmed before the bath is entered, either by a hot bath of some kind, or by the accumulation of heat in the wet-sheet pack, the dry pack, or by exercise. The head, face, and neck should be thoroughly bathed with very cold water before the bath is entered.

It is best to enter the bath suddenly, as the sensation of cold is thus far less noticeable than when the bath is entered gradually. The duration of the bath may vary from 2 or 3 seconds to 1 or 2 minutes.

The patient should rub himself vigorously while in the bath; or if the space is sufficient, should exercise by swimming movements. Successive dipping under the water is also advantageous, the head and shoulders being completely immersed each time.

As soon as the patient emerges from a bath, he should be wrapped in a Turkish sheet and vigorously rubbed by two attendants, himself assisting. When dry, he should dress at once, and exercise moderately for half an hour, or if too feeble to do this, massage or manual Swedish movements should be administered to insure good reaction.

In taking the cold plunge bath, as in other forms of the cold immersion bath, the patient should leave the bath during

the first reaction, that is, while the surface circulation is goc and the sensation of warmth pervades the skin, and befoı chilly sensations have begun to be experienced. If he remair until the secondary chill occurs and the skin begins t assume a bluish appearance, thermic reaction is almost ce: tain to be excessive, often resulting in fainting and subsequer intense congestion, with headache, visceral pain, and possib: inflammation of internal parts.

The effects of the plunge bath are most excellent if goc reaction is secured, but highly depressing when reaction do(not occur. Headache, malaise, nervousness, and depressic are indications of defective reaction or an excessive applic: tion; that is, too long a time spent in the bath.

1109 **Physiological Effects.**— The plunge bath is a powerful exciting and alterative measure; the whole surface of tl body being suddenly brought into contact with water at low temperature, a most profound impression is made upc the central nervous system. The heart and the circulatic are also powerfully influenced. The sudden inrush of bloc from the surface causes an intense congestion of all tl internal viscera, a fact which should never be forgotte: as it renders this bath inapplicable in quite a large numb of cases.

The effect of the bath is at first a slight elevation of tl internal temperature in consequence of the sudden checki of heat elimination. After reaction occurs, there is a slig falling of the temperature, but respiration, heart action, a all the vital functions are quickened by the profound nervo impression made. The blood pressure is raised, the circul tion of the brain is stimulated, respiratory movements produ vigorous fluxion of the blood and lymph through the cer brum, so that the mind, if previously clouded, becomes clea and all the intellectual functions are facilitated. The sudd contact of cold water with the general surface likewise stim lates the action of the kidneys and the liver, excites perist sis, causes contraction of the hollow viscera, and arouses

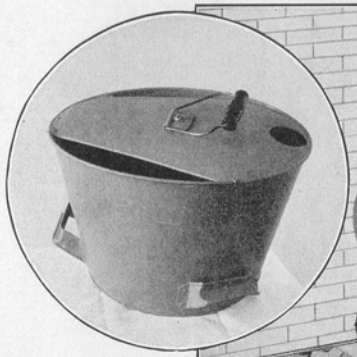


FIG. 60. AFFUSION PAIL (p. 518).

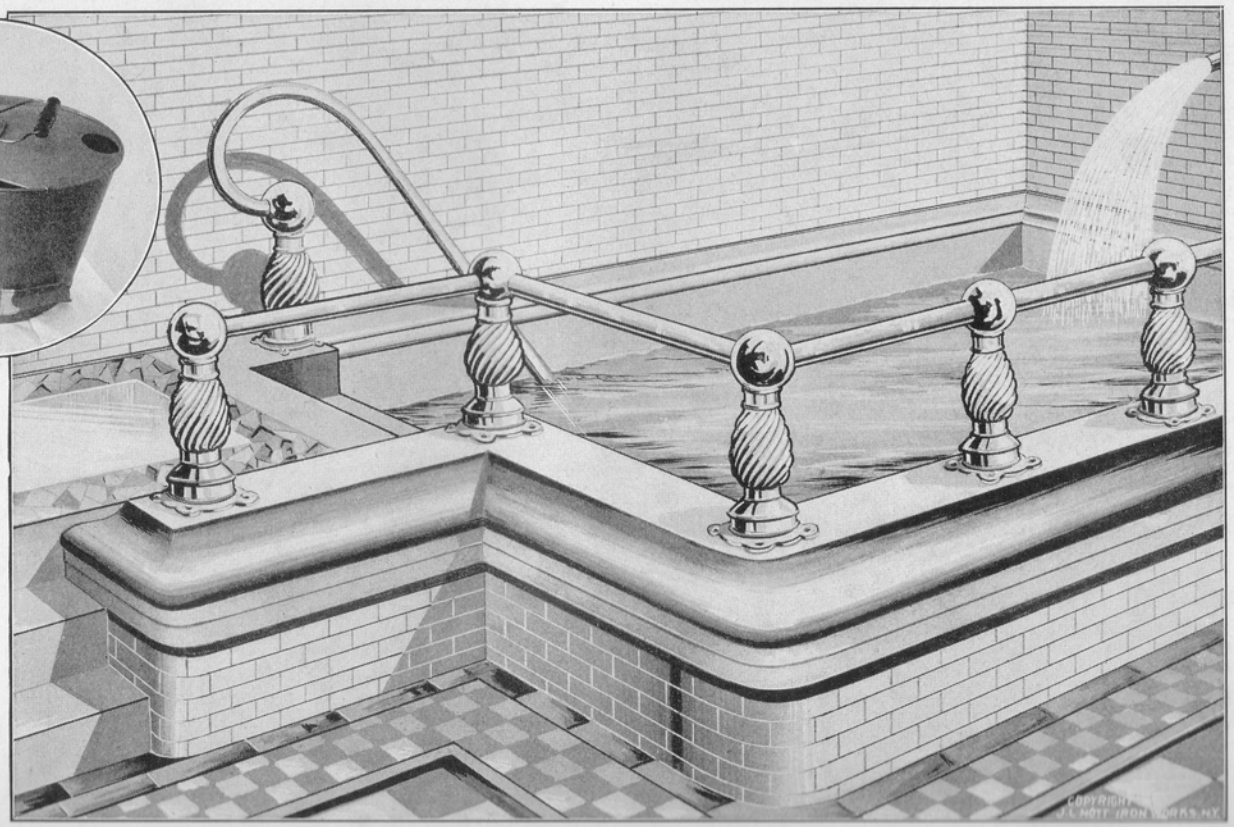


FIG. 61. PLUNGE BATH (p. 523).

the vital functions. Indeed, the cold plunge produces a more powerful thermic reaction than any other form of bath.

Therapeutic Applications.— The cold immersion bath is especially indicated in cases requiring powerful stimulation of metabolism, and especially in the class of cases designated by Bouchard under the general term "slowed nutrition," in diabetes without emaciation, in obesity, and for persons in ordinary health, requiring simply vigorous recuperative measures to repair the damages arising from sedentary employment and lack of exercise. The plunge bath is useful in cases in which the cold douche can not be employed in consequence of its percutient effects. It is a much more vigorous application than the half bath, producing very powerful refrigerant effects, with correspondingly strong thermic reaction and metabolic changes. It may be properly used after any sweating procedure, as the sweating pack, the electric-light bath, the vapor, the Turkish, the Russian, the hot air, the hot immersion, and other similar procedures. In the Turkish bath establishments of Constantinople and Cairo, visited by the writer, there are tanks of hot water in which the patients immerse themselves, or sit upon the edge with the legs immersed, laving the water upon their bodies. Some European establishments provide a hot plunge in addition to the cold, but it is very little used. The cold plunge bath, being a most vigorous procedure, should not be prescribed without a full knowledge of the patient's condition. **1110**

Contraindications.—The routine use of the plunge bath so common in connection with Turkish bath establishments is highly dangerous. Many persons can not take the plunge bath without running the risk of serious injury. The short cold plunge should be avoided in all cases in which there is an elevation of temperature, as the bath has a decided tendency to produce temperature elevation, the body temperature being sometimes found one or two degrees above normal several hours after the bath, owing to the great increase of heat production resulting from the thermic reaction. **1111**

This bath is contraindicated in pernicious anemia, anterior sclerosis, cardiac weakness, great exhaustion from either physical or mental labor, loss of sleep, great emaciation, Bright's disease with albumin in the urine, and in diabetes with rapid loss of flesh. It is also dangerous for persons having a tendency to pulmonary hemorrhage, or hemorrhage of the stomach, as in gastric ulcer and hepatic sclerosis.

THE FULL OR IMMERSION BATH.

1112 This bath (Fig. 62) was first scientifically studied by Currie, who recommended the cold immersion bath as a means of prolonging the effects obtained by cold affusion, and especially as a measure to be applied in intermittent fevers as soon as the second or hot stage is developed, asserting that "the judicious and resolute application of cold might supercede all other remedies in fevers of this class." *

Method.— The full bath is administered in an ordinary bath-tub, which may be made of wood, copper, zinc, porcelain, or enameled iron; or a bath-tub may be improvised in a number of ways. Portable tubs convenient for dwellings not provided with plumbing may be easily constructed. The first requisite is a frame of wood resembling in shape the top of an ordinary bath-tub. To this support, rubber sheeting is attached in such a way that when the ends of the frame are placed on chairs or other supports, the sagging sheeting just touches the floor (Fig. 63). Water may be conducted into the tub by means of a rubber hose attached to the water faucet. Well-oiled or painted ducking may be used in place of the rubber sheeting.

Perhaps, on the whole, the cheapest way, when it is necessary to improvise a tub, is to make one of ordinary lumber —whitewood, basswood, or pine boards, an inch and a half thick, and planed smooth on both sides. The tub should be about six feet in length, two feet in width, and a foot and a half in depth. The cracks may be caulked with oakum.

* Currie's "Medical Reports."

Such a tub can be made by a good carpenter in a few hours, and if kept well painted inside, may be used for a long time. When necessary for use for a fever case, the tub may be placed near the bed and filled with water. The temperature of the water may be regulated by adding either hot or cold water as needed. The prolonged cold bath will require the addition of ice or very cold water. The temperature of the hot bath, that is, a bath above the temperature of the body, may be readily maintained by the addition, from time to time, of jugs or bottles filled with boiling water, which does away with the necessity of so much dipping out and in of water. The patient's head while in the bath should be supported by an air pillow, or other suitable means.

For an alkaline full bath, add a half ounce of salsoda for each gallon of water.

Full baths may be conveniently classified according to their **1113** temperature as *cold*, *neutral*, *hot*, *graduated*, and *alternate*.

THE COOL OR COLD FULL BATH.

The temperature of this bath may be from 50° to 75°; **1114** duration, 4 seconds to 20 minutes. Before entering the bath the patient's head, neck, and chest should be well wet with water at a temperature ten or twelve degrees below that of the bath, the head while in the bath being protected by a towel wet in very cold water. The bath should be entered as suddenly as possible, so as to generalize the impression made. Vigorous rubbing by the patient himself or by one or more attendants should be applied during the entire duration of the bath.

As in the case of the plunge bath, the patient should leave the bath during the first reaction, and should never remain until the second rigor occurs.

Currie's method of administering the cold bath was quite unique. The temperatures employed ranged from 54° to 59°. The patient was placed on a sheet, with which, by the aid of several attendants, he was lowered into the bath and allowed

to remain for five seconds, then lifted out until reaction began, as shown by slight reddening of the skin, then dipped again, the operation being repeated from three to five times. After the last dip he was rubbed vigorously. Currie found this method especially successful in the treatment of infectious fevers, for which purpose he considered it a specific more than a century ago (1797). It is evident, however, that the beneficial effects he obtained from this bath could not to any considerable degree be attributed to the temperature reduction, but must have been derived from the stimulating influence of the application upon the general vital processes, whereby the vital resistance of the patient was increased.

It is interesting to note that Currie was familiar with the fact that the cold bath gives rise to an elevation of the temperature,* when of short duration (1 to 5 min.). This elevation of temperature is especially marked when the friction, which should always be applied during the bath, has been omitted.

When the bath is prolonged beyond a mere dip in cold water, it is a good plan for the patient to sit up in the tub, rubbing his chest, legs, sides, and arms, dipping his hands constantly in the water, and every three to five seconds leaning backward until the body is immersed to the neck.

1115 **Physiological Effects.**— The effects of this form of immersion upon a healthy person are essentially the same as those of the cold plunge bath, but a little less intense. The thermic reaction after the cold full bath is greater than after any other bath. The temperature curve shows first a depression amounting to one or two degrees, continuing for two or three hours after the bath, but finally followed by a return to normal, or even an elevation of a degree or more. The temperature rise may be followed by sweating, as after a malarial chill and fever. By a frequent repetition of the cold bath a veritable hydropathic fever may be induced.

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*Currie, "Medical Reports," page 154.



FIG. 62. IMMERSION BATH TUB (p. 526).

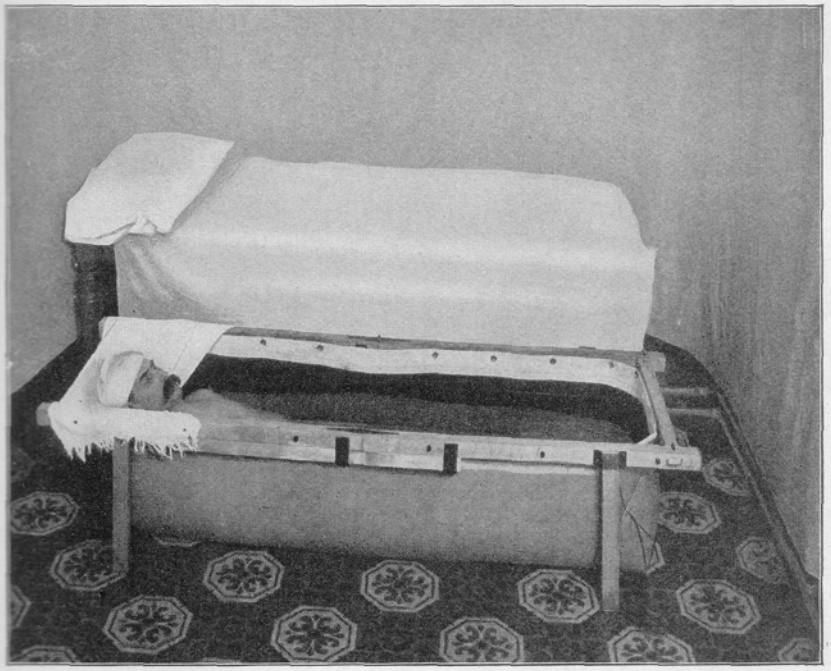


FIG. 63. IMPROVISED IMMERSION BATH (p. 526).

According to Maggiori and Vinaj* the cold immersion bath nearly doubled the muscular capacity of the middle finger of the left hand, while the neutral bath produced no effect at all, and the warm bath at 104° for 6 minutes decreased the work from 5,000 to 900 kilogrammeters (Exp. 58).

The perturbing and alterative effects of the cold immersion bath are greater than those of the douche and half-bath, for the reason that the system is left almost wholly to its own resources to produce reaction; hence this bath is unsuited for very feeble patients, or those whose reactive powers are not vigorous. The immersion bath is less valuable as a tonic than baths in which the application is accompanied by mechanical movements, as friction or percussion; but that it powerfully stimulates metabolism is shown by the observation of Lepine,† who found that the immersion of a fasting dog for 15 minutes in water at 40° more than doubled the amount of urea.

Therapeutic Applications.— The immersion bath may be **1116** used in cases in which the plunge bath is not readily accessible. It is also admissible in cases in which the plunge bath can not be safely employed on account of its excessively exciting effects, as with certain neurasthenics, or when the patient is too feeble to take the plunge bath because of inability to assist himself to the extent necessary. The prolonged cold full bath not accompanied by friction is one of the most depressing of all hydriatic procedures, and is seldom indicated. When a general cold application is required, the wet-sheet pack, the shallow bath, the douche, or some other form of bath in which the mechanical effects of friction or percussion are added to the powerful thermic effects of the cold as an aid to reaction, will, with but very rare exceptions, be found preferable.

The cold bath was once used as an antipyretic measure,

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* *Blätter für Klin. Med.*

† *L' Union Médicale*, 29, 1880, p. 722.

but has long since been abandoned in favor of the so-called "Brand bath," to be described later, which is generally meant whenever the term "cold bath" is employed in current medical literature as used in connection with the treatment of febrile disorders. That the cold bath may render valuable service in the treatment of fevers has been abundantly proved by clinical experience; and it is not necessary to appeal to modern statistics to find proof of the marvelous efficiency of the cold bath in the treatment of febrile maladies. Currie describes an epidemic of typhus which occurred at the military prison located at Stapleton, England,* where a large number of French prisoners were confined. There were, in all, 815 cases. All were treated by the cold affusion, with a result of only forty-one deaths, a little less than five per cent., which for typhus fever is certainly an unusually fortunate record. The mortality was almost wholly confined to persons who were debilitated by age, dissipation, or exposure. We find no equally favorable statistics in the record of modern military practice. The usual enormously high mortality, in the light of present knowledge, would certainly seem to indicate an unnecessary waste of human life.

The cold full bath is indicated, and may be most appropriately employed, in cases of obesity without marked cardiac degeneration, and in cases of slowed nutrition when the general strength is fair. It creates an appetite and improves the digestion in appropriate cases, but is so much inferior to other hydric procedures equally useful for the same purpose that it is seldom used.

Employed as a means of cooling after a vigorous heating procedure, it may render excellent service.

The cold full bath is a useful measure as a means of toning the skin after a prolonged hot bath, and may be advantageously employed in some cases in alternation with the hot immersion bath as a means of exciting the sympathetic centers and encouraging the production of hydrochloric acid in cases of hypopepsia. For persons enjoying fairly good health, a dip

*Currie, "Medical Reports," 4th edition, p. 388.

into a tub full of cold water is an excellent morning bath. It creates an appetite, accelerates the circulation, arouses the nervous system, and produces decidedly exhilarating effects in those who have become accustomed to its use. When employed for this purpose, the duration of the immersion should not be more than 3 to 15 seconds. The patient should rub himself vigorously while in the bath, and should dry himself quickly and thoroughly afterward. He should then take moderately active exercise for 15 to 20 minutes, such as walking, or general exercises in the gymnasium. The daily use of the cold immersion bath in the manner suggested is one of the most effective means of fortifying the system against disease, both acute and chronic.

Contraindications.— These are essentially the same as 1117
for the plunge bath, though the cold full bath may often be tolerated when the cold plunge would be inadmissible. It is contraindicated for young children and very aged persons. The cold full bath should be avoided during gestation and in febrile conditions due to acute inflammation of some internal organ, as in acute peritonitis or gastritis, enteritis, inflammatory conditions of the uterus or ovaries, and other visceral inflammations.

Another morbid condition which should have mention as a contraindication to the cold bath, is hematuria. This condition, when present, indicates disease of either the bladder or one or both kidneys, a condition likely to be enormously increased, perhaps to a dangerous stage, by the retrostasis necessarily resulting from the cold bath. The short hot bath, followed by cold friction, wet-sheet rubbing, and the cold compress, exchanged at intervals of an hour or two for fomentations to the loins, are suitable measures for cases of this sort.

The Cold Full Bath as a Hygienic Measure. 1118
The cold full bath may be advantageously employed as a measure of hygienic routine by persons of fairly robust constitution. The author does not recommend plunging into rivers and lakes in the winter-time through a hole in the ice, a practice highly lauded by certain writers, and under-

taken by many to their sorrow, a quarter of a century ago. Such a measure is dangerous and quite unnecessarily heroic, as all the good effects obtainable from the cold bath may be secured by its use in a more rational and convenient way.

A good method of employing the cold bath as a morning tonic is this: Fill the tub sufficiently full of water to allow complete and instantaneous submergence of the entire body except the head. Immerse as quickly as possible after cooling the head. The duration of the bath must be very brief, not more than 5 to 10 seconds. Rub vigorously while in the bath, and after emerging rub with coarse towels until the body is warm and dry. Exercise till reaction is complete. The best time for the bath is immediately after rising from bed, and while warm and feeling a relish for the contact of cold water. Used thus, this bath is a powerful means of promoting vital resistance and maintaining the integrity of the body.

A remarkable testimony to the hygienic value of the daily cold bath is noted by Currie in his "Medical Reports" (4th edition, p. 378). Quoting Dr. Wright, he says: "I agree with Dr. Falconer, of Bath, in thinking that the cold affusion will secure persons from taking the plague itself, though exposed to its contagion."

Surgeon Mc Gregor, formerly superintendent surgeon of the English army in Egypt, confirms this view by a very interesting observation. While he was in charge of the "Blues," a famous old regiment then located at Canterbury, an epidemic of typhus fever, generally complicated with pneumonia, broke out. The disease developed so rapidly that in a short time one fifth of his regiment were on the sick-list, and there were thirty-three cases of fever, with daily accessions to the number. At this juncture it occurred to McGregor, a disciple of Currie, who was familiar with the use of the bath in the treatment of cases of fever, that the cold bath might be used for prophylactic as well as curative purposes. Accordingly, to use his own words, "About the 12th, at my earnest recommendation, all the regiment out of the hospital

were marched three times a day to the riverside, and every man was made to bathe. The good effects of this were speedily manifest; the number of new fever cases decreased daily, and those that did appear wore a milder aspect. Many, indeed, yielded to the common treatment; in some cases an emetic, and in others the cold bath, at once cut short the disease. We lost no case in October. Indeed, it was evident to all that after the general bathing of the regiment, the contagion stopped; the few cases that occurred after this were stripped of all the alarming and dangerous symptoms with which the disease broke out. In all, there were sixty cases of fever occurring from July to the 21st of October, on which day the last case appeared. We lost six of this number." *

The immunity evidently conferred by the tri-daily bath was certainly more than a coincidence. It would seem eminently reasonable to suppose that if the cold bath aids recovery by stimulating the vital forces and increasing the vital resistance, and to such a degree that the patient already thoroughly infected with the disease is brought to a safe recovery, the application of the same measures before the contraction of the disease ought so to fortify the system as to enable it to successfully withstand the influence of the infectious element to which the malady owes its origin. The principle involved in this suggestion is one well worthy of the most thoughtful consideration. If the principle holds in relation to a single malady, it is equally sound in relation to all others which depend upon either infection or any other external cause, of course excepting accidents.

The Cold Bath an Antidote for Alcoholic Intoxication.

1119 It is a well-known fact that intoxicated sailors are often suddenly sobered up by falling into the sea. The excitant effect of the contact of the cold sea water with the temperature nerves of the skin reacts upon the brain and spinal cord with such intensity as to arouse to activity the alcohol-narcotized centers. The author has long

* Currie's "Medical Reports," p. 394. † Curiosities of Common Water, 1793.

been familiar with this fact, and has made very frequent use of it in overcoming the acute effects of alcohol poisoning. He has frequently seen a man so profoundly under the influence of liquor as to be unable to stand alone, who could not speak distinctly or coherently, completely sobered within four or five minutes by the employment of the hot and cold shower bath.

Dr. Robertson, of Barbadoes, reported in the early part of the present century an interesting case which illustrates very forcibly the powerful influence of cold water in antagonizing the acute effects of alcoholic poisoning. The temperature of the water employed, as determined by Dr. Robertson, was 76° to 80°. We quote as follows. from page 201 of Dr. Currie's "Medical Reports," to which we are indebted for the account of this interesting case: —

"A gentleman of this island, whose name was Weeks, a great votary of Bacchus, was in the practice, from fifteen to twenty years, of plunging into cold water when he rose from his bottle, and of actually going to sleep in a trough full of water, with his head supported on a kind of wooden pillow made for the purpose, above the surface. When he dined abroad, and had not the convenience of his own trough, he used to strip off coat, waistcoat, and shirt, and sit exposed in the open air, and in that situation go to sleep, whether it rained or not. And sometimes he went and bathed in the nearest adjoining pond, to which he generally required assistance to be conveyed. The effect of this practice was, that instead of experiencing debility, lassitude, headache, and nausea on awakening, he found himself cheerful and refreshed, and free from all the effects of intoxication. In the year 1789, dining one evening abroad, he got alternately drunk and sober three several times before midnight, each time recovering his sobriety by immersing himself and sleeping in cold water; and on awakening, returning to the company. The last time, after supper, he was so immoderately intoxicated that he insisted on his companions' undressing him and

carrying him to the pond. They carried him accordingly in a chair, and set him up to the chin in water, where he continued upwards of an hour, a person supporting him. I have this last circumstance from a gentleman of the party, whose veracity may be entirely depended upon.

"At home, however, he used, as I have already mentioned, a trough made for the purpose, with a bench in it as a pillow, having been nearly drowned when sleeping in his pond, from the negro who was appointed to watch him having himself fallen asleep. In this watery bed he would sleep, one, two, three, or even more hours, experiencing always the greatest refreshment. His wife and family, when they wished him to change his quarters, used to draw out the plug and let the water run off, when he would awake, and humorously complain of the loss of his bed-clothes. At length this expedient began to lose its effect in arousing him, and one time he continued to sleep in his empty trough. In consequence of this he was seized with extreme rigors and chills, followed by a severe attack of rheumatism, which affected him a long time, and made him desist from this practice in future. But to the end of his life he was in the habit of sitting with his clothes open, and sometimes quite naked, exposed to the wind and rain."

THE GRADUATED BATH.

This bath, the advantages of which have been urged by Ziemssen, Bouchard, and others, is a form of the full bath especially adapted to the treatment of fevers. The method consists essentially in a full bath the temperature of which is gradually lowered. 1120

Method.—The patient enters the bath at a temperature from nine to ten degrees below that of the body, and the temperature of the bath is lowered at the rate of two degrees a minute to 77°, continuing at this point until shivering and chattering of the teeth occur (Ziemssen).

The principle of graduation thus suggested by Ziemssen is

a valuable one, but the temperature of the bath is so rapidly lowered that the discomfort to the patient is almost as great as in the method of Brand. Bouchard aims to avoid the nervous shock and suffering of the patient by the following method, as described in his work.* The initial temperature of the bath is three or four degrees below the temperature of the patient. For example, if the patient's temperature is (per rectum) 104°, the bath will begin at 100° F. At this temperature the patient is comfortable, and experiences no shock. The water is cooled at the rate of two degrees Fahrenheit, or 1° C. (1.8° F.), every five minutes until the temperature of the bath is reduced to 86°, never lower. The patient should be continuously rubbed after the temperature of the water has been lowered sufficiently to produce chilly sensations. This prevents chilling and shivering, and the consequent increase of heat production.

The advantages of the graduated bath of Bouchard are that it does not produce vascular spasm, arterial pressure is not raised, and the lowering of temperature is greater than in the cold bath. In fevers, the bath is administered every three hours; so that when a patient's temperature rises to 104° or above, it may be necessary for him to spend half of his time in the bath. The temperature is usually reduced about one degree, though sometimes it falls as much as three or four degrees.

A formidable objection to the cold bath is the nervous shock which it produces, the dread the patient experiences, the discomfort, the cyanosis, which latter symptom often gives a case a very grave appearance, although the danger may not be so great as it appears. It must also be remembered that in persons whose hearts are organically diseased, and especially when the arteries are weakened by arteriosclerosis, the very cold bath can not be employed without great danger. The graduated bath is free from these objections, and is hence a most valuable hydrotherapeutic measure.

* "Leçons sur les Auto-Intoxications," Paris, 1887, p. 230.

Physiological Effects.— The special physiological effect of the graduated bath is to reduce the body temperature, which it accomplishes in a most efficient manner, though perhaps less rapidly than by the cold bath with friction. The graduated bath for 30 minutes is equivalent, as an antipyretic measure, to a cold bath at 70° for 10 minutes, and its effects are more permanent. **1121**

A marked advantage of the graduated bath is that it promotes thermic reaction to a much less degree than does the cold bath, hence has not so great a tendency to increase heat production, while it is equally efficient as a means of increasing heat elimination.

The graduated bath may be managed in such a way that no shock whatever is produced; so that it is much more agreeable to sensitive patients and those who dread cold applications.

The intensity of the bath depends upon the length of time it is continued and the degree of temperature to which the water is lowered. As the temperature of the bath is gradually lowered, opportunity is afforded for observing the effect upon the patient, so that the bath can be stopped at the point at which the most favorable results are noted; that is, the cooling may cease at any temperature desired, the bath being then continued at a fixed temperature, which may be tepid, cool, or cold, as is most desirable.

Therapeutic Applications.— The graduated bath is, in the author's opinion, the most efficient method of reducing temperature in fevers. By its aid all the effects can be secured which are obtainable from any other form of the bath. It can be easily managed in such a way as to produce the temperature-reducing effects of the tepid, cool, or cold bath, by ceasing to add cold water at the proper point, and may be graduated to a nicety to suit the varying conditions of individual cases. **1122**

The principle of the graduated bath is an exceedingly important one, and may be applied to other procedures as well as the full bath. It may be remarked also that in the

employment of the cold bath and cold friction, the bath may be graduated by giving the first bath at a temperature eight or ten degrees below that of the body, and lowering each successive bath.

If in a fever case indications are present which point to the necessity for cold applications for *general tonic effects*, *to increase vital resistance*, or *to energize the heart*, these may be met by the cold friction, the cold towel rub, the rubbing wet sheet (in bed), the ice-bag over the heart, and a variety of measures which may be much more conveniently, safely, and comfortably employed than the Brand bath.

THE TEPID IMMERSION BATH.

1123 The method of administering the tepid bath is essentially the same as has been described for the cold immersion bath (**1112**). The temperature is from 80° to 90°. The tepid bath is generally administered at a temperature ten to twelve degrees below that of the body. Care should be taken to see that the water covers the shoulders, in order to prevent pulmonary congestion. The usual time of the tepid bath is about 30 minutes, but by employing general friction it may be continued for many hours (at 88° to 90°).

1124 **Physiological Effects.**— The tepid bath slows the pulse, lowers the temperature of the body by the abstraction of heat, but produces little or no thermic reaction, and hence does not give rise to increased heat production. The circulatory reaction takes place slowly, the preliminary contraction being slowly developed and the subsequent dilatation equally slow. The effect of the bath in reducing temperature will depend upon the relative temperature of the patient, the duration of the bath, and the degree to which the bath approaches the lower limit of the range of tepid temperature, or near 80°.

1125 **Therapeutic Applications.**— The tepid bath was much used by Hippocrates in the treatment of fever, and has been in modern times extolled by Dujardin-Beaumetz and Bouchard.

Riess treated several hundred cases of typhoid fever with the continuous tepid bath at 88°. The patients were kept in the bath from eight to fifteen hours, or until the temperature fell to the normal, or nearly so. The temperature usually began to rise again soon after the patient was removed from the bath. As soon as it reached 101°, the application was repeated. In some instances the patient was obliged to spend almost his entire time in the bath in order to keep the temperature near the normal point. For a continuous bath of this sort it is necessary that the patient be made comfortable by suspension in a sheet, the ends of which are secured to the sides of the bath-tub. The statistics furnished by Riess showed that the duration of the disease was very perceptibly diminished by the continuous tepid bath.

The tepid bath given for half an hour or an hour is to be preferred to the very cold bath in *pneumonia*, also in low stages of *typhoid fever* in which the patient has not had the advantages of cold water treatment in the early period of the malady. Care should be taken to protect the head with cold water in the tepid bath as well as in the cold bath, and friction should be applied when there is the slightest tendency to chill. Friction must be more energetic in the tepid than in the cold bath, for the reason that the thermic impression is feeble, so that the circulatory reaction depends almost wholly upon mechanical effects.

The tepid bath may sometimes be used as a training for cold applications. It is also a very useful measure in connection with electricity in the electro-thermal bath.

THE HOT IMMERSION BATH.

This is an ordinary full bath administered at a tempera- 1126
ture of 98° to 104°. At temperatures above 104° the bath is properly termed "very hot," but the effects of the full bath at temperatures ranging between 100° and 113° differ in degree only, not in kind. It is the purpose to consider under this heading the effect of the immersion bath at any temperature above that of the body.

Methods. — The time of the hot bath varies from 2 or 3 minutes to 15 minutes, according to the temperature and the case. It must never be very greatly prolonged, for the reason that baths at any temperature above that of the body cause a rapid accumulation of heat and rise of temperature. In the administration of the bath at a temperature considerably above that of the body, the beginning temperature should be 100°, it being gradually raised by the addition of hot water to the maximum temperature desired. By this means the skin becomes gradually accustomed to the heat, and a much higher temperature will be tolerated than if the patient enters the bath at the maximum temperature. The cerebral excitation is also less.

1127 **Physiological Effects.** — The hot or very hot immersion bath is a powerfully exciting measure. During the application the general nervous system, the heart, and the blood-vessels, as well as the system generally, are strongly excited by the powerful thermic impressions transmitted inward and by the profound vascular impression made through the dilatation of the surface vessels. Heat production, the oxidation of nitrogen, or the production of urea and metabolism in general, are quickened under the influence of the elevated temperature. The skin is intensely congested by the paralytic effect of the heat upon the vasoconstrictors. A very short primary contraction of the vessels occurs when the temperature of the application is very high (113° or above), but the characteristic effect upon the cutaneous circulation of hot general applications is to paralyze the small vessels. The cutaneous glands are excited to activity, the skin is reddened and bathed in perspiration.

The study of the effects of the hot immersion bath upon the circulation by means of the instruments of precision devised by Oliver, of England, for determining arterial pressure and measuring the caliber of the arteries, affords interesting results. The author has found the use of these instruments somewhat difficult, requiring considerable prac-

tice in order to secure uniform results. They are the best yet made for the purpose, however, and afford reliable data when carefully used. The general result of many experiments, as reported by Oliver, is that a hot application — that is, a bath at 100° to 105° — causes contraction of the radial artery, by reason of the extreme dilatation of the small vessels; it is also indicated by the marked enlargement of the submerged parts, which may amount to more than six per cent. When the temperature of the bath was slightly below that of the body, the radial artery was at first enlarged, but later contracted with the dilatation of the surface vessels. The cold bath caused strong contraction of the radial artery, its diameter being reduced by a bath of 40° from 2.2 mm. to 1.3 mm., with a corresponding increase of tension. This effect lasts, of course, only until reaction begins.

These experiments are of great practical interest in showing that the effects of applications to the surface are not upon the small cutaneous vessels only, but involve the large arterial trunks lying deep in the tissues, at least when large areas of the skin are acted upon.

Much useful information respecting the effects of the hot immersion bath has been gathered from a study of this bath in the public baths of Japan (Fig. 64). Professor Bältz has had an excellent opportunity, during many years' residence in Japan, for a thorough study of the effects of these baths, since in that country it is the general custom to take a hot bath almost daily. In Tokio alone there are given about 400,000 hot baths daily, the price being so low as to be within the means of the very poorest,— one-half to one cent. Bältz himself has for many years taken a hot bath at least twice a week, and in summer, after great exertions in mountain-climbing, often twice a day.

The Japanese usually take the bath at 115°, sometimes hotter; while Europeans living in Japan take it at 104° to 109.4° F. Before going into the bath, the head is rubbed with hot water, whereby the blood-vessels of the head are at

once relaxed, and anemia of the brain is prevented. The duration of the bath is 5 to 20 minutes, according to the temperature. When the sensation of heat is very great or strong palpitation of the heart is experienced, the bather leaves the bath at once.

The first effect upon going into the hot bath is a goose-flesh contraction and blanching of the skin for a few seconds, followed by a gradual relaxation of the cutaneous vessels with reddening. The pulse is at first slow, then gradually quickens. The respiration is only slightly influenced at the beginning; later it is manifestly changed, especially in the case of men, to the thoracic type. The body temperature, measured under the tongue, shows a gradual rise to 104° F., and even above. This rise is produced not only by the retention of heat, but also through its direct absorption. The rise appears very quickly, often within six minutes. After leaving the bath, the temperature rise generally continues to the amount of .6° to 1° more; and does not return to the normal until from one to two hours have passed. The arteries relax, and the temporal artery becomes tortuous, as in arteriosclerosis. The pulse is full, and the pulse-curve high. Remaining in the bath after the proper temperature is reached causes dizziness and nausea. The albumin metabolism is, according to this observer, not increased in the hot bath, as previously supposed. Before leaving the bath, the bather generally pours cold water over himself to prevent continued sweating.

It is generally supposed that after a hot bath one takes cold very easily. Dr. Bältz claims, on the contrary, the very opposite, namely, that it is impossible to take cold; that taking cold occurs only after a tepid or warm bath whose temperature is the same or lower than that of the body. The very hot bath produces paralysis of the skin vessels, which continues for some time, and prevents the vessels' reacting to cold. The opinion that the very hot bath produces diminished resistance is disproved by daily experience in Japan.

The author has obtained interesting information concerning the Japanese baths from a friend, Dr. Swartz, who was for many years a medical missionary in Japan, and through long residence in the country and frequent attendance at the baths, became able to enjoy them at as high a temperature as the Japanese. Dr. Swartz testifies that the effect of the bath is decidedly stimulating, and that no depressing effects whatever follow its use. Some persons cool off the skin by means of the cold bath after coming from the hot bathing tanks, but natives may frequently be seen running through the streets quite nude, even in very cold weather, without any cooling application; and yet it is asserted that they do not take cold.

The effects of the bath at this very high temperature are in many respects identical with those of the cold bath. This is true, however, only during the application. After the hot bath, certain atonic effects are apparent. Perspiration, quickening of the pulse, and reddening of the skin continue for a varying period; but sooner or later contraction of the cutaneous vessels occurs, accompanied by dilatation of the internal vessels. The heat production, which was temporarily increased, is now lessened, and the phenomena of atonic reaction appear.

That the Japanese native does not take cold after this extremely hot bathing, is probably due to the fact that the temperature of both the skin and the blood is at so high a point that ordinary and even extraordinary exposure does not suffice to produce a chill either by lowering the temperature or by cooling the peripheral nerve filaments. The cutaneous vessels remain dilated for a long time after these extremely hot baths, as the result of paralysis of the vasoconstrictors. The cooling occasioned by evaporation takes place very slowly; consequently the contraction of the peripheral vessels and the resulting intense visceral congestion which introduces the train of phenomena accompanying the condition known as a "cold," does not take place.

1128 **Therapeutic Applications.**— The hot immersion bath is perhaps most useful as an eliminative or spoliative procedure. The bath at 104° to 110° for 10 minutes, followed by a dry pack, is a most efficient sweating procedure. This bath may be advantageously employed in *dropsy*, when excessive loss of tone of the heart and blood-vessels, as indicated by general cyanosis, is not present. It must be remembered, however, that in dropsy, when due to cardiac disease, the heart is not able to bear the sudden shock of cold water, and consequently the greatest care must be taken in cooling off the patient after the hot bath. He should be wrapped in a Turkish sheet, covered with a blanket, and allowed to cool off gradually in a room at a temperature of 65° to 70°, or he may be rubbed with the moist hand, or even tepid sponging may be practiced when the skin is very hot and the tendency to perspiration strong. To avoid chilling by evaporation, only a small portion of the body should be uncovered at a time during the sponging or rubbing. In treating patients who chill very easily it may be necessary to do the rubbing beneath the blanket. Very high temperatures should be avoided in the hot immersion bath, because of the tendency to excitation of the brain and heart. A temperature of 120° is dangerous to life, and a bath at 110° should not be continued more than 10 or 15 minutes.

The hot bath is also a powerful derivative. Bältz considered it a specific in the *capillary bronchitis* and *bronchial pneumonia* of children, but found it of no benefit in croupous pneumonia. It operates in these cases as a derivative measure, relieving the overfilled vessels of the lungs by congesting the vessels of the skin and the muscles. Its effect is manifested very quickly. The breathing at once becomes easier, and the cough ceases. The temperature of the bath in such cases should be 104° to 106°; its duration from 5 to 15 minutes. As soon as strong reddening of the skin appears, the patient is removed from the bath. Such a bath may be applied to children two to four times in the twenty-four hours,

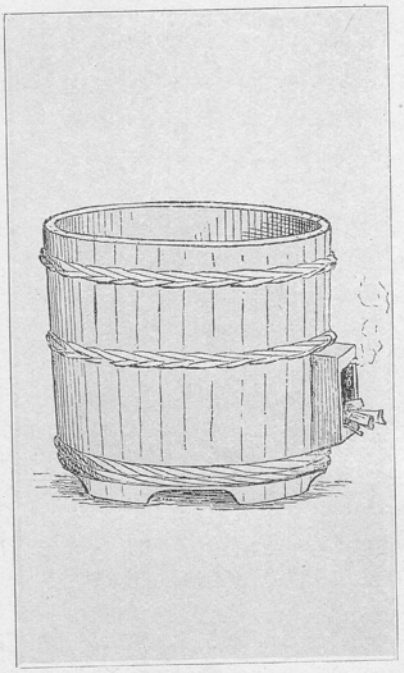


FIG. 64 *(a)*. JAPANESE BATH TUB CONTAINING HEATING OVEN (p. 541).

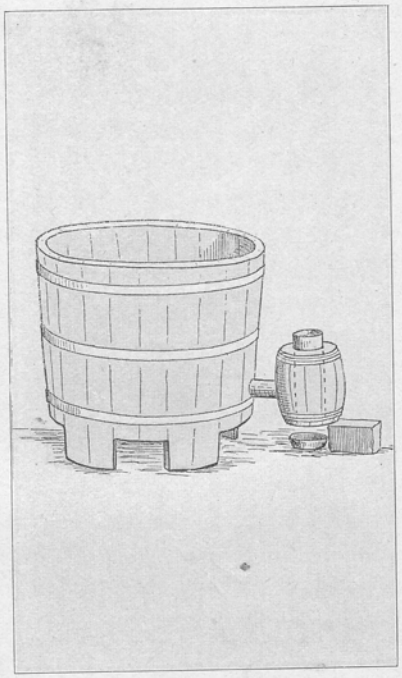


FIG. 64 *(b)*. JAPANESE BATH TUB WITH EXTERNAL HEATING CHAMBER (p. 541).

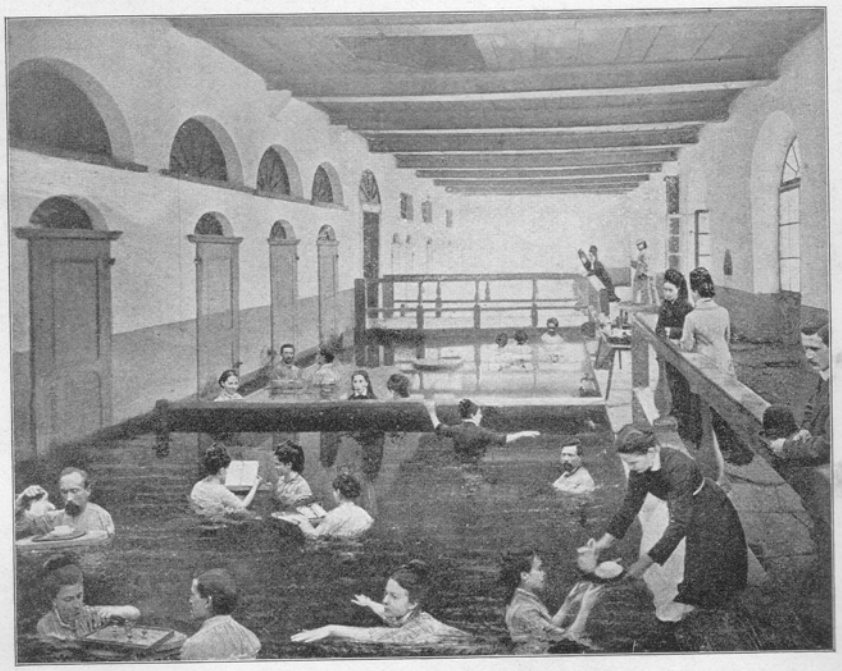


FIG. 65. BATHING AT LEUKERBAD, SWITZERLAND (p. 552).

as seems to be indicated. In cases in which the temperature is very high, the child may be placed in the bath up to the epigastrium while cold water is poured over the upper part of the body.

The hot immersion bath has proved itself a very valuable measure of treatment in *cerebrospinal meningitis*. The temperature should be 103° or 104°; duration from 10 to 15 minutes, the application to be repeated every three or four hours. The head should be protected by a compress saturated with ice-water, which should be frequently renewed, or by cold irrigation or a cold coil.

In *amenorrhea* or in *suppressed menstruation* this bath should be administered at 101° to 105°; duration half an hour or more, at the time menstruation is due. It may be repeated twice a day for two or three days in succession. There is no more effective measure for *dysmenorrhea* with scanty flow, a temperature of 102° to 112° being employed for 15 minutes. The hot bath may also be administered in *painful menstruation* when the flow is profuse; but when employed in such a case, it should be of short duration, not more than 3 or 4 minutes, at a temperature of 105° to 110°, and should be immediately followed by the hot vaginal douche at 104°.

In *chronic bronchitis*, a very hot bath, 5 to 7 minutes in duration, accompanied by rubbing with the friction mitt, relieves congestion of the mucous membrane; and when the disease is complicated with asthma, generally affords prompt relief from the distressing paroxysms. The patient should be carefully cooled after the bath, and oil should be rubbed upon the skin.

The hot bath at 102° to 106° may be very profitably employed in *chronic rheumatism* and *obesity*, being used daily, or every other day, for 10 to 15 minutes. Rubbing during the bath increases the beneficial effect in rheumatism, by aiding circulatory reaction. Massage of the joints may be practiced with great advantage during the hot bath.

Lasèque* in his work upon "Hot Baths" recommends the bath at a temperature of 113° in rheumatism.

The hot bath should always be followed by a cold application, which in cases of obesity should be very vigorous and prolonged, as cold immersion or a cold shallow; but in rheumatism the prolonged tepid or Scotch douche or cold friction should be employed instead.

In the *acute nephritis* of scarlet fever the Scotch douche affords the best means of relief from the renal congestion. The temperature should be from 106° to 110°; duration, 10 minutes. It may be repeated two or three times in twenty-four hours when the symptoms are urgent.

The daily hot bath affords relief from the intolerable *itching* of *jaundice*, and aids the skin as well as the kidneys in ridding the system of the bile pigment with which the tissues are poisoned. *Gastric* and *intestinal colic* are quite promptly relieved by the bath at 110° for 10 to 15 minutes, but in *cholera* the cold friction bath succeeds better.

The relaxing effect of the hot bath is highly valuable as a palliative measure in cases of *gallstones* and *renal colic*. The effects of the bath may be increased by gentle massage employed at the seat of pain in such a way as to aid the movement of the calculi through the proper channel.

The intolerably depressing pain of *cystitis* yields promptly to the very hot bath, but is greatly aggravated by cold; so that gradual cooling at a neutral temperature is required. Other measures must of course be employed to remove the causes of the pain.

In *muscular rheumatism*, the hot bath relieves pain by encouraging the elimination of the toxins to which the pain is due, as well as by direct revulsive or derivative effects.

The hot bath is an excellent means of preparing the skin and the system at large for a cold bath in cases in which such a preparation is necessary. The hot bath may be equally well employed in cases in which an overdose of cold water

* Lasèque, *Arch. Gen. de Med.*, 1874, p. 132.

has been inadvertently applied. It is well to remember that heat is a perfect antidote for cold, while cold is an equally perfect antidote for excessive applications of heat, provided no structural change has taken place.

In *delirium tremens* a short hot bath followed by cold friction or a cold shower bath renders valuable service.

In the beginning of *measles*, *scarlet fever*, and other eruptive disorders, the hot bath often renders great service by encouraging the development of the eruption.

In *typhoid fever*, when the patient is in a low state, and in cases in which the circulation is sluggish, as indicated by cyanosis, and when the nerve centers are depressed by the profound toxemia present, the hot bath at 102° to 106° may be advantageously employed for 3 to 5 minutes. It should be followed by cold affusion, two or three gallons of water being poured over the back and chest, with the patient sitting up in the tub, or by general cold friction with the friction mitt. The same measure is equally valuable under similar conditions when occurring in *measles*, *smallpox*, *diphtheria*, and other febrile disorders.

Galen recommended the warm bath followed by rubbing with cold water as a means of lowering the temperature in *fever*.

In *infantile convulsions* the hot bath for 3 to 5 minutes, followed by affusion consisting of a quart or two of water poured over the patient's head and spine, is a powerful life-saving means. Immediately after the affusion the child should be wrapped in warm blankets, so as to produce quick reaction.

The very hot bath may also be used with very great advantage in *asphyxia* of the newborn. The child should be dipped in hot water for 15 to 20 seconds, then cold water dashed over it, while artificial respiration is practiced.

Tarnier recommends the hot bath (100° to 104°) for 40 minutes as a successful means of combating the profuse vaginal discharge which so often occurs in nursing mothers

of feeble constitution. The continued and obstinate bloody discharge which often occurs under the same conditions likewise yields to this measure. A brief application of cold friction should follow the bath.

1129 **Contraindications.**—The hot bath must be avoided in cases of organic disease of the brain or spinal cord, as *tabes, sclerosis*, and *myelitis;* in cases of *cardiac weakness* and *cardiac hypertrophy;* in *arteriosclerosis;* and in threatened or existing *cerebral apoplexy*. If employed at all in cases of *chronic nephritis*, it should be with the greatest care and precaution to prevent subsequent chilling, and resulting visceral congestion with an increase of renal inflammation.

It should be remembered, also, that in the employment of the hot bath the body temperature is rapidly increased. Hot baths are naturally contraindicated in febrile disorders, except in certain adynamic states; and even then the hot immersion bath will rarely be called for, other procedures being preferable and safer. If for any reason it seems necessary to employ the hot bath in a febrile case, the application must necessarily be very brief (3 to 4 minutes), to avoid undue elevation of temperature.

THE NEUTRAL BATH.

1130 This is simply a full bath at the temperature of 92° to 97°, administered in the usual manner. For a discussion of the general properties of the neutral bath, see paragraph **717**.

Method.— Friction should not be administered, unless it be very gentle rubbing when the patient first enters the bath, if he feels a slight inclination to chill. Chill will not occur, however, if the temperature of the bath is properly adjusted to the patient's conditions. The average temperature of the bath should be 94° or 95°. When the patient is feverish and the skin hot and flushed, even though there be no rise of temperature, the temperature of the bath may be 92° or 93°. If the patient is thin and bloodless, with small heat-making capacity, the temperature of the bath should be 96° or 97°.

All mechanical effects should be avoided after as well as during this bath, as its purpose is to secure calmative or sedative effects. The duration of the bath when applied for relief of insomnia should be from 15 minutes to one hour. When used for the reduction of temperature, however, it may be continued for a much longer time, as three to four hours: and in certain cases of *acute mania, obstinate insomnia,* or *fever,* it may be continued for several hours consecutively, at a temperature of 92° or 93°. In certain traumatic cases, it may even be continued for weeks or months, the patient being removed only for urination and defecation (**1136**).

Physiological Effects.—Kuhn, of Niederbronn,* first scien- **1131**
tifically described the interesting characteristics of the neutral bath. He considered a bath as neutral when of such a temperature that it abstracts from the part immersed exactly the same quantity of heat that the part naturally receives from the blood. The neutral point, according to this authority, is the physiological zero. Below this point water is absorbed; above, it is exhaled. Both the absorption and the exhalation increase in proportion as the temperature of the body varies from the neutral point. This is usually 93° to 94°. This point marks, then, the limit where absorption ceases and exhalation begins. He also noted that fresh water, in determining the more or less rapid imbibition of water by the skin, promotes the cutaneous reaction which plays so important a rôle in hydriatic treatment. The reaction in this case is increased according to the coldness and purity of the water. Cold or cool baths, by introducing cool water into the blood mass, render the blood more aqueous, diminishing its density, and thus acting as a sedative. The purer the water, the more calming are the effects of the bath on account of the greater amount of water absorbed. The neutral point is not fixed. It is solely and entirely regulated by the individual sensation. There is a certain equilibrium between the heat subtracted and the heat produced in normal conditions. It varies a little

*Monograph, Paris, 1854.

according to the constitution of individuals, and the disease, and especially with the refrigerating power of the surrounding medium; that is, it is always more elevated when the water is charged with salts than with pure water. In other words, salt-water baths can be taken at a lower temperature than fresh-water baths, since the former stimulate heat production more than do the latter at the same temperature.

The neutral bath diminishes the pulse-rate, but does not modify the respiration. Exhalation by the skin is suspended, so that water accumulates in the tissues. It is in this way the cutaneous nerves become supersaturated with water, rather than by absorption of water from the bath. At the neutral point, there is then practically no movement of fluids either inward or outward. The urine is greatly increased in quantity; while its acidity is decreased; it may even become alkaline.

The temperature and mode of administration of the neutral bath are such that neither thermic nor circulatory reaction is produced. The bath may consequently be prolonged for an almost indefinite period without producing exhaustion or any other untoward effects. When the bath is prolonged for a considerable period, the patient should be suspended in a sort of hammock consisting of a sheet let down into the tub and secured to the edges, and should be made comfortable by means of an air pillow. The temperature of the neutral bath may be maintained uniform by placing covers over the tub, and adding jugs or bottles filled with hot water as often as may be necessary; or a portion of the water may be removed from time to time, and replaced with water at a higher temperature. When the temperature of the surrounding atmosphere is such as to prevent cooling, so that the bath is warmed by the heat of the body, it may be necessary to add cooler water occasionally to prevent elevation of temperature, whereby the bath would cease to be neutral in its effects. This bath depends for its good effects entirely upon the careful adjustment of the temperature within the limits named, 92° to 97° F.

The physiological effects of this bath are to lessen nerve sensibility, and Kölliker, Hyman, and Krebs have shown that the absorption of water by the nerve filaments accomplishes this. That an anemic or bloodless skin is more sensitive than a congested skin has long been a matter of observation, but it is only recently that the actual demonstration has been afforded by the experiments of the investigators named. The protection afforded the central nervous system against reflex irritation of all sorts by a perfectly neutral medium contributes to the sedative effects of the neutral bath.

The neutral bath is the most purely sedative procedure afforded by the whole range of hydriatic measures. The neutral douche produces very similar results. Its influence is strongly derivative through the circulatory reaction induced by the mechanical effects. The neutral bath excites activity of both the skin and the kidneys to a marked degree.

The neutral full bath, as well as other baths near or above the body temperature, is followed by a decided lowering of the surface temperature. The internal temperature remaining normal, it is evident that there must be a decided reduction in the rate of heat production. The surface temperature sometimes falls as much as six degrees, which would indicate a lessened heat loss amounting to nearly 25 per cent. and a corresponding decrease of heat production. In the case of the neutral bath, this effect is not due to atonic thermic reaction, as when an application above the temperature of the body is made to the skin, but must result simply from the cutting off of those reflex influences due to contact with the skin of air at a temperature below that of the body, thus annulling one of the important factors in maintaining the activity of the thermogenetic processes in the muscles. This effect of the neutral bath necessitates special care to avoid chilling of the patient by exposure to cold air. The patient should generally recline for an hour after the bath, covered sufficiently to prevent chill, but without overheating.

1132 **Therapeutic Applications.**— At the quaint and interesting old bathing resort at Leukerbad, Switzerland, which the author visited in 1883, he found still in use the system of immersion in water at a neutral temperature which has there been employed during several generations in the treatment of a large class of chronic disorders, including skin affections of various kinds. The patients enter the bath about 6 or 7 o'clock in the morning, without breakfast, and remain immersed up to the chin until about 1 P. M. The accompanying cut (Fig. 65) represents scenes such as may be daily observed.

Riess applied the neutral bath in a large number of cases of organic disease of the brain and cord, including *paraplegia*, *locomotor ataxia*, *chronic inflammation* of both *brain* and *cord*, especially in *meningitis*, in *rheumatism deformans*, and in various other chronic affections. His success was so great as to give good reason for the belief that this procedure presents valuable therapeutic value in cases of this sort. The author's experience with the continued neutral bath has been sufficient to convince him of its great value.

It is interesting to note that Currie* had a thorough appreciation of the value of the neutral bath, which he employed at 90° to 95°. He recommended it "when the strength is wasted by fatigue and perspiration." He remarked, "In the degrees in which it does not quicken the circulation, the warm bath is soothing and sedative, especially when the immersion is prolonged; and it is the temperature from 90° to 95° that is so singularly restorative for fatigue."

The neutral bath, continued for thirty to sixty minutes, or even longer, renders great service in *general dropsy*, whether due to cardiac or renal disease, especially in cases in which more vigorous measures can not well be employed. It also renders valuable service in chronic sciatica accompanied by severe pain, as a means of continuing the good effects obtained in the use of other measures, such as the Scotch

*Currie's "Medical Reports," pp. 194–196.

douche, the prolonged fomentation, the revulsive compress, massage, electricity, and other well-known means.

In *insomnia* there is practically no single measure of treat- 1133
ment so valuable as the neutral bath. For this class of patients the bath should be administered at bedtime. The patient often becomes drowsy in the bath, and may fall asleep. He may be allowed to sleep in the bath for several hours if it is found that removal counteracts its hypnotic effect, which is not infrequently the case. The sleeping patient must be carefully watched, however, to see that the head is not submerged.

On removal from the bath, in cases of insomnia, great care should be taken to avoid chilling of the surface by evaporation. The patient should be instantly wrapped in a Turkish sheet and woolen blankets, and should be dried by gentle patting of the sheet or blanket, and without rubbing either with the sheet or with the dry hand, being afterward placed in bed as quickly as possible, and his surroundings made in every way conducive to sleep, so that the good effects of the bath may not be lost by excitation of the nervous system by unfavorable conditions.

It will be interesting to recall the fact that Hippocrates well appreciated the neutral bath as a means of inducing sleep.

In *multiple neuritis*, *apoplexy*, and in the treatment of the *alcohol*, *opium*, *cocaine*, and *chloral habits*, the sedative effects of the neutral bath are of immense service. In cases of this sort it is generally necessary to employ a temperature of 95° to 97°. The influence of a difference of two or three degrees, or even of a single degree, is quite surprising to a person who is not thoroughly acquainted with the singular potency of hydriatic measures, when employed with exactness.

Vigoroux* recommends the neutral bath for one to three hours for *neurasthenics* and *rheumatics*. This author strongly condemns the cold douche in these cases, as he finds the

* Vigoroux, "Neurasthénie et Arthritisme," p. 308.

urine of neurasthenics, as of rheumatics, acid, which denotes deficient oxidation, notwithstanding the total amount of the products of excrementitious waste is deficient.

When there is a tendency to *heart failure* in the use of the warm bath, in cases of cardiac insufficiency, or after the withdrawal of opium or other drugs, this inconvenience may be wholly overcome by the use of the ice-bag over the heart during the bath. An application to the head and neck is also necessary in cases of this sort when a temperature approximating that of the body is employed. The value of the neutral bath in the affections mentioned is largely due to its action upon the kidneys, the activity of which it encourages to a high degree, while at the same time it quiets the irritated brain and cord. This purification of the blood through increased renal and cutaneous activity improves general vital action, and gives this bath decided restorative as well as sedative effects.

The neutral bath is of great value in *chronic diarrhea*, *peritonitis*, and other chronic affections of the abdomen, and especially those in which the patient is in a condition to interdict the employment of very hot or very cold baths. In such cases it may be employed daily for 15 to 30 minutes. It is also of value in cases of *toxemia*, which is so commonly present in *chronic dyspepsia*, and in *pruritus* without eruption, either with or without jaundice, also in the several forms of *urticaria*.

The neutral bath is often employed in connection with electricity. The author has for more than twenty years made extensive use of this bath as a means of making general applications of the galvanic, faradic, and sinusoidal currents. This subject will be treated more fully under the head of Electro-Hydric Baths (**1457**).

1134 The neutral bath may be employed as an antipyretic and antifebrile measure in *continued fevers*, and is especially serviceable for infants, old persons, and others with a feeble constitution, or in cases which have been neglected in the

early stages until the patient has reached so low a state that the cold bath is interdicted because the nerve centers have not enough vitality left to react to so heroic a measure. When employed for this purpose, the temperature of the bath at the beginning should be 98°, and should be rapidly lowered to 92° or even 90°, when it should be prolonged for half an hour to two hours. The length of the bath should be not more than 10 minutes for very aged persons, and 5 to 10 minutes for infants, but should be repeated every two hours, or whenever the temperature reaches 100° to 102°.

The neutral bath is especially indicated in disorders of the nervous system and of the heart and blood-vessels. Arteriosclerosis gives rise to deterioration in the central nervous system as well as elsewhere. From deficient flushing of the parts with healthy blood, tissue deterioration begins; and the disorder is then rapidly intensified by the accumulation of tissue poisons in the part, and degeneration of the blood-vessels takes place with great rapidity. Long-continued contraction of the blood-vessels gives rise to a disturbance in the nutrition of their walls, which finally results in relaxation and paralysis, and the local disorder becomes fixed.

Either very cold or very hot applications must be avoided in cases of chronic disease of the central nervous system, because of the diseased condition of the vessels, which are overworked, and liable to rupture under the strain of the sudden inrush of blood in the general retrostasis accompanying applications to the whole surface, and in the collateral hyperemia resulting from very cold applications to the back. As a rule, a temperature below 70° or above 110° is not useful in the treatment of organic nervous disorders. Partial cold friction may be employed in these cases, but general applications should be at temperatures not far removed from the body temperature, or 85° to 104°.

Contraindications.— About the only contraindication for 1135
the neutral bath is the presence of some morbid condition to which the application of water may be inappropriate or inju-

rious. In certain cases of *eczema* and some other forms of skin disease, water aggravates the symptoms. Also in great *cardiac weakness*, and in certain cases of *neurasthenia*, the neutral bath is depressing, and must be avoided, or at least employed with exceeding care and caution, and accompanied by supplementary procedures, such as cold friction, the wet-sheet rub, and the cold precordial compress over the heart.

THE CONTINUOUS BATH.

1136 The continuous bath (Fig. 66) is simply a neutral bath prolonged for many hours, days, weeks, or months, as the case may require.

Method.—A suitable bath-tub must be provided, and should be placed in a well-ventilated and convenient apartment with suitable arrangements for changing the water as may be required for cleanliness and regulation of the temperature. The ordinary bath-tub, without accessories, will not answer the purpose, for the reason that the patient soon becomes weary with the effort to support himself, or is inconvenienced by the pressure of his tissues against the hard metal or porcelain surfaces of the tub. The arrangement should be such that the patient may be as fully as possible at ease. This requires that he should be suspended by some arrangement resembling a hammock. A closely woven hammock, covered with a blanket, may be used for the purpose, or a strong linen sheet may be employed. The hammock may be suspended from hooks attached to the walls of the room, being allowed to sag into the bath-tub sufficiently to submerge the patient. The sheet may be supported in proper position by means of a frame with pegs or holes properly adjusted to the top of the tub. By means of strong tapes attached to the sheet, it may be fastened to the frame in such a way as to maintain the patient's body in the most comfortable and restful position.

In emergency, and while better arrangements are being perfected, the patient may be made comparatively comfort-

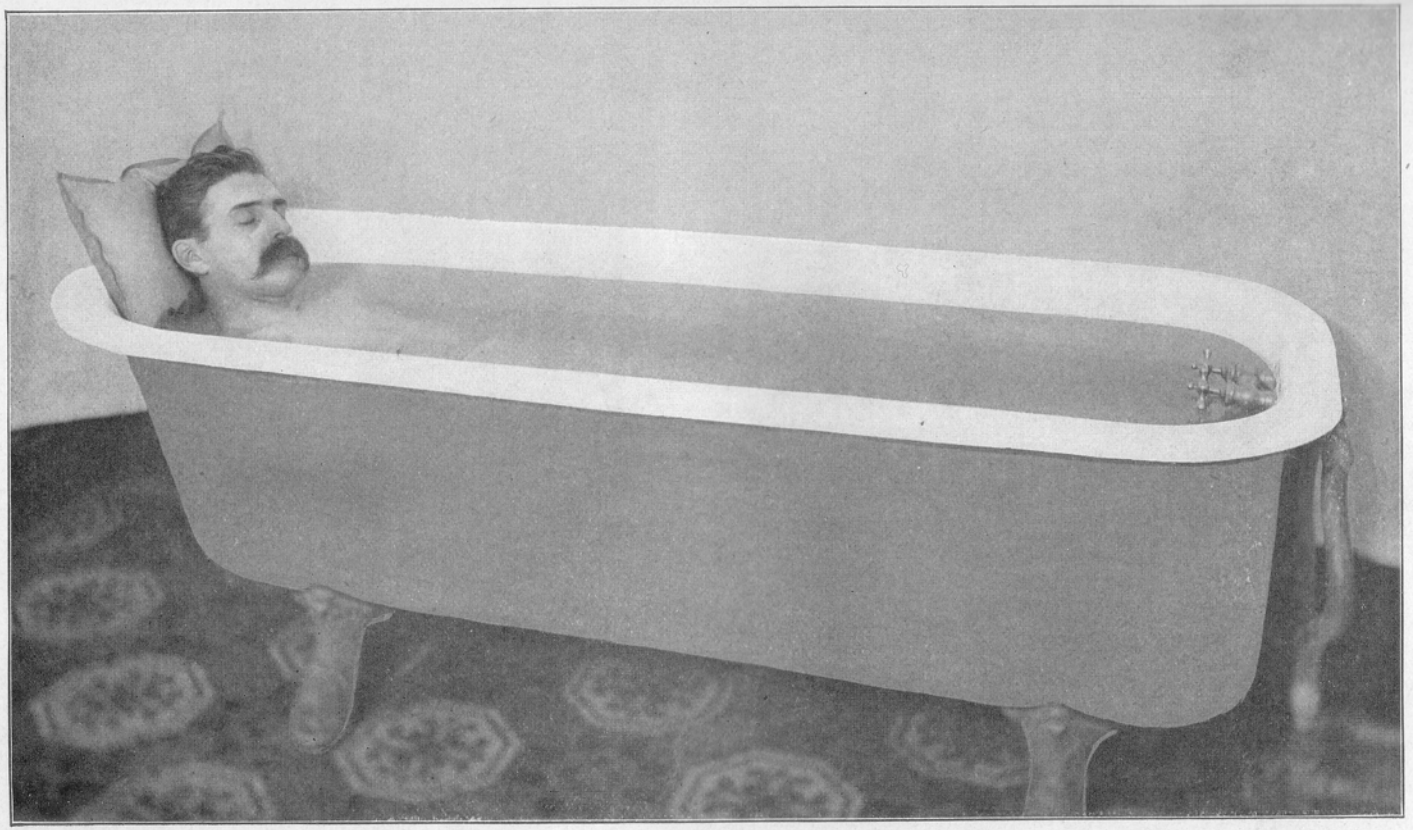


FIG. 66. CONTINUOUS BATH (p. 556).

able by means of one or more blankets folded and placed in the bottom of an ordinary bath-tub, or better still, by means of air pillows filled with water of the same temperature as the bath, or several large water-bags placed in the bottom of the tub so as to support the hips, shoulders, and heels. Pillow-cases filled with excelsior, such as is used for mattresses, or curled hair, may be employed in the same way. The head should be properly supported, and care should be taken that the shoulders are constantly covered with water to prevent chilling by evaporation and the consequent pulmonary congestion which is almost certain to result from prolonged cooling of these important reflex areas.

The temperature of the water should be 94° to 95°, the average neutral temperature. On first entering the bath, the patient may be very gently rubbed for one or two minutes, to prevent the preliminary contraction of the cutaneous vessels which sometimes occasions at first a slight disturbance of the general circulation. The temperature of the bath may be maintained by dipping out a portion of the water from time to time, and adding either hot or cold water, as may be required to bring the temperature to the neutral point. By covering the bath, cooling by evaporation may be prevented, and the necessary reduction in temperature may be readily effected by putting into the bath bottles or jugs filled with ice-water. A jug containing three quarts of ice-water will lower the temperature of a forty-gallon bath one degree.

The duration of the bath will differ according to the character of the case. When employed for temperature reduction or to control delirium, pain, peripheral hyperesthesia, nervous excitability, or mania, a few hours (at most ten or twelve hours) will usually suffice to accomplish the result desired. In continued fevers, and in organic affections of the brain and spinal cord, for which the bath may be employed, it is sufficient in most cases to keep the patient in the bath during the greater part of the day, allowing him to rest in bed at night. But in cases of extensive burns, bed-sores,

and certain forms of skin disease, it is often necessary to make the bath absolutely continuous, removing the patient only long enough at proper intervals to allow opportunity for evacuation of the bowels and bladder. In a few instances, the bath has been continued for an entire year, and even longer. There is no reason why life might not be prolonged indefinitely in this bath so far as the normal performance of all the vital functions of the body is concerned, as the bath interferes with no vital process. The water of the bath should be entirely changed every twenty-four hours.

1137 **Physiological Effects.**— Riess, who made a careful study of this bath in the city hospital of Berlin, in the years 1874 to 1876, maintained that the physiological effects of the bath are negative, affecting neither pulse, temperature, nor respiration. More recent observations have, however, shown that the pulse is slowed by the bath, and that other bodily functions are affected, if not profoundly, at least to a noticeable and important extent. As in the neutral bath, the cutaneous nerves imbibe moisture, not through the absorption of water from the bath, but by retention of water through the suspension of perspiration. The urine is noticeably increased in quantity, and becomes less acid or even alkaline. The higher the temperature of the bath, the greater the alkalinity, as shown by Jardet. At the neutral temperature there is practically no absorption of water nor of substances contained in the water. There is only suspended perspiration.

1138 **Therapeutic Applications.**— Hebra was one of the first among scientifically trained physicians to make use of the continuous bath.* When studying skin diseases in Vienna with Hebra, Jr., and Professor Kaposi, Hebra's successor in 1883, the author found the continuous bath in systematic use. One patient then in the hospital had been in the bath more than a year. Hebra reported five hundred cases,— of *variola*, *pemphigus*, *burns*, and *gangrene* of the *skin*,— and showed that most excellent results were obtainable by this therapeutic procedure.

* Hebra, *Wien. Med. Woch.*, 1877, also 1865, pp. 893, 920, 940.

Passavant, of Frankfort, reports most gratifying success in the treatment of extensive burns with the continuous bath. According to his experience, pain is almost instantly relieved by immersion in the neutral bath, the patient remaining comfortable so long as submerged.

Riess,* of Berlin, made a special study of the influence of the continuous bath upon internal maladies of various sorts, as well as in the treatment of typhoid and other fevers. In the treatment of over eight hundred cases of typhoid fever he secured a death-rate of 8.5, a much better record than that shown by the statistics of any other hospital in the city. He employed a temperature of 88° in fever cases, and administered the bath whenever the temperature rose to 102°, keeping the patient in the bath continuously until the temperature was brought down to 100°, and returning him to the bath as soon as the original temperature was reached. The continuous tepid bath presents the following advantages over the cold bath, as shown by Riess, together with some possible disadvantages: —

1. It is less disagreeable to the patient; indeed, it occasions him no inconvenience, and is generally welcomed, while the cold bath is received only under vigorous protest.

2. It involves no risk of injury to the heart in cardiac weakness, nor to the brain in arteriosclerosis, and can be used in many cases in which the cold bath must be interdicted.

3. It affords more prompt relief to cerebral and nervous symptoms, these features, when present, disappearing almost altogether with the first bath.

4. Cyanosis and other evidences of disturbance of the circulation do not occur.

5. The temperature is reduced slowly, hence temperature reduction is more permanent, there being no increased heat production by thermic reaction.

6. The duration of the disease is decidedly shortened, the

* Riess, *Arch. für Klin. Med.*, 1889, 1890.

average stay in the hospital, with Riess's eight hundred cases, being less than eighteen days.

7. All the symptoms of the disease are mitigated to a marked degree.

8. The labor of caring for the patient is greatly lessened, which is a boon to the patient as well as to the attendant.

It is true that the continued bath does not afford that degree of cardiac stimulation or excitation of vital resistance which is developed by the cold bath; but this is largely compensated for by the increased activity of the kidneys and skin which is secured by the continuous bath, a fact of primary importance, since the symptoms of cardiac weakness which are often so pronounced in continued fevers, are to be properly attributed not so much to actual exhaustion of the heart as to the profoundly depressing effects of the toxins characteristic of the special malady present and the retention of tissue wastes resulting from diminished oxidation. When desired, however, any required degree of cardiac or general vital stimulation may be secured by the occasional application of the Brand bath, when not contraindicated, or by the cold friction, the cold-towel rub, or the cold wet rubbing sheet in bed.

The large clinical experience of Riess showed that the continuous bath possesses powerful curative virtues in all affections of the brain and the spinal cord which are at all curable, as in cases of exudate from inflammations, as in *meningitis*, and mitigates the symptoms to a wonderful degree even in the most intractable and incurable cases. The measure proved decidedly beneficial in cases of *spinal sclerosis*, *locomotor ataxia*, *paraplegia*, *hemiplegia*, *apoplexy*, and *chorea*. It was found equally helpful in the treatment of *intractable sciatica* and *cutaneous hyperesthesias*, affecting a cure in cases which had resisted all other measures. In *delirium* and *mania*, it exercised a phenomenal sedative effect, was highly beneficial in *dropsy* and in *chronic diarrhea*, and afforded excellent results in *chronic rheumatism*. No remedy has been found more useful in *bed-sores*. Its

results in other functional nervous disorders suggest its possible value in *epilepsy*.

Dauchez* reports complete relief from *hysteria* with extremely grave gastric symptoms. The patient was immediately relieved by the tepid bath in four to eight hours, and in three weeks was well.

The principal patrons of Leukerbad, Switzerland, where the neutral bath is administered to many scores of persons in great tanks for several hours a day, are *irritable neurasthenics, rheumatics*, and persons suffering from *psoriasis* and *eczema*. That many are cured is evident from the fact that these famous old baths still retain their popularity, notwithstanding their comparative inaccessibility, and the powerful competition of the more fashionable resorts in Germany and Bohemia. When the author visited these baths, some seventeen years ago, although the season had yet scarcely opened, multitudes were already flocking there, to avail themselves of what they supposed to be the specific virtues of the mineral ingredients of the bath, by which, however, they were not at all likely to be benefited, since at the temperature at which the baths are given (95° to 98°) the movement of fluids is toward the surface of the body, so that absorption can not take place to any appreciable degree.

The partial continuous bath, which renders such signal service in certain surgical cases, will receive attention elsewhere in this work (**1303**).

Hebra employed the continuous neutral bath for many days, and even months, in hundreds of cases of *skin diseases*, especially in *pemphigus* and *extensive burns*. When the continuous neutral bath is to be employed, the precaution should be taken to rub the skin with vaseline at least once a day, to avoid unpleasant effects from the prolonged maceration of the skin in water.

In employing the continuous bath, care should be taken

Bull. Gen. de Therap., 1884, p. 153.

to apply oil or vaseline to the surface of the body to avoid excessive maceration of the skin.

The continuous bath is certainly a hydriatic procedure of great value, and one worthy of more attention than it has received from the profession in this country.

THE EFFERVESCENT BATH.

1139 This consists of a full bath the water of which contains chloride of calcium, carbonate of soda, and carbonic acid gas. The effervescent bath is administered at the famous resort of Nauheim, Germany, by the aid of natural mineral water which is heavily charged with carbonic acid gas and contains in solution a large amount of chloride of calcium. The author was, through the courtesy of Dr. Schott, afforded an excellent opportunity of studying this bath and its effects at the principal bathing houses at Nauheim; and, having for a number of years made use of the artificial Nauheim bath in a similar manner at the Battle Creek Sanitarium, he feels confident that just as good effects are obtainable from the artificially prepared bath as from the natural mineral water of Nauheim.

1140 An artificial effervescent or Nauheim bath may be prepared by adding to ordinary water carbonate of soda, chloride of calcium, chloride of sodium, and hydrochloric acid, in proper proportions. The effects obtained from a bath thus prepared are practically identical with those obtained from the use of the natural Nauheim water.

Method.—The bath is given in three grades, the intensity and stimulating effect of which are progressively increased with the increasing proportion of the chemical substances which they contain. The composition of these several grades is as follows for a bath of forty gallons:—

1. Chloride of sodium, 4 lbs.; chloride of calcium, 8 lbs.; sodium bicarbonate, $^1/_2$ lb.; to which is added commercial hydrochloric acid (25 per cent.), $^3/_4$ lb.

2. Chloride of sodium, 8 lbs.; chloride of calcium, 12 lbs.; sodium bicarbonate, 1 lb.; commercial hydrochloric acid, 1½ lbs.

3. Chloride of sodium, 12 lbs.; chloride of calcium, 20 lbs.; sodium bicarbonate, 2 lbs.; commercial hydrochloric acid, 3 lbs.

When a copper tub is employed, the amount of bicarbonate of soda must be increased about one fourth, to protect the copper from the action of the hydrochloric acid.

In the preparation of the bath, the chloride of sodium, chloride of calcium, and bicarbonate of soda are first dissolved in the water, and the hydrochloric acid, the quantity of which should be fifty per cent. greater than the bicarbonate of soda, is then added. The effervescence may be produced rapidly or slowly, as desired.

For slow effervescence, place the bottle containing the acid, with stopper removed, at the bottom of the bath, laying it down upon the bottom, and moving it around from time to time. The bath will be ready in two or three hours. For rapid effervescence, invert the bottle without removing the stopper, place the mouth of the bottle just below the surface of the water, withdraw the stopper, and move the bottle about over the surface of the bath, so as to distribute a uniform layer of acid. By this means, the bath may be prepared in five minutes. Its temperature should be 92° F.

Hydrochloric acid may be dispensed with by employing **1141**
the substances indicated in the formula given on the next page, the intensity of the application being regulated by the number of powders used, one, two, or three powders being employed, according to the effect desired. The powders are graduated in such a way as to give three degrees of cutaneous stimulation, according to the strength of the solution formed by dissolving them in the water of an ordinary full bath. No harm is done to tin-lined copper tubs.

FORMULA FOR ONE POWDER.

℞

Sodium carb. (sal-soda)	1½ lbs.
Sodium bicarb	½ lb.
Calcium chloride	3 lbs.
Sodium chloride	2 lbs.
Sodium bisulphate	1 lb.

Mix and dissolve the first four ingredients; then add slowly the sodium bisulphate, which should be kept by itself. It is not desirable to produce very marked effervescence, but rather to secure the saturation of the water of the bath with CO_2.

The carbonic acid gas is produced by this formula very slowly, so that it is nearly all absorbed by the water, thus making the method an economical one. It should be remembered that it is the CO_2 dissolved in the water, and not that which escapes by effervescence, that produces the desired effect upon the skin.

Generally the bath should be taken two or three days in succession each week, then one day's respite be allowed. With persons in good strength, four or five successive baths may be given.

1142 **Physiological Effects.**— In the effervescent bath the thermic and circulatory reactions produced by an ordinary water bath at the same temperature is supplemented by powerful reflex vasomotor effects resulting from the irritation or stimulation of the skin by the carbonic acid gas, the chloride of calcium, and the chloride of sodium in solution in the water. Chloride of calcium and CO_2 are by far the most active of the several chemical substances present. These substances stimulate the cutaneous circulation to a high degree without provoking thermic reaction, and in this way a powerful derivative or revulsive effect is produced. The viscera are relieved of congestion; the activity of the peripheral vessels greatly lessens the labor of the heart, and secures a better distribution and more active movement of the blood through-

out the body; the skin is stimulated to increased activity, thus lessening the labor of the kidneys.

Therapeutic Applications.— The increased activity of the 1143
surface circulation, through dilatation of the cutaneous blood-vessels, produces a powerful derivative and revulsive effect upon the viscera. In this respect the effervescent bath at a neutral temperature accomplishes the same result as does the very hot bath or the Scotch douche, and has the advantage that the extreme temperature is avoided, a matter of great importance in cases of *cardiac weakness* with *dilatation*, and in *chronic nephritis*, since in both these cases very hot and very cold baths must be avoided. In *weakness of the heart*, hot baths are contraindicated because of the harmful excitation first produced and the secondary depressing effect. Cold baths are equally damaging because of the increased labor brought upon the heart by the contraction of the cutaneous vessels before reaction appears. In cases of *renal disease*, the diseased organs are likely to suffer serious injury from the temporary congestion resulting from the contraction of the surface vessels.

An ordinary water bath at a neutral temperature is incapable of calling into activity the reflexes essential for decided revulsive or derivative effects. By the warming of the skin through the strong circulatory reaction produced, a lower temperature is tolerated without shivering, and thus a decided tonic effect upon the heart and vessels is realized from the neutral bath, a fact of much importance in the treatment of cases of cardiac insufficiency with dilatation. The author has for more than a quarter of a century been decidedly opposed to the use of mineral waters of all descriptions, as wholly unscientific in principle; but from his personal experience at Nauheim, he feels compelled to admit that, in this one instance at least, the presence of mineral salts in the water effects certain advantageous results worthy of recognition; and the effervescent bath has given, in his hands, most excellent results, even in some very extreme cases of cardiac disease

with dilatation. Dropsy soon disappears, the heart lessens its volume, sometimes to the extent of one fourth its size during a single bath, and all the symptoms improve, many times to the extent of complete disappearance. Equally good results are obtained in renal affections. Not infrequently albumin disappears entirely from the urine, and dropsical and other symptoms also disappear, so that the patient is brought to a condition of comparative health. Graduated manual Swedish movements and a special dietary must be employed in connection with the baths.

Schott,* who has made a study of the Nauheim baths for more than twenty years, claims them to be very efficient in the cure of cardiac and renal cases. He has even seen old valvular murmurs disappear entirely under treatment by these baths.

In illustration of the power of the effervescent bath to influence the dilated heart in a favorable way, several illustrations are presented herewith, showing the diminution in size which may be secured by this means, and that often in a remarkably short space of time (Figs. 67, 68, 69). The author has seen the area of cardiac dulness diminish nearly an inch in diameter after an effervescent bath in a case of marked cardiac dilatation and loss of compensation.

1144 **Precautions.**— In the employment of the effervescent bath, care should be taken to avoid exhausting the patient, especially in cases of cardiac disease. The breathing of the patient should be quiet when the bath is entered. If considerable dyspnea is present from walking to the bath, the breathing should be allowed to become tranquil before the bath is administered. The chest should be wet before entering the bath, and the limbs should be well rubbed during the process. With very feeble patients, this bath should be administered only every other day. To those a little stronger it may be given two or three days in succession, but even the strongest

* *Blätter Klin. Woch.*, 1880, 17, 35, 7-9, 372, 4. *Medical Record*, March 11 1899, p. 345.

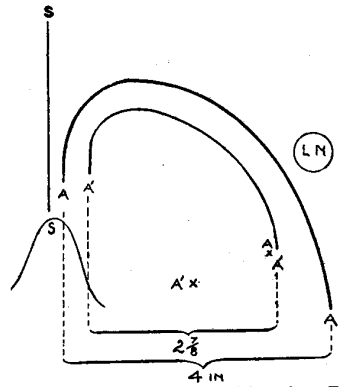


FIG. 67. Outline of Dilated Heart, (*a*) before Treatment; (A′) after Treatment (p. 566).

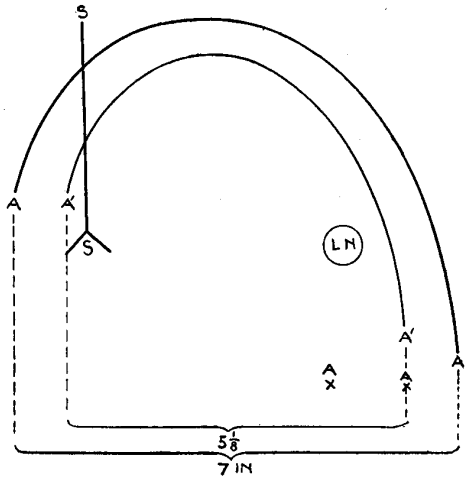


Fig. 68. Outline of Dilated Heart (A) before and (A′) after Effervescent Bath (p. 566).

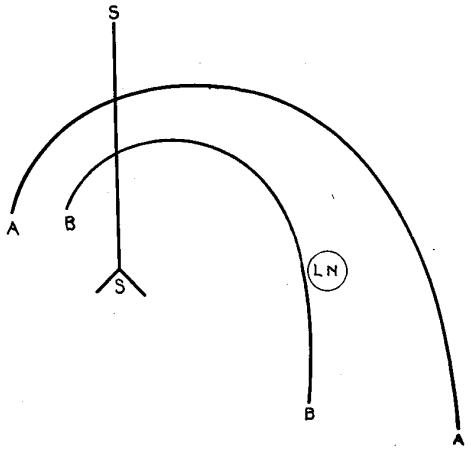


Fig. 69. Outline of Dilated Heart (A) before and (B) after Effervescent Bath (p. 566).

patient should not take more than three baths in succession without a day's interval.

At the beginning and before the patient's susceptibility is known, it is best to start with the mildest bath, increasing the quantity of the chemical ingredients as he becomes accustomed to the measure. In the case of very sensitive persons, the temperature may be made a little higher (94° or 95°). It is important that the patient should not become chilled during the bath.

THE SURGE BATH.

1145 This bath is given in a rocking tub (Fig. 70). The temperature of the water employed should be from 60° to 75°. The effects are intermediate between those of the ordinary full bath at the temperature named and the sea bath. Reaction occurs more quickly than in the ordinary full bath, allowing the use of a temperature from five to eight degrees lower.

1146 **Therapeutic Applications.**—The surge bath at 60° for 15 or 20 seconds is a powerfully tonic measure, well adapted to robust patients. The bath should be used following a heating bath of some sort, as the wet-sheet pack, an electric-light bath, a hot shower, or some similar procedure.

SEA BATHS.

1147 The sea bath is a measure of great value from both a hygienic and a therapeutic standpoint. Under this head we may consider the swimming bath, and baths taken in natural bodies of water, whether in lakes, rivers, or the sea.

Method.—The sea bath may be a simple immersion, or a swimming bath in which the effects of the bath are combined with exercise. The length of the bath must depend upon the temperature of the water, and upon the individual's susceptibility, or whether he has been accustomed to the baths. Ordinarily, the duration of the bath at first should not be more than 3 to 5 minutes. Later, it may be increased to 20

or 30 minutes, but should seldom be longer than this. The effects of the sea bath are essentially those of the full bath at a slightly higher temperature. The saline constituents of sea water encourage circulatory reaction, as does also the exercise which is commonly taken with the bath.

1148 **Therapeutic Applications.**— This bath is especially useful as a tonic or restorative measure, for which purpose it is employed by many thousands of people who visit seaside resorts during the summer season. Many persons are injured by the sea bath through neglect of the common rules which should always be observed with reference to cold bathing. The following precautions are especially important: —

1. The bath should not be taken within an hour before or after eating a meal.

2. The bath should not be taken when a person is exhausted from either mental or muscular effort, or through loss of sleep, or if he is nervously weak from any other cause.

3. On first entering the water, a slight chill occurs, which, however, quickly disappears as reaction sets in. The bather should not remain in the water until the second chill appears, as the reaction from the second chill will be imperfect, and the result will be languor, lassitude, stiffness in the muscles and joints, and depression with possibly various nervous symptoms. Gentle rubbing must be continuous to prevent chill.

4. When the bather emerges from the water, he should receive a spray or shower douche at a temperature ten or fifteen degrees below the temperature of the sea, and should afterward be thoroughly dried and vigorously rubbed. The cold douche following the bath should be of short duration, not more than 3 or 4 seconds.

5. The bather should dry quickly, and afterward exercise with moderate vigor for 15 or 20 minutes, or until the circulation is thoroughly established.

If the bath is succeeded by cold feet or hands, headache, chilliness, lassitude, sleepiness, or other unpleasant symptoms, it is probable that it was too long continued, or that some of the foregoing rules have been violated.

MUD BATHS.

1149 In this bath, the patient lies in a tub surrounded with mud of about the consistency of thick gruel or mush. The muds used for this purpose usually contain saline and alkaline substances, which act upon the skin, stimulating the peripheral circulation. The effects of course vary somewhat according to the ingredients of the particular mud employed. The mineral substances are not absorbed from the mud, as is generally supposed, but simply act upon the skin. The effect is consequently in some cases similar to that of the effervescent bath.

Therapeutic Applications.— The mud bath is most often employed in cases of rheumatism and gout. Many persons are doubtless helped by its use, but the benefit received is not greater than might be obtained from the scientific use of water without the mud.

THE BRAND BATH.

1150 This bath (Fig. 71), which is generally meant when a cold bath is spoken of in the treatment of typhoid fever, differs from the ordinary cold bath in several particulars. The routine procedure as employed by Brand and his disciples in the treatment of continued fever cases is as follows: —

Method.— The bath-tub, containing water at a temperature of 65° to 70°, is placed near the bed. The patient is lifted from the bed into the tub as quickly as possible, the face and head having been previously cooled by the application of water at 50°. Care should be taken to immerse the patient to the neck. Exposure of the shoulders is likely to give rise to pulmonary complications. The head should be protected by a towel wet in ice-water and wrapped about the head in such a way as to form a sort of trough leading down the back of the head. On entering the tub the patient is rubbed vigorously for two or three minutes, then sits up for a few seconds while two or three gallons of water at 50° are poured upon his head and allowed to run down the back of his neck. He then lies

down again, and the rubbing is repeated. At the end of five minutes the affusion to the head is repeated, and the rubbing continued.

If there is weakness of the heart, the cold water should also be poured upon the front of the chest. The rubbing of the patient should be continued during the whole bath. When the patient first enters the bath, he often experiences extremely unpleasant sensations. Respiration is gasping and difficult. This inconvenience is at once relieved when the cold water is poured over the head. The bath is continued from 10 to 20 minutes. If employed for infants or old persons, the bath should be very short. If the skin becomes cyanotic, or if marked shivering or chattering of the teeth occurs, the patient should be quickly removed from the bath, snugly wrapped in a sheet, and covered with a blanket. A hot bottle should be placed at his feet if cold, and the limbs should be rubbed. Reaction soon takes place, and the skin is reddened by the increased movement of blood through it. The patient's temperature falls from half a degree to two or three degrees. The bath is usually repeated at the end of three hours or sooner — whenever the rectal temperature reaches 102°. The author prefers not to allow the temperature to rise above 101.5° before administering an antipyretic bath of some sort. This rule may be easily adhered to during the whole course of the fever, except, possibly, during the developmental stage of the disease, when the temperature is rising.

Although this bath is a most effective and valuable therapeutic procedure, and one which is much used, its rationale is comparatively little understood; it will therefore be worth while here to devote space to a special consideration of its physiological and therapeutic effects, that there may be a thorough appreciation of their bearing upon the management of febrile disorders.

It is certainly a mistake to govern the employment of hydric procedures altogether by the temperature in febrile

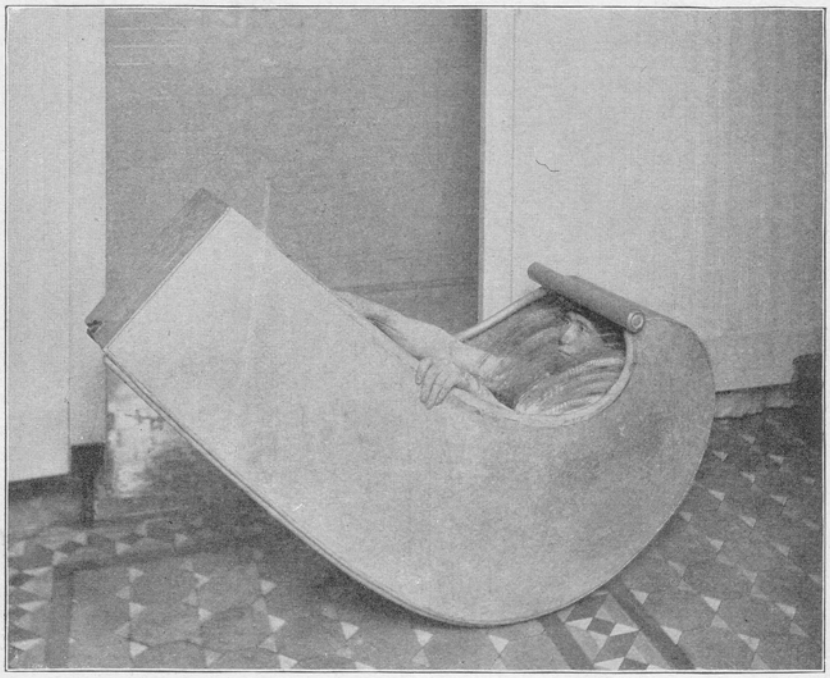


FIG. 70. SURGE BATH (p. 567).

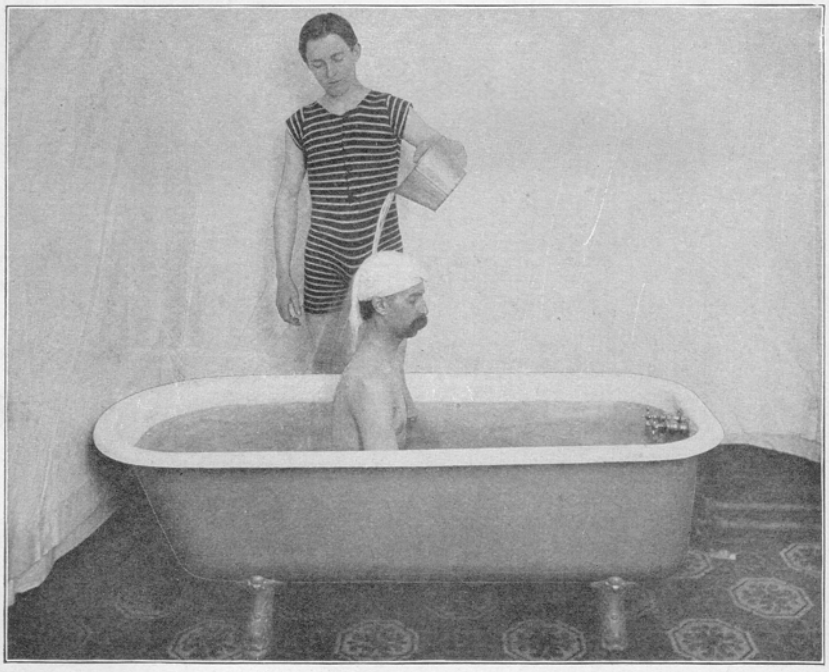


FIG. 71. BRAND BATH (p. 569).

cases. In typhoid fever, it might not be wise to use the cold bath when the temperature is below 102°, but hydric procedures of some sort may be applied; hence the author does not think of confining himself to the use of the Brand bath alone in the treatment of this disease, notwithstanding his high opinion of its value. The most important purpose gained by the use of this application is not the reduction of temperature, but the increase of vital resistance and the elimination of toxins, as Winternitz long ago pointed out.

In rare instances of typhoid fever, the temperature scarcely rises above normal during the whole course of the malady, and yet a fatal issue has sometimes occurred in these cases. This fact alone is sufficient indication of the necessity for the employment of other means than the thermometer as a guide in the direction of therapeutic agents. In cases in which the temperature remains comparatively low because of some peculiarity of the patient's constitution or some unknown factor, there may be as great need as in any possible case for the general vitalizing and tonic effect of cold, which, however, may be obtained by the employment of measures far less vigorous than the Brand bath. It is certainly a patent error to say that if a patient's temperature does not reach 102° or more, there is no call for a bath. The bath is needed for cleanliness, for tonic effects, and to energize and sustain the heart. Cold friction, the cold-towel rub, the tonic wet-sheet pack, and even the half-bath at a moderate temperature, are all measures which may render invaluable service in so-called mild cases of typhoid and other fevers, and should have their place in the therapeutics of febrile disorders.

Physiological Effects.— Applied in the manner indicated, **1151** the effects of the Brand bath are as follows :—

1. General vital resistance is increased.
2. The nerve centers are energized.
3. Muscle tone or excitability is increased.
4. Activity of the kidneys, liver, and skin is increased.

5. The amount of oxygen received and CO_2 exhaled during the bath is nearly three times the normal amount, showing great increase of oxidation.

6. There is marked increase in the blood pressure.

7. The pulse is slowed.

8. The heart is energized.

9. The number of blood-corpuscles in the circulation is increased, especially white corpuscles.

10. The circulation is improved in a number of ways; viz.: —

(*a*) By the primary contraction of the cutaneous vessels and subsequent dilatation, vigorous fluxion is produced in the internal viscera and vessels, which are first made to contract, then to dilate; and then, as dilatation of the skin vessels increases, contraction again takes place, thus wonderfully stimulating the movement of the blood through the body, and correcting any condition of stagnation or hyperemia which may exist in the lungs, liver, spleen, brain, or elsewhere.

(*b*) The excited respiratory movements act in a powerful manner in increasing the movement of blood and lymph in the central nervous system and the abdominal viscera, the diaphragm acting as a blood-pump as well as aiding the processes of respiration.

The friction applied aids the reaction by dilating the vessels of the skin, prevents shivering, and assists heat elimination. The rubbing must not be too violent, as vigorous rubbing will have a tendency to excite heat production. It must be applied with just enough vigor to warm and redden the skin. Strong shivering gives rise to marked increase in heat production. When shivering is prevented by friction, the refrigerant effects of the bath are greatly increased at the same time that the internal congestion is prevented, and the patient is able to endure the bath very much longer, and a more pronounced antipyretic effect is produced.

Cold affusion practiced at intervals during the bath causes contraction of the cerebral vessels, accelerates the movement

of the lymph and blood throughout the brain and cord, and thus energizes the nerve centers to a remarkable degree. By the application of cold water to the chest, the respiratory and cardiac centers are also powerfully stimulated.

Therapeutic Applications.— How these effects may be **1152** usefully employed in typhoid and all continued fevers will be readily appreciated after considering the conditions and indications present in these disorders. The indications in typhoid fever and most other continued fevers may be briefly stated as follows:—

1. To sustain vital forces, and increase vital resistance.
2. To destroy and eliminate bacterial toxins and tissue poisons.
3. To increase respiratory activity.
4. To increase oxidation.
5. To augment the activity of the liver.
6. To facilitate the work of the kidneys.
7. To encourage the functions of the skin.
8. To energize the heart.
9. To raise the tone of the peripheral vessels; that is, to energize the peripheral heart.
10. To regulate and increase the movement of the blood through the vessels, preventing visceral congestion and functional failure.
11. To encourage blood formation, and to improve the quality of the blood.
12. To lower the temperature of the body.
13. To ameliorate the sufferings of the patient.
14. To prevent complications.

Let us consider each of these indications somewhat at length.

1. It is not by the high temperature, nor by the patho- **1153** genic organisms which invade the body, but by the poisons produced by these organisms and by the toxins generated within the body itself, that life is destroyed. These poisons kill by their effect upon the nervous system,— a pernicious

influence which is manifested by headache, delirium, insomnia, weakness, stupor, coma, ataxia, and various other symptoms which point directly toward the great centers of life, the ganglia of the brain and cord. Space does not here permit the detailing at length of the various ways by which the organism defends itself against these toxins, which have been so admirably pointed out by Charrin in his work, "Le Defenses Naturelles de l'Organisme." But a modern study of febrile disorders has shown clearly that the most important thing to be accomplished in dealing with this class of cases is to aid the body in its battle against death by toxemia through support of the organism in every possible way; hence, any measure which increases vital resistance, which replenishes the life forces, which antagonizes the depressing and other toxic influences of the poisons present must be of paramount importance. The fever patient has no appetite because digestive ability is lacking; little or no hydrochloric acid is found in the gastric juice; the secretion of the salivary glands, the pancreas, liver, and other digestive glands is likewise lessened or impaired in quality, and all the nutritive processes are nearly paralyzed. The assimilative activity of the tissues is also weakened as much as is the digestive power of the alimentary canal and accessory organs.

The cold bath rouses to activity the nearly paralyzed nerve centers by the powerful sensory impressions sent inward from the skin; it relieves the congested brain of surplus blood by the powerful fluxion induced, cleansing it from the accumulated poisons by increased movement of fluid in the lymphatics of the brain, and secures conditions favorable to sleep, thus giving the nerve centers a chance for rest and recuperation. And it does more: it increases the activity of the gastric glands, thus encouraging the production of hydrochloric acid, thereby securing both an appetite and the ability to digest the food taken. With improved nutrition, the resisting power of all the cells of the body is increased. This is shown by the clean tongue, the absence of sordes, and the

disappearance of fetor in the breath. The bodily forces, thus encouraged, are enabled to maintain the battle against the invading parasites until their life period has run out, or the body, by physiological changes, is rendered an unfavorable habitat for them.

2. In typhoid fever the body is exposed to the noxious **1154** influence not only of typhotoxin, a product of the specific germs which characterize this disease, but also other toxins produced by the colon bacillus, and various microbes which thrive in the alimentary canal. Roque and Wile have shown that the quantity of toxins found in the urine of typhoid fever patients is double the normal. The application of the cold bath decreases the toxicity fivefold until convalescence is established. The advantage to the system of thus getting rid of this enormous amount of toxic material can not be overestimated.

The cold bath, by increasing the movement of the blood, and thus stimulating the activity of the entire organism, encourages not only the destruction of germ poisons by those glands which are charged with this special duty, but also their elimination through the various channels which furnish outlets for both physiological and pathological poisons.

3. The increase of respiratory activity reflexly produced **1155** by the bath secures a vigorous movement of blood in the pulmonary vessels, thus combating stagnation and preventing hypostatic congestion with its resulting evils. Accumulated mucus is expelled from the small tubes, and the volume of air passed into the lungs is increased to two or three times the ordinary amount.

4. One of the best-known effects of cold applications to **1156** the surface is the thermic reaction (**460**), by means of which there is an increase in all the metabolic processes, and especially in the oxidation processes. This is very important, as in the grave forms of fever there is generally a marked decrease of oxidation. The leucomains, or accumulated typhotoxins, are imperfectly oxidized; and not being reduced

to the perfectly soluble form necessary for elimination, they accumulate in the blood. The retained excretions and accumulated specific poisons, as has been shown by Robin, sometimes augment the amount of extractives from four to twelve per cent., or over three times the normal amount. In ordinary cases of fever these substances have been shown to increase more than fifty per cent. The increased oxidation produced by the cold bath renders these substances soluble, and thus facilitates their elimination, while the increased movement of blood brings them in contact with the organs capable of further changing or removing them. That the increased amount of oxygen introduced by the deeper respiration resulting from the cold bath is utilized, is shown by the fact that the respiratory quotient remains the same; that is, while the amount of oxygen absorbed is three times the usual quantity, the amount of CO_2 eliminated is proportionate to the oxygen absorbed.

1157 5. The liver plays an exceedingly important rôle in fever cases. It is the organ upon which, more than upon any other, perhaps, depends the life of the fever patient. The liver is a sentinel standing at the door of the circulation. The toxins which enter the portal vein from the alimentary canal, as well as those which are in circulation in the blood, when brought to the liver, are held back and destroyed by it to such an extent that by comparison of the blood of the portal vein and that of the hepatic vein, its toxicity is found to have been diminished one half by passing through the liver, as has been proved by Rogers and others. In fever, its functions as a regulator of nutrition, as an excretory organ, as a blood organ, and as a destroyer of toxins, are all in large measure held in abeyance, as is readily shown by the glucose test for hepatic insufficiency. The system is so flooded with poisons as to overwhelm the liver; it becomes congested, its vessels are distended with stagnated blood, its tissues filled with paralyzing poisons, and local pathological processes not infrequently result, as shown by the enlargement so frequent in febrile

cases, and the degeneration which is so prominent a feature in the post-mortem changes observed after death from typhoid and other fevers. These degenerative processes, once supposed to be due to the elevated temperature of the blood, are now known to be due to the influence of the toxins with which the blood is filled.

The cold bath, by the strong fluxion of blood which it sets up, empties the vessels of the stagnated and half-paralyzed liver, energizes to renewed activity the poison-benumbed ganglia which control it, arouses to its work the hepatic cell, thus renewing all the functions and maintaining the integrity of this most important viscus, which has been aptly described as a "shut door," preventing the entrance of poisons into the general circulation so long as it retains the full use of its powers.

6. One of the most marked effects of the cold bath is its **1158** influence upon the kidneys. The volume of the urine is sometimes increased two or three times. The kidney, as well as the liver, suffers from the constant contact of the toxins with which it has to deal, as shown by the renal degeneration often found after death from febrile diseases. So long as the kidneys and liver can be kept doing their duty as blood purifiers, the organism has a good chance to hold its own in the battle for life. The cold bath assists the functions of these organs as no other measure does.

7. The dingy, dry, inactive skin of the fever patient, under the influence of the cold bath soon becomes white, moist, and active. The improvement of the cutaneous circulation may be noted from day to day. Nothing could be more marked than the contrast between a fever patient who has been subjected to daily bathing and one who has not enjoyed the advantage of this wonderful regulator of the vital processes. The skin of the latter is dry, leathery, tawny, inactive as parchment, while that of the bathed patient is clear, supple, moist, elastic, lively, and responsive to the thermal and mechanical agents applied for the purpose

of aiding heat elimination, arousing the nerve centers, and awakening vital resistance. The skin has been shown by Bouchard and others to be an important outlet for highly toxic substances, which are generated in the body under morbid conditions as well as in the physiological state. The marked stimulation of the skin by the contact with cold water, and the friction to which it is subjected, adds a powerful factor to the defenses of the body against the toxins which are poisoning the nerve centers, in addition to the service rendered through the internal reflex actions set up by the impressions made upon the cutaneous nerves, whereby the liver, the suprarenal capsules, and other poison-destroying glands are brought to a high degree of activity.

1159 Brunner has shown* that the active skin is capable of eliminating germs in vast numbers; while Herz has shown that the dry skin transmits very little heat outward; and Leyden, that one of the most important indications in typhoid fever is to encourage the elimination of water, which, as he has demonstrated, accumulates to an abnormal extent in the tissues in this disease. Weyrich has shown that friction of the skin may increase the elimination of water fifty per cent. The moist friction of the cold bath and the increase of skin activity created by it thus meet at one and the same time three important indications presented in typhoid and other infectious fevers; viz.: (1) Increased elimination of moisture through improved blood supply; (2) increased elimination of heat through conduction and evaporation of the moisture of the skin, not only immediately after the bath, but subsequently, as the result of the increased blood supply; (3) increased cutaneous activity and elimination of germs.

1160 8. The cold bath aids the heart to a degree which is unapproached by alcohol, digitalis, strychnia, or any other known agent. It renders a still more valuable service in its influence upon the blood-vessels. The low tension often

* Brunner, *Berliner Klinische Wochenschrift*, 1891, page 505.

present in grave febrile conditions is not due alone to the depressing influence of the toxins upon the cardiac centers and the interference with the nutrition of the muscular structures of the body, but is largely, perhaps chiefly, due, as shown by Romberg,* to the loss of tone in the peripheral vessels and the weakening of the vasomotor centers of the medulla. This is indicated by the cyanotic appearance of the face, the blue lips and nails, and the general turgid appearance of the skin.

The condition of the blood stream under these conditions may be compared to that of a stream of water leaving the hose of a fire-engine from which the nozzle has been removed. The machinery itself may be in no way interfered with, but owing to the removal of the resistance against which it has been working, and which acts as a means of regulating its action, the pump "runs away," as the engineer says. The wear and tear to the engine is tremendous, but its cylinders do not fill with water, and the lessened quantity of water pumped is raised only a few feet, and runs away with little force to low levels where there is no resistance.

The same thing happens with the heart when general vasomotor relaxation occurs. An important element in heart regulation is lost. The steadying influence of well-filled vessels and a solid column of blood to work against being no longer in operation, the heart flies away in rapid, ineffective movements, and the blood stream flows off in the shortest circuits instead of filling the whole system. The natural result is congestion of the great vascular internal viscera, the liver, lungs, and kidneys, as well as the brain and spinal cord.

Under these circumstances the heart may be compared, as Hare has suggested, to a locomotive which has steam up, and is in a condition to do a tremendous amount of work, but because of the slipperiness of the track makes no headway in pulling the train, its wheels only flying around like a spinning

* *Berliner Klin. Woch.*, 1895.

top, doing no effective work. A little sand on the track, however, changes the whole situation by affording the resistance necessary to regulate the action of the engine. The wheels move slowly and steadily, the steam cylinders have time to fill, and the energy in the steam is utilized.

These illustrations are not wholly exact, since in the case of the pump and the locomotive the machine may remain wholly intact, while in the case of the heart this is not true. The heart depends for its energy upon the constant filling and flushing of its vessels. When the blood pressure is low, its nutrition suffers in consequence. Blood accumulates in the dilated vessels, so that the volume passing through the heart is diminished; the whole blood stream is slowed; it becomes filled with waste products, and may be compared to a stagnant or sluggish stream of water in which filth accumulates. In consequence of this slow movement, the action of the liver, kidneys, skin, lungs, and other poison-destroying organs is interfered with, and the heart is worn out by its constant ineffective work. Its period of rest may be diminished perhaps one third or more. Under these defective conditions for nutrition and rest, its energy rapidly fails, so that a vicious circle is formed. The low pressure weakens the heart, and the weakened heart still further decreases the pressure. In this condition, without relief of some sort, the patient must rapidly sink into collapse, followed by complete syncope and death from so-called heart failure. The cause of the failure is not, however, primarily with the heart, but in the vessels, as suggested by Romberg, and further demonstrated by Paessler.* The importance of the researches of Romberg and Paessler can scarcely be overestimated, for they show us at once the folly of seeking to correct the morbid condition known as cardiac weakness or failure, when present in acute febrile disorders, by the administration of drugs to excite or stimulate the heart. To do this is like putting on more steam

* "Kongress für innere Medicin," Weisbaden, 1896, pp. 256, 266.

pressure when the pump is running away or the locomotive wheels slipping on the track. Nature has provided us with a most admirable remedy in an external agent; viz., cold, which strikes at the root of the evil, and is attended by no ill effects. It is only necessary that these facts should become known to the medical profession to secure for cold water the universal recognition which intelligent men are always ready to accord a great truth that has for its basis a fundamental law of nature.

9. Cold applications to the skin cause contraction of the **1161** small arteries throughout the body, and this instantly raises the blood pressure. Cold excites the activity of the heart also, so that at first it beats not only with more vigor but with greater frequency. As a result, the blood-vessels are rapidly filled, blood pressure is raised, and the liver, kidneys, and other excretory organs are flushed with blood and encouraged to do their normal work, thus rapidly diminishing the amount of poison taken into the blood. The nutrition of the heart is also improved; and with the higher tension its movements are slowed, so that its periods of rest are increased; while at the same time the small vessels, constituting the peripheral heart, by their increased activity, accelerate the movement of blood, thus lessening the work of the heart. While by this combination of factors the heart's work is decreased, the energy of its action is increased, as is also its power to work, *by the improved conditions under which it labors;* so that, instead of a vicious circle, there is soon organized a group of influences which steadily improve the condition not only of the heart but of all the tissues, thus enormously increasing the power of the body to resist the disease and expel the invading organisms and their toxic products.

10. The increased movement of blood throughout the **1162** body, and especially the fluxion of the visceral vessels, occasioned by the several vascular movements set up,—first brief contraction, then a longer dilatation from retrostasis of the blood from the skin, and lastly a considerably prolonged con-

traction due to the filling of the surface vessels when reaction occurs,—antagonize in the most powerful way the tendency to visceral congestion with stagnation of blood, failure of local nutrition and function, and the multiple mischiefs flowing out of the disturbance of the activity of the organs essential to the maintenance of organic life.

1163 11. The effect of the cold bath upon the blood must certainly exert a potent favorable influence in febrile disease. As has been shown by Winternitz and various other observers, the number of corpuscles in circulation in the blood may be at once increased by the cold bath to the extent of twenty-five per cent., or even more; and Thayer* has shown that this effect follows the administration of cold baths in typhoid fever as well as in health.

In fever the number of corpuscles is greatly diminished, consequently the oxygen-carrying power of the blood is proportionately diminished. The area of the corpuscles circulating in the blood of a healthy person is about 3,100 square yards. With the reduced blood count of fever, this oxygen-absorbing area may be reduced to 2,000 square yards or less. If this area can be increased two thirds, or brought up to nearly the normal amount, the oxygen-absorbing power, and consequently the oxidizing power of the blood, may be proportionately increased. It is interesting in this connection to recall the fact that the white corpuscles are increased in number to a greater extent than are the red corpuscles by cold applications. The leucocytes play an important rôle as defenders of the body, in destroying microbes, while the serum destroys bacterial toxins. From these facts it is readily apparent that the action of the cold bath in increasing the number of corpuscles in circulation serves a most important purpose in sustaining the body in its conflict. What other agent known to man is capable of rendering such service as this? *Antipyrine and antipyretics of all sorts diminish the*

* *Johns Hopkins Hospital Bulletin*, Balt., 1893, IV, 37-40.

blood count instead of increasing it, and thus greatly lessen the oxidizing power of the blood.

12. Liebermeister * has shown that heat production is 1164
increased in fever, while Winternitz has demonstrated that heat elimination is decreased, at least in many cases. It is apparent that the greatest degree of elevation of temperature would be produced by the co-existence of increased heat production with diminished heat elimination. The cold bath renders an important service in reducing the temperature, although this is not by any means the most valuable of its effects. The elevation of the temperature in fever is without doubt a conservative or protective action by the vital forces, it having been clearly shown that the elevation of temperature accompanying infectious disorders serves a most useful purpose in establishing immunity, by rendering the body an unfavorable habitat for the invading parasites.

However, the importance of lowering the temperature in fever, even one or two degrees, or a fraction of a degree, is shown by the investigations of Maurel,† according to which the white blood-corpuscles are destroyed at a temperature of 109° to 111° within an hour, and are able to survive at a temperature of 107.6° to 109.4° for only three hours. When it is remembered that the internal temperature of the body is two or three degrees higher than the axillary temperature, it is evident that whenever the patient's axillary temperature reaches 105° to 106°, his life is in imminent danger. The lowering of the body temperature one or two degrees in such a case may be the immediate means of saving life.

Another consideration of importance is the fact that elevation of body temperature gives rise to increased oxidation of nitrogen, causing rapid wasting of the muscular, nervous, and glandular structures of the body. This weakening of vital structures is one of the chief sources of danger in febrile diseases. Here is a frequent cause of cardiac failure, and of

* Liebermeister, *Deutsch. Arch.*, 1868, v. V, p. 217.

† *La Semaine Médicale.*

many other grave conditions which accompany ataxic and adynamic febrile states.

The cold bath lowers the temperature of the body not simply by abstracting heat or by dilating the surface vessels, but by aiding in the removal of the conditions which give rise to the elevation of temperature; in other words, it strikes at the causes of the condition, and is hence not merely a symptomatic remedy. The cold bath is thus not only a powerful antithermic agent, but is antifebrile as well, which is more than can be said of any of the medicinal antipyretics; for, while they do lower the temperature, *they do not shorten the duration of the malady, nor lessen its fatality.* While lowering the temperature, they at the same time lessen the vital resistance, stupefy the nerve centers, and weaken the defenses of the body. The cold bath, on the other hand, arouses the dormant nerve centers, energizes all the vital functions, and improves oxygenation and metabolism at the same time that it abstracts superfluous and harmful caloric.

1165 13. Another most important service which the cold bath renders the fever patient is the amelioration of his discomforts. Medical men who have been subjected to this method of treatment while suffering from typhoid and other fevers, have unanimously testified to the comfort which it secures. The application itself is by no means a pleasant procedure; but the relief which it affords, the sense of well-being which it creates, with the decidedly favorable modification of all the morbid conditions characteristic of febrile maladies, speaks so strongly in its favor that intelligent patients readily submit to it, and after the first few baths welcome the arrival of the hour for the treatment.

It is true that nervous, excitable, and illy controlled individuals sometimes resist the treatment, while ignorant friends urge vigorous protests against what seems to them unnecessarily severe and cruel treatment. Their prejudices must be overcome by gentle management and a little tact, which seldom fails to secure their co-operation. The brown, thickly

coated, swollen, and parched tongue, the sordes-covered lips and teeth, the catarrh of the stomach and bowels, the tympanitis, flatulence, exhausting diarrhea, headache, mental stupor, nervousness, apprehension, the cadaverous, ocher-colored appearance of the patient are almost never seen when the cold bath has been administered from the very beginning. Indeed, the picture of the disease is so completely changed that one would scarcely recognize it from the typical description in the text-books. If all patients could be taken in hand with thorough hydriatric management within two or three days after the beginning of the attack, or at least before the fifth day, in typhoid fever, the disease would rarely appear in other than its mild form.

14. Lastly, it may be said in behalf of the cold bath as a **1166** remedy in typhoid fever, that its thorough use early in the disease rarely fails to prevent grave complications of any sort, such as pneumonia, myocarditis, nephritis, perforation, intestinal hemorrhage, and the various paralyses and other distressing sequelæ so notoriously frequent in typhoid fever when managed in the usual way. The same is true as regards all the infectious fevers. The prejudice sometimes encountered against the use of cold water, based on the supposition that it increases the liability to pneumonia or other complications, is wholly without foundation. The very opposite, in fact, is true.

In regard to the results of the cold bath in typhoid fever **1167** and other infectious febrile disorders in relation to the saving of lives, a long chapter might be written. A very few statistical facts must here suffice: The ordinary mortality in typhoid fever, as shown by the statistics of our large cities, is 25 to 30 per cent., and a still larger percentage of mortality is not infrequently reported. Brand has collected a series of 1,223 cases in which the cold bath was intelligently employed from the beginning, the treatment having been instituted within the first week. Of these only twelve died, or less than 1 per cent. The mortality in a series of 5,000 cases,

including many in which treatment was not thoroughly applied, was less than 4 per cent. Osler,* of the Johns Hopkins Hospital, reports a very great reduction in mortality from typhoid fever by the adoption of the cold bath treatment. In the experience of the author and his colleagues, which includes several hundred cases of this disease treated by the cold bath and analogous procedures, the mortality has been less than 3 per cent. In pneumonia, the mortality has been reduced more than one half. Schill reports 110 cases of scarlet fever, with no deaths. Remier treated 3,000 cases of scarlet fever with cold baths followed by rubbing, and with a very low mortality rate.† Equally satisfactory results have been obtained in the treatment of smallpox and other infectious fevers.

The Question of Alcohol with the Cold Bath.

In Germany and France it is the almost universal custom to administer alcohol to the patient just before putting him in the cold bath. Some practitioners, as Winternitz, administer but a very small amount, as a single mouthful of wine; while others give brandy in considerable quantities. A few American practitioners also employ brandy freely with the cold bath. The unwisdom of this practice will be apparent on due consideration of the following facts: —

1168 1. One purpose in administering the cold bath is to secure a true stimulant or tonic effect by arousing the vital energies, especially through excitation of the nerve centers of the vasomotor, sympathetic, and cerebrospinal systems. Alcohol was once supposed to be capable of effecting this, and was used for this purpose in typhoid fever and various other morbid conditions accompanied by depression of the vital forces. At the present time, however, it is well known, and with practical unanimity admitted, that alcohol is neither a tonic nor a stimulant, but a narcotic; that it depresses and does not excite; that it lessens, and does not increase, the activity of

* "Johns Hopkins Hospital Reports," p. 321.

† Thomas, *Journal of the American Medical Association*, 1896, p. 1332.

the nerve centers; and that this is true of small as well as large doses, as has been shown by the researches of careful investigators. In evidence of the foregoing may be cited the following statements from medical men recognized as authorities throughout the civilized world: —

Harnack says: "It should also never be forgotten, that, even in small doses, *the paralyzing action of alcohol is exercised most rapidly and energetically upon the tonus of the blood-vessels — the importance of which tonus for the regularity of the circulation and the cardiac energy is well known.*"

Victor Horsley, an eminent English surgeon, speaks thus respecting the influence of alcohol upon the heart: "Surgeons of former days used alcohol extensively to combat shock, but *the old theories of shock have been proved erroneous, and alcohol has consequently become unnecessary. It will be less and less used in the future, and the discredit into which it has fallen is justified.*"

Hermann Frye, by the use of Mosso's ergograph, showed that "*in the unfatigued muscle, alcohol lessens the extent of its maximum contraction*, owing to a lessening of the peripheral irritability of the nervous system."

The heart is a muscle, and consequently alcohol can not be expected to increase its working power; and when laboring under the influence of toxic agents, as in a febrile state, it is clearly evident that the effect of this agent must be distinctly and altogether pernicious.

Chantemesse* calls attention to the diminished toxicity of the urine in many cases of typhoid fever, the toxins being retained in the body during the fever, resulting in an enormous increase of the toxicity of the urine during convalescence. This fact is of great importance in connection with the use of antipyrine and alcohol, which lessens the activity of the kidneys, and so causes still further retention of toxins.

The use of hot coffee, tea, or other medicaments in con-

* Bouchard's "Traité de Médecine."

nection with hydriatic procedures is also to be in every way deprecated, as a sort of mixed and antagonistic therapeutics, for which no good scientific reason can be assigned. Coffee, like alcohol, is a narcotic. It lessens the susceptibility of the nerve centers to stimulation by the thermic impressions made upon the skin, and thus lessens the effect of the applications made, as shown in relation to alcohol. When it is desirable that these impressions should be mitigated, this may be accomplished much more effectively and consistently by raising the temperature of the application, or by preparing the skin for the application of cold water by a preceding hot application, either local or general.

In a series of physiological experiments conducted by the author in 1893, and reported at the meeting of the American Medical Temperance Association held at Milwaukee in May, 1893, it was clearly shown that nervous, muscular, and glandular activities are all diminished to a noticeable degree by the ordinary medicinal doses of brandy and other stimulants.*

It is clear, then, that those who administer alcohol before the cold bath, by so doing antagonize the therapeutic activity of the measure, since so far as the alcohol has any effect whatever, it is to depreciate or neutralize the very effect which it is designed to secure by the cold application.

1169 2. The effect of alcohol is to cause dilatation of the peripheral vessels. This it does by paralyzing the vasoconstrictors

As already stated, paralysis of the peripheral vessels and of the vasomotor centers of the medulla, as shown by Romberg and Paessler, are the real causes of heart failure; hence alcohol, in its effect upon the vasomotor centers and nerves can only aggravate the very condition for the relief of which it is administered. Alcohol at the same time exercises a like effect upon the accelerator nerves of the heart, which are both anatomically and physiologically associated with the vaso

* See *Medical Temperance Quarterly*, July, 1893.

constrictors, as Waller has so clearly pointed out. By this means, while the heart's action seems to be freer, the movement of the blood through the systemic circulation is slowed, as is shown by the stasis in the peripheral vessels, which is clearly indicated by the dusky hue of the skin in a man under the influence of alcohol. The influence of alcohol is in this respect somewhat akin to that of the warm bath. The effect of a cold application, however, is the very opposite; viz., the stimulation of the vasoconstrictors. At first this effect is so pronounced that the blood-vessels are almost completely emptied of their contents, and the skin becomes blanched in appearance.

As reaction sets in, the caliber of the blood-vessels is increased, but stimulation of the vasoconstrictors continues in that wonderful rhythmic activity of the small vessels, the peripheral heart, whereby the blood is steadily pumped from the arterial into the venous system, resulting in a bright red flushing of the skin, which indicates an increased flow of the blood through the periphery and an increased rate of movement throughout the whole circulatory system.

3. It is not maintained that no preparation for the cold **1170** bath is needed, but rather that there is a far better method than by the use of alcohol. The ideal preparation is to be found in the application of heat. If alcohol in any way aids reaction, it is not by augmenting the activity of the nerve centers, but by encouraging the relaxation of the surface vessels. But this can be accomplished far better by either a general or a local application of heat, as a foot bath, fomentations to the spine, or when convenient, a general application of heat, such as a hot full bath for one or two minutes, a hot-blanket pack, a hot shower, or even hot water drinking or a hot enema, or wrapping the patient in warm woolen blankets for a half hour or so, with hot bags about him. All these are measures whereby the preparation for the cold bath may be accomplished far more efficiently than by any form of medication.

Heat is a natural preparation for cold. The application of heat to the surface vessels is a physiological stimulus whereby the centers are aroused to activity, and the thermic nerves rendered in the highest degree capable of responding to the reflex stimulus which the cold applications communicate to the skin, and through it to the nerve centers.

1171 4. While it is true that the patient *seems* to bear the cold bath better when alcohol is administered, this fact is the strongest kind of argument against the use of alcohol in this connection; for the only way in which alcohol can diminish the shock or lessen the discomfort of the patient in the application of cold water, is by lessening nervous sensibility through its narcotic effect; and just so far as this is accomplished, the effect of the bath is neutralized and its efficacy lessened, for the reason that the whole effect of the cold application depends upon the thermic impression made upon the skin. Thus, *so far as this impression is diminished, the effect of the bath itself is diminished; the combination of such antagonistic measures as alcohol and cold water can not be regarded otherwise than in the highest degree unphilosophical, and from the standpoint of rational therapeutics, absurd.* The practice is one which appeals strongly not only to the prejudices of the laity, but to the predilections of quite too large a proportion of physicians; but not one scientific fact or even plausible apology can be brought forward in support of this practice.

After twenty-five years of extended experience in the use of baths of all temperatures, the author feels justified in taking a most uncompromising stand against the use of alcohol in any form in connection with hydriatic procedures. If there are any two agencies in the world which are absolutely irreconcilable, they are alcohol and water. Their application in conjunction gives, not the sum of two co-operating or complementing agents, but the difference between two neutralizing and antagonistic measures. In any case in which alcohol may seem to be indicated as a means of preparing the

patient for the application of a cold bath, heat may be employed to far better advantage, with the certainty of better results, and with absolute physiological consistency.

It is important that a further word be said regarding the employment of the cold bath. The idea that no very decided effects can be obtained from the use of water without resorting to a very low temperature, is certainly an error. The utility of the cold and the very cold bath has certainly been very greatly overrated. In France, Beni-Barde and others have long been contending for the employment of less heroic measures in hydrotherapy, and the more general recognition of the utility of wider ranges of temperatures for hydriatric applications.

A long experience in the practical use of hydrotherapy in the treatment of all classes of ailments, acute and chronic, has convinced the author that very cold general applications, especially if prolonged, are rarely needed, and that far better effects can be obtained by the use of temperatures which do not occasion the patient so much discomfort nor give rise to such apprehension as to constitute a nervous shock either to him or to his friends. The author has never found it necessary to exclude the patient's friends from witnessing any treatment applied because of the alarming or distressing symptoms occasioned by it, and considers that it is entirely unnecessary that any such treatment be employed. Indeed, a measure so violent in character that constant vigilance must be employed to prevent collapse or heart failure can not be regarded as safe to be commended for general use. Putting a patient into a very cold bath and keeping him there until his teeth chatter and there is painful shivering with perhaps cyanotic skin, is a measure which would better be relinquished for other safer and quite as potent procedures, which the science of hydrotherapy is abundantly able to supply.

It is true that by constant rubbing of the patient during the bath and by the strictest attention to the pulse, the color of the surface, and the condition in general, any serious

effects from cold applications of water may generally be avoided; but it must be considered that if the desired results can be obtained by the employment of less violent measures, they are certainly to be preferred.

1172 In this connection it should be mentioned that Jacques, of France, reported, in 1839, 313 typhoid fever cases, with only four deaths, treated by means of the cold enema, cold water drinking, and the cold abdominal compress changed every 10 to 30 minutes, while 349 cases treated at the same period by ordinary methods gave a mortality of 91 deaths,* a statistical showing which is scarcely outdone by the most favorable results reported for the Brand treatment.

Scientific therapeutics gives no countenance to routine methods in the treatment of any malady, whether by the use of water or medicinal agents, and the author feels certain that a better acquaintance with the versatile resources of hydrotherapy will lead many practitioners who have regarded cold baths as almost the sole method to be employed in the treatment of infectious fevers, to adopt a much more comprehensive hydriatic armamentarium.

1173 The following excellent suggestions concerning the hydriatic treatment of fevers are from Winternitz, the highest living authority on all subjects pertaining to hydrotherapy:—

1. Give the first bath at a temperature of 75° to 85°, diminishing the temperature of each bath one degree until 65° is reached.

2. During the bath pour over the head and spine water at a temperature two to five degrees lower than the water of the bath. The effect of this will be not only to cool the head but also the bath, and thus secure better reaction.

3. The duration of the first bath should be 3 or 4 minutes. The time may be extended with succeeding baths until the duration is from 10 to 12 minutes. If the first bath is given at as high a temperature as 88°, the duration should be longer, as longer time is required for temperature reduction.

* Bernard, "Leçons sür la Chaleur Animale," Paris, 1876.

4. The number of baths should be three or four daily.

5. The abdominal compress should be worn during the night. It should not be too cold nor too frequently changed, to avoid excessive excitation of the nervous system. The temperature should be ordinarily about 60°, and the compress should be changed about once in 40 to 60 minutes.

6. When the maximum daily temperature begins to decline, the temperature of the bath should be raised to 84° to 88°.

7. Avoid too severe friction on account of excessive stimulating effects.

8. The patient should be left in the bath until the axillary temperature, as felt by the hand, is the same as that of the rest of the body. This is a good indicator of the effects of the bath in lowering temperature.

9. The patient should be immediately removed from the bath at the first symptom of secondary chill. If he is threatened with collapse, a very short bath should be administered every hour until the collapse is no longer threatened.

It is almost needless to add that the application of the cold bath or an equivalent hydric measure should begin at the earliest possible period in the disease, or as soon as decided febrile symptoms make their appearance, both in typhoid and other more infectious maladies, when not contraindicated.

The author employs the bath whenever the temperature reaches 101.5° F., repeating it as often as once in three hours if necessary. Natural and refreshing sleep should not be interrupted for the bath unless the temperature is high and rising rapidly; but the comatose sleep indicating profound intoxication may be interrupted with advantage by the administration of the bath, which will often be followed by normal refreshing sleep for an hour or more.

Contraindications.—Collapse, sub-normal temperature, inability to react, threatened pulmonary or intestinal hemorrhage, hematuria, shivering, sweating, old age, infancy.

The Brand bath is likewise contraindicated in the eruptive fevers, as smallpox and measles. In the author's opinion its use is unwise in *pneumonia*, and in other disorders in which intense inflammation is present in an important internal organ, as in acute *hepatitis*, *salpingitis*, *ovaritis*, *meningitis*, acute *gastritis*, *enteritis*, and especially in the various forms of *nephritis*, either acute or chronic.

THE SHALLOW BATH.

1174 In this procedure (Fig. 72) the patient is rubbed while sitting in a tub partially filled with water. The requisites are, a tub with four or six inches of water of the proper temperature, a sheet, two or three towels, and a large dipper.

Method.— The patient, having been properly prepared,— the feet warm, the general circulation well established by exercise or previous warming in bed or by a warm bath, the head protected by a towel wet with water at 60°,— seats himself in the tub with the legs extended, and immediately begins vigorous rubbing of his arms, chest, and abdomen, while the attendant rubs the back and sides with both hands for 20 seconds, then dips water from the tub and dashes it upon the back for 10 seconds, then rubs 20 seconds, then the patient lies down in the bath while the attendant rubs his legs for 10 seconds. This occupies just one minute. For a two-minute bath, the above is repeated; for a bath of three minutes, the procedure is repeated a third time.

At intervals of one minute the patient should lie down in the bath, so that the whole body except the head is submerged for 5 to 10 seconds, the attendant rubbing the legs vigorously in the meantime.

When employed for tonic effects, the temperature of the water should be 75° to 65°, and the length of the bath 1 to 3 minutes. For the reduction of temperature in febrile cases, the temperature should be 85° to 70°, and the duration 6 to 15 minutes.

Care must be taken to adjust the temperature of the bath

exactly right, for when the temperature is too high, the skin is left in an anemic, pale, and relaxed condition. If too low a temperature is used, excessive congestion of the internal viscera may be induced through weakness of the walls of the blood-vessels, which, being unable to contract with sufficient vigor to throw the blood back to the skin, reaction may fail, and the effects of the bath be spoiled, by exhaustion of the vasomotor centers through a too prolonged application.

The depth of the water in the shallow bath is ordinarily not more than six inches; if deeper, it interferes with the rubbing. When the depth of the water is sufficient to reach the umbilicus, the bath is termed a *half-bath*. The points in which the shallow bath differs from the half-bath are chiefly, (*a*) the longer continuance of the latter; (*b*) the rubbing may be dispensed with unless the temperature is low; (*c*) the temperature is usually cool, neutral, or hot.

The effects of the shallow bath are intensified and somewhat improved if two attendants are employed, one rubbing the legs while the other rubs the back and sides.

A useful mode of applying this bath is in combination with the immersion bath — the shallow bath at 70°, the immersion at 60°, the water having been previously prepared in two tubs at the temperatures indicated, and the patient warmed by the hot-blanket pack, the vapor bath, or the electric-light bath. The patient is first immersed for three to five seconds in the full bath, then placed in the shallow bath, which, having a temperature ten degrees higher, produces a warm and comfortable sensation. The patient feels no disposition to chill, and by the aid of rubbing he is rendered so comfortable that the bath may be continued for a considerably longer period than when administered without the preparation suggested.

A fairly vigorous patient can administer the shallow bath to himself, sitting in a tub containing a few inches of cold water, and applying the water to various parts by means

of a long towel folded lengthwise and dipped in water, one end being grasped by each hand, whereby the towel may be drawn back and forth in a sawing motion across the back and other portions of the trunk. It may be used in this manner daily as a hygienic measure with great benefit.

The *standing shallow* (Fig. 73) is a modification of the bath in which the patient stands in a tub containing water at 75° to 80°. The patient is rubbed by two attendants, one on each side. The water is poured over his spine, chest, and shoulders, at intervals of 15 or 20 seconds. In rubbing the legs, the attendant's hands are constantly dipped in the water, and very vigorous friction is applied, duration 1 to 3 minutes.

At the conclusion of the bath, a pailful of cold water (60° to 55°) is poured over the patient, thus insuring good reaction. He is then quickly dried and vigorously rubbed, after which he should engage in moderate exercise until good reaction is secured.

The standing shallow is a sort of transition from the dripping sheet to the douche. The best time for giving it is in the morning as the patient comes warm from the bed, unless it be preceded by a hot bath. It is necessary that it should be applied when the skin is well heated.

1175 **Physiological Effects.**— The term "half-bath," devised by Priessnitz, is really a misnomer, as in this procedure the application involves the whole surface of the body. It combines the effects of the rubbing wet sheet, the affusion, and the immersion bath, producing powerfully alterative and tonic effects by reason of the repeated and ever-varying thermic and mechanical impressions made upon the skin.

The cold shallow bath stands next to the douche in power and efficiency as a tonic hydriatic procedure. That the shallow powerfully stimulates metabolism was clearly shown by the experiments of Pospischil, who found the flow of respiratory air to be increased nearly 300 per cent. during the bath, while the respiratory quotient remained the same; viz., 67. The favorable influence of this bath upon the general

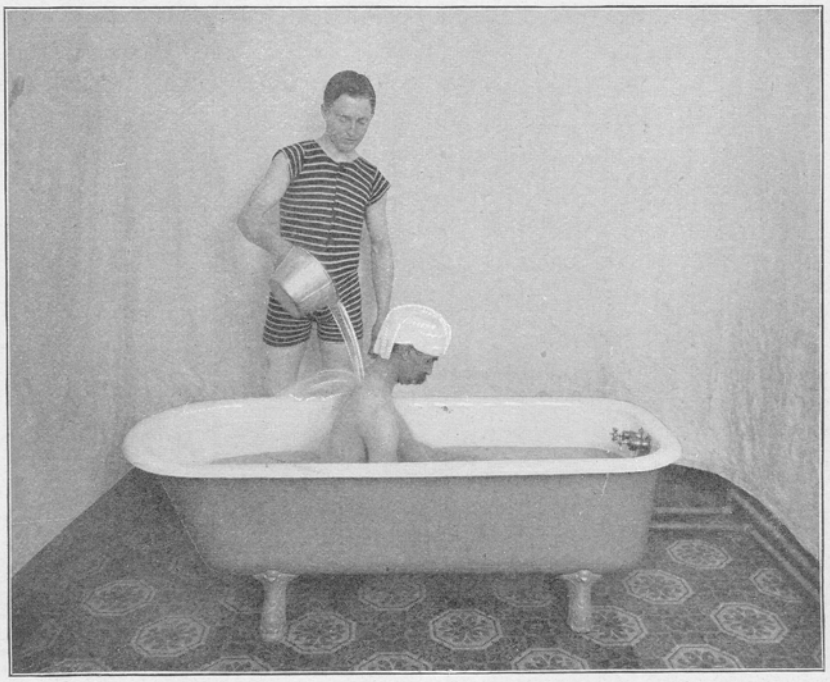


FIG. 72 (a). SHALLOW BATH — First Step (p. 594).

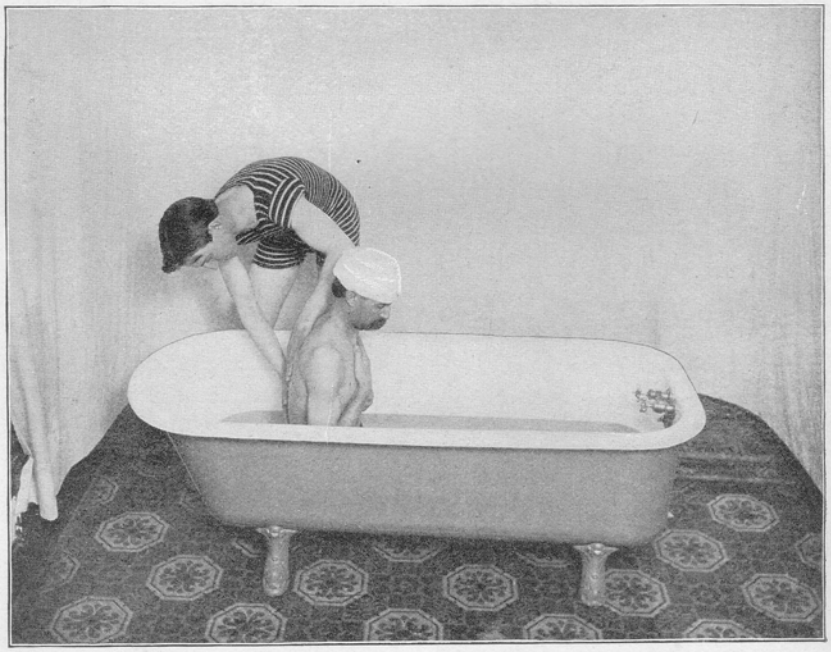


FIG. 72 (b). SHALLOW BATH — Second Step (p. 594).

condition of the patient and its power to increase vital resistance is clearly indicated by its effect in increasing muscular capacity, as has been repeatedly and clearly shown (Exp. 59).

Employed at a temperature of 80° to 85°, the shallow or half-bath is a quieting or sedative measure. The higher the temperature, the more vigorous the rubbing necessary to produce good circulatory reaction, as the intensity of the thermic impression is lessened.

Therapeutic Applications.— The shallow bath is one of the most generally useful of all hydriatric procedures. It may be used as a substitute for the douche when the latter is not available, and when a procedure less powerful than the douche is desirable, though essentially the same results may be obtained by increasing the length of the application and the frequency of its repetition. **1176**

The impact of cold water upon the skin, the thermic impression, together with the strong friction applied by the attendants, and the exertion made by the patient in rubbing himself, together constitute a powerful combination of potent factors for dilating the surface vessels, and thus antagonizing the *anemia of the skin* present in the vast majority of *chronic diseases* and in most *infectious fevers* as a result of the toxic influence of the retained excretions and the specific poisons of bacterial origin.

The temperature of the shallow bath, when administered for anemia, should ordinarily be about 75° to 60°. The application should be short (1 to 2 min.). For very feeble and irritable patients, the duration of the bath at first application should be not more than from 15 to 30 seconds, a simple dip in the cold water.

The bath may be usefully employed in *anemia*, in *organic affections* of the *spine*, as *chronic myelitis*, *meningitis* with *exudate*, and *ataxia* with *paralysis* but without marked pain. The temperature of the application in such cases should be 70° to 80° and the duration 6 to 10 minutes.

The shallow bath may be used not only as a principal pro-

cedure, but also as a tonic measure following a sweating application. It is much better tolerated than the douche by persons suffering from *cardiac troubles* and *asthmatic affections*. It may also be employed in place of the Brand bath as a means of *lowering temperature* in patients whose temperature is not very high and who are not very weak. When the antipyretic effect is desired, it is wise to introduce the principle of graduation, by beginning the bath with a temperature of 92° to 95° and lowering it by pouring water upon the patient and lowering the temperature of each pailful until 70° to 75° is reached. The patient must be rubbed vigorously enough to prevent chilling. If severe chill occurs, he should be removed from the bath at once, rubbed dry, and put to bed, wrapped in warm blankets.

The shallow bath is an excellent means of antidoting the depressing effects of heat after a prolonged spoliative application, as the electric-light bath or the vapor bath employed in cases of obesity, the sweating pack, or any other prolonged heating process which leaves the patient in a depressed condition. For this purpose it answers very satisfactorily as a substitute for the douche, and is of great service in cases in which the latter is contraindicated, or when a douche apparatus is not accessible.

The shallow bath is an excellent bath for use in neurasthenia, especially *gastric neurasthenia*, also in *hypopepsia*, *chronic constipation*, *diabetes*, *uric acid diathesis*, and a large class of disorders due to uric acid accumulation, when neuralgia and local inflammatory processes are not present to any marked extent.

Röhrig has shown that a considerable increase of perspiration causes constipation, a result frequently noted in hydriatic establishments in patients who are taking a course of sweating baths for the reduction of flesh, or other spoliative or eliminative purposes. The shallow bath is of special service in these cases as a means of counteracting the constipating effect of the sweating processes, as well as in ordinary cases

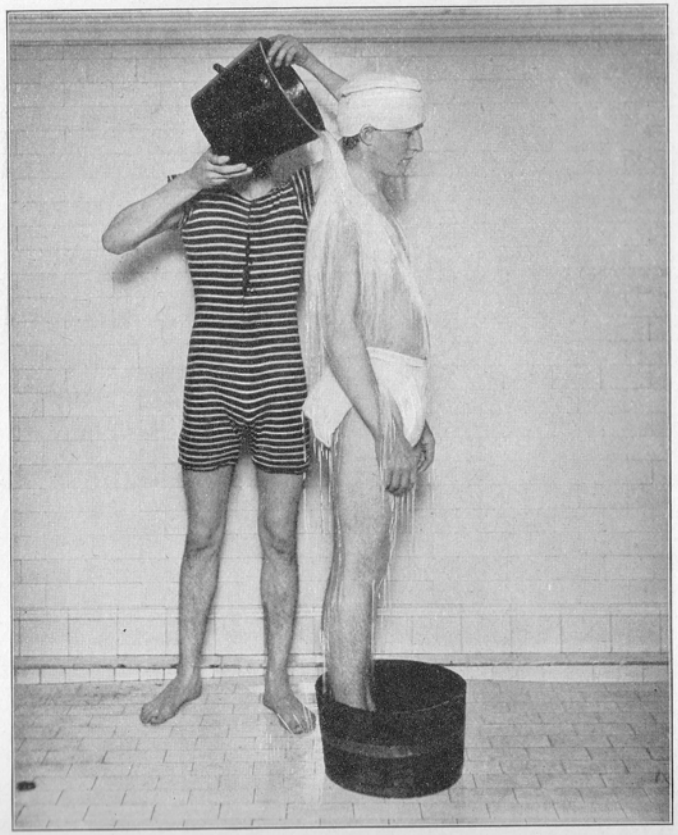


FIG. 73. (*a*) STANDING SHALLOW — First step (p. 596).

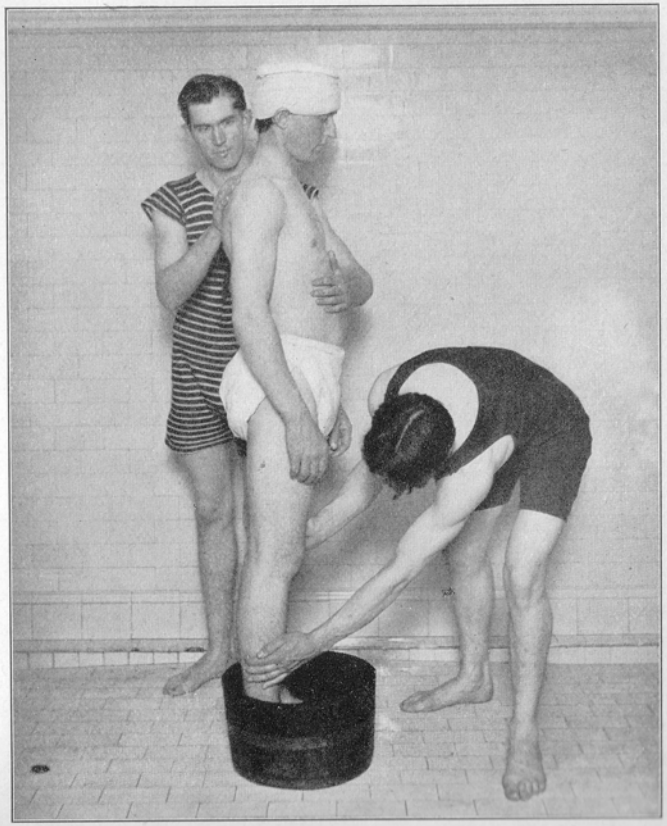


FIG. 73. (*b*) STANDING SHALLOW (p. 596).

of constipation in which the disorder is the result of deficient intestinal secretion. This effect must of course be encouraged by the copious drinking of cool or cold water at the proper hours (**1375**).

When employed for the relief of constipation or congestion of the liver or spleen, the water should be dashed upon the umbilical region or upon the surface overlying the liver or the spleen as may be indicated.

In Germany the shallow bath is much used as a method of preventing threatened chill in *intermittent malarial fever*. The author can testify to its merits as a means of aborting the malarial paroxysm, but he prefers to precede the application by a preliminary heating by means of a hot immersion, a hot-blanket pack, an electric-light bath, a vapor bath, or a vapor douche. When given for preventing the malarial chill, the bath should be very short and very vigorous, duration not more than 30 to 60 seconds. The patient should be immediately afterward wrapped in warm woolen blankets and surrounded with bags or bottles filled with hot water or other means of heating, and kept in bed until two hours after the time of the expected chill has passed.

The *hot* half-bath produces powerful revulsive and anal- **1177**
gesic effects in relieving pain. The shallow bath is seldom employed except for cold applications, but the hot shallow bath may be used in place of the hot sitz for the relief of *pelvic pain*, also for the relief of *sciatic* and *crural neuralgia*, and in some cases of *rheumatic pains* affecting the joints of the legs. It allows a better position of the limbs than the sitz bath, the circulation through them being less interfered with than when they are flexed, as in the sitz bath, and pressure upon great nerve trunks is avoided.

Contraindications.— The shallow bath is contraindicated **1178**
in cases of chronic congestion of the heart, brain, or spinal cord. With great care it may be used in *pneumonia* and *pleurisy*, but it is not needed in these disorders, and may better be avoided. Its use is contraindicated in fever cases compli-

cated with *myocarditis*, in *perforation*, *collapse*, *peritonitis*, and *hemorrhage* from injury to the vessels, also in acute *pelvic inflammation* or congestion, in all *suppurating processes* in the pelvis, in cases of *ovarian neuralgia* and neuralgia of the *sciatic nerve*. Neither should it be used in cases of *menorrhagia* or *profuse menstruation* or *metrorrhagia* from *bleeding fibroids* or *cancer*. It must be sedulously avoided in all forms of acute inflammation when deeply seated, as in *cystitis*, *enteritis*, *gastritis*, *nephritis*, *myelitis*, or *meningitis*, *prostatitis*, *ovaritis*, and *salpingitis*.

THE WET-SHEET PACK.

1179 This extremely useful and widely applicable hydriatic procedure, generally accredited to Priessnitz, was invented and first used by Lucas, in 1750. It consists in enveloping the body with a wet sheet, and preventing evaporation by careful protection with dry wrappings.

Requisites.— One large double blanket, one single blanket, two large sheets, one of which should be linen, a large linen towel, two or three gallons of water at a temperature of 60° to 70°. Water at a higher or lower temperature may be used when indicated, but is seldom required.

Method.— The pack may be applied in various ways, but the following method, which is employed by Winternitz, and was kindly demonstrated to the author by Dr. Strasser, assistant to Professor Winternitz, and lecturer at the Polyclinic in Vienna, is the most satisfactory: —

1. A sheet is folded once lengthwise, and laid across a couch near its head. The upper edge of the sheet should cover the lower third of a thin cotton or hair pillow placed at the head of the couch (Fig. 74).

2. Next, the double blanket is spread out, and placed across the couch so that one end hangs over the side opposite the attendant about two feet, the upper edge falling about two inches below the upper edge of the dry sheet (Fig. 75).

3. The linen sheet should now be wrung out by two persons' grasping the sheet at each end and twisting it in opposite directions until it is as dry as possible. The sheet is then spread out upon the blanket, the lower end falling an inch or two below the upper edge of the blanket (Fig. 76).

4. The patient lies down upon the sheet in such a way that the upper edge of the wet sheet projects three inches above the shoulders.

5. The patient raises both arms above his head while the attendants draw one side of the sheet across the body, turning it well up under the arms and tucking it in closely all along the side of the body. From the hips down, the edge of the sheet is tucked snugly around the leg of the corresponding side, leaving the other leg uncovered (Fig. 77). The patient lowers his arms and holds them close by his side while the other side of the sheet is passed over and tucked in. A fold is made in the sheet over each shoulder so as to make it fit the neck closely, care being taken not to constrict the vessels. The body is thus completely and closely enveloped by the sheet (Fig. 78).

6. The farther edge of the blanket is now drawn across the patient and tucked under the shoulder, the side, and around the legs, with great care. A fold is made over the farther shoulder, so as to make the blanket fit closely about the neck (Fig. 79).

7. The attendant now seizes the long end of the blanket, and pulls upon it in such a way as to bring the coverings in close contact with the body everywhere. The loose end is then thrown over and tucked around the patient, being wound about him two or more times like a winding-sheet. He is thus enveloped like a mummy (Fig. 80).

8. The blanket is next doubled under at the foot, and the dry sheet at the head is brought around with a neat fold over each shoulder, and tucked under the shoulders so as to protect the skin of the face and neck from contact with the blanket, and completely to exclude the air (Fig. 81).

9. For additional warmth, a woolen blanket is folded once, laid lengthwise upon the patient, and tucked under the shoulders and sides and about the legs. Two or more blankets may be applied at first, if necessary, one or more to be removed later.

When the pack is administered in this way, the patient will rarely complain of long delay in "warming up." Chill in the pack is usually due to the fact that at some points the wet sheet is not in perfect contact with the surface, and as a result, evaporation takes place with cooling, instead of accumulation of heat and vigorous reaction. The cooling effect thus started in small areas extends to the whole surface, and the patient is made exceedingly uncomfortable. But when the cold sheet is brought everywhere in close contact with the skin, reaction occurs immediately, and the disagreeable effects resulting from prolonged chilling are avoided.

In cases of very feeble or very nervous persons, one or both arms may be left out of the wet sheet, but should be included in the blanket, to avoid chilling.

Care should be taken to see that the patient's feet and the whole surface of the body are warm when the pack is applied. If the feet do not warm up readily in the pack, they may be left out at the first application, and until reaction is improved.

Kussmaul recommends the wet-sheet pack in acute nephritis. When used for this purpose, it should be applied immediately after a vigorous heating of the skin by means of the hot-blanket pack or short hot immersion bath, that reaction may take place immediately. The sheet should be wrung very dry, and the patient should be well and very carefully enveloped, and allowed to sweat freely.

Rendu prefers the wet-sheet pack to the Brand bath as a therapeutic measure in acute febrile disorders, not only because it aids the elimination of the toxins present in the disease, but because of its quieting effects upon the central nervous system, while it at the same time develops vital resistance.*

* *Revue d'Hygiene Therapeutique*, June, 1893, p. 164.

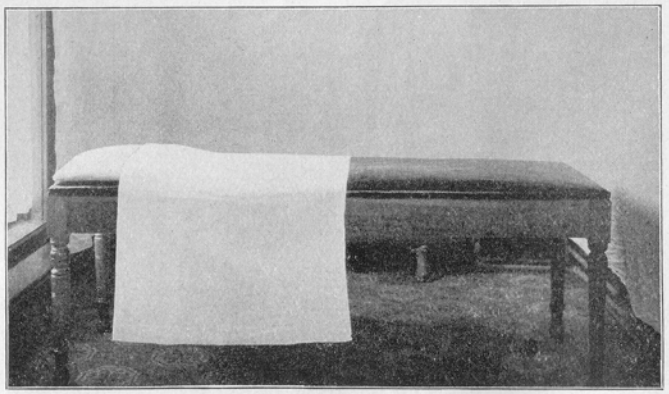


FIG. 74. WET-SHEET PACK — First Step (p. 601).

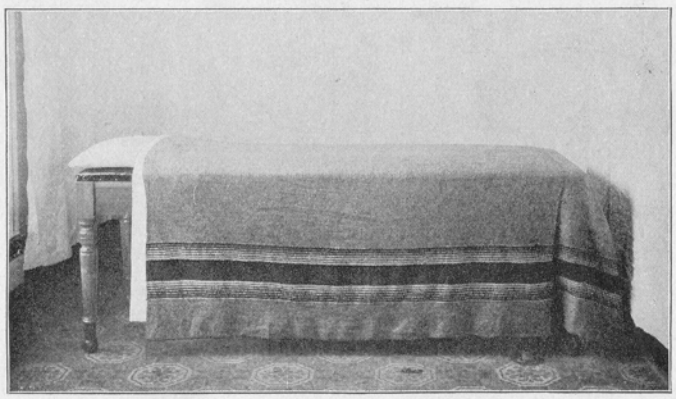


FIG. 75. WET-SHEET PACK — Second Step (p. 601).

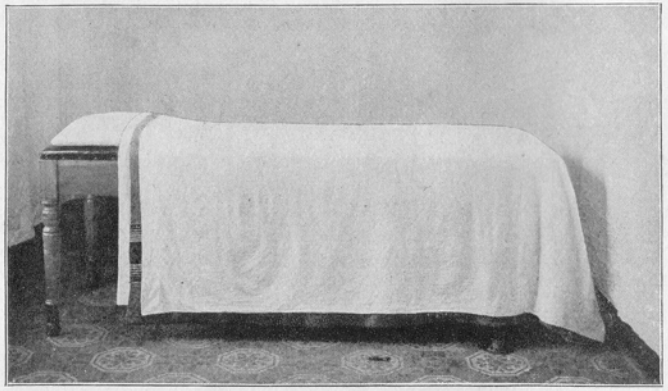


FIG. 76. WET-SHEET PACK — Third Step (p. 601).

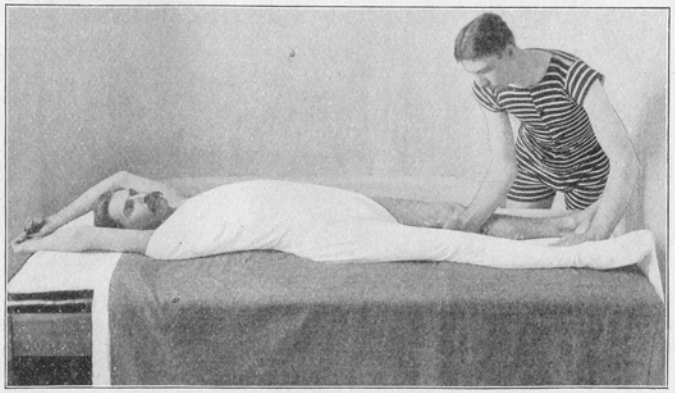


FIG. 77. WET-SHEET PACK — Fourth Step (p. 601).

Rendu* also especially praises the pack as a measure for the treatment of pneumonia, because of its value as a means of preventing cardiac failure and collapse.

It is less disturbing to the patient, much more convenient to use, does not require a bath-tub, which is not always ready at hand; hence can be used anywhere, and may be graduated to any degree of intensity required.

The cold wet-sheet pack employed in the manner directed has another advantage over the cold bath in that its effects are more durable, being somewhat slowly developed.

Winternitz has clearly shown that the cooling pack is much more effective as a means of reducing temperature than the Brand bath, the gradual lowering of temperature being more decided and more durable than after the cold bath.

In the use of the wet-sheet pack as an antipyretic, it will be observed that the sheet is warmed up more slowly with each successive application; consequently, the duration may be increased from three to five minutes at each successive renewal. The sheet need be changed only when it is shown by actual examination to have acquired nearly the temperature of the body. So long as the temperature of the sheet is lower than that of the body, a good cooling action is taking place.

In the dripping sheet, shallow bath, and many other hydriatic procedures, reaction is increased by friction; but in the wet-sheet pack, friction can not be employed; as a substitute, in cases in which reaction does not readily set in, warm bottles may be placed at the feet and sides of the patient. This is undesirable, however, as a routine method; the bottles should be used only when actually necessary. A better plan is to press and rub the limbs outside the coverings.

The head should be thoroughly cooled by wetting the scalp, face, and neck with cold water before the patient goes into the pack, and a towel, or better, a cheese-cloth napkin, saturated with cold water should be placed upon the face and

* Rendu, *Journal de Med. et de Chirurgie Pratiques*, 1893, p. 209.

wrapped around the head, or the neck, if the patient will not permit the wetting of the hair. The towel should be changed at intervals of 10 to 15 minutes during the pack. The duration of the pack will depend upon the effect desired. For tonic effects the usual length of the application should be 20 minutes, or until the patient feels a general glow induced by the return of the blood to the skin and a sensation of comfort and well-being, which marks the beginning of reaction. If *exciting* or *heating* effects are desired, the patient should remain in the pack until perspiration begins. If the effect desired is *elimination*, then the pack may be continued for one to two hours or even longer, or so long as sweating continues, if the strength of the patient will permit. If a sufficient supply of blankets is not at hand, the accumulation of heat may be assisted by enveloping the patient in a rubber sheet outside the other wrappings. When this plan is adopted, the rubber sheet must be spread upon the bed or couch between the folded dry sheet and the blanket.

1180 **Physiological Effects.**— When the wet sheet first comes in contact with the surface of the body, a decidedly chilly sensation is produced, which lasts for 5 to 20 minutes, when a febrile process is not present; when the skin is hot and the temperature high, no disagreeable sensation is produced. As reaction sets in, the chilliness disappears, and gives place to a sensation of comfort and well-being. Nervousness, when present before the application, is somewhat aggravated during the first few minutes after the patient enters the pack, but soon disappears, and a sensation of delicious calm pervades the system, and in many cases the patient falls asleep.

Schüller, in his experiments upon rabbits, noticed that the vessels of the brain, which were dilated at first, as soon as the general reaction set in, began to contract, the brain substance steadily shrinking, while the dura bulged more and more through the accumulation of lymph. This condition is one most favorable for the production of sleep and repair of the brain structure. It is the condition present during

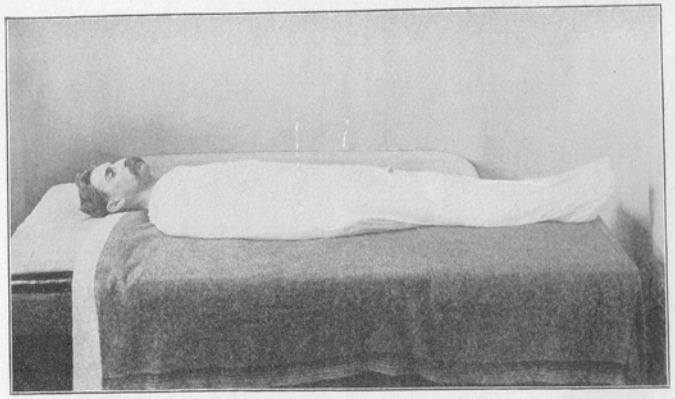


FIG. 78. WET-SHEET PACK — Fifth Step (p. 601).

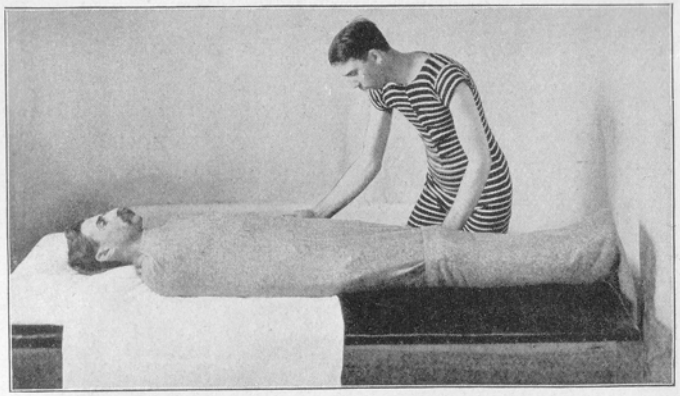


FIG. 79. WET-SHEET PACK — Sixth Step (p. 601).

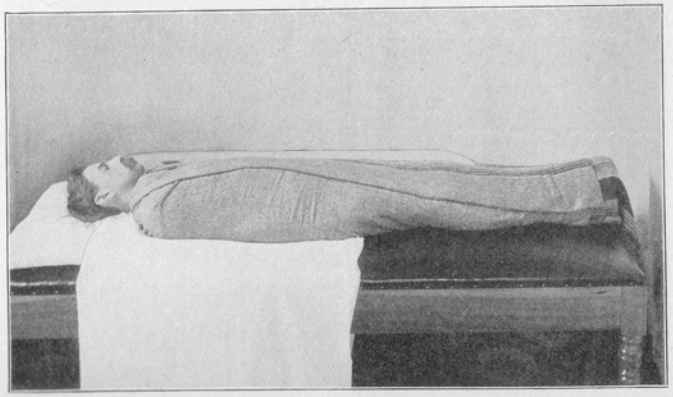


FIG. 80. WET-SHEET PACK — Seventh Step (p. 601).

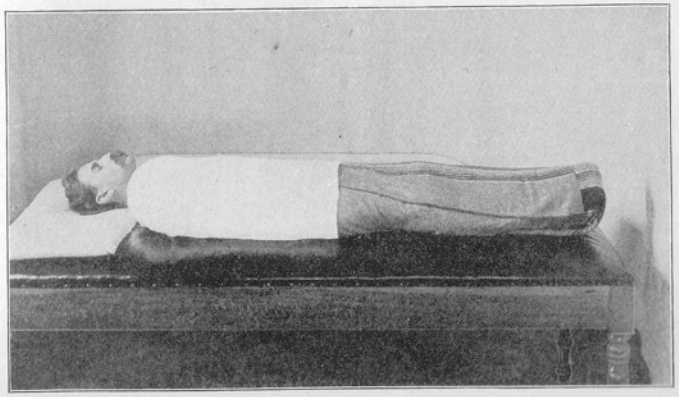


FIG. 81. WET-SHEET PACK — Eighth Step, Application Completed (p. 601).

physiological sleep. Later, as the heat thrown off by the skin, which is greatly increased in amount by the dilatation of the surface vessels, warms up the wet sheet, the heat accumulates in the covering about the patient, and the temperature of the blood is raised sufficiently to induce general perspiration, the beginning of which is indicated by the moistening of the brow.

If the pack is continued for several hours, perspiration will continue, growing more and more profuse for one or two hours, and possibly longer in some cases, but sooner or later the activity of the sweat-glands will cease, their energy seeming to be exhausted. Sweating may be increased and prolonged by making the patient drink freely.

From the foregoing it will be recognized that the effects produced by the wet-sheet pack are exceedingly varied, a series of distinct groups of effects presenting themselves in regular succession. The actual effects produced will depend, then, upon the length of the application, or at least upon the degree of development reached. In some persons the march of the phenomena is more rapid than in others.

The time occupied in the development of the various phases of the procedure may be divided into four periods, which are characterized as follows: (1) Cooling or antipyretic, (2) neutral, (3) superheating, (4) sweating. These several periods are the natural result of the progressive accumulation of heat, for which provision is made by the close wrapping of the patient, and which necessitates the exercise of very great care in so adjusting the wrappings about the neck and the feet as to prevent the escape of the warm air and vapor developed by the heat of the body. The amount of heat generated by a person of average size in the course of an hour is very considerable, amounting to 450 heat units, or sufficient to raise 45 pounds of water ten degrees in temperature, or to elevate the temperature of the entire body of a patient weighing 150 pounds three degrees, if this heat should be all retained. The greater part of this thermic energy is ex-

pended in warming up the wet sheet and its coverings and in evaporating the moisture of the sheet. As soon as the coverings are raised to the temperature of the body, the heat begins to accumulate ; and as soon as it has accumulated sufficiently to elevate the temperature of the blood .7°, perspiration begins (Bouchard).

1181 During the *first* or *cooling* stage, heat is rapidly abstracted from the body, and powerful thermic reaction is induced. Circulatory reaction is slow, for the reason that there are no mechanical aids to dilatation of the surface vessels, such as the friction of the rubbing sheet and the shallow bath, and the percussion effects of the douche. The pack in this respect differs from nearly all other general hydriatic procedures. The body is left wholly to its own resources, hence the importance of the proper preparation of the patient before the bath, so that his powers of calorification and circulatory reaction may be equal to the demand made upon them. This is the reason why heating processes of some sort—exercise, vigorous rubbing, or the hot bath—are almost indispensable as a preparation for the cold wet-sheet pack, unless the patient is in a febrile state. Priessnitz, who, though without scientific education, was certainly blessed with remarkably acute intuition, usually administered the wet-sheet pack before the patient arose in the morning, while the skin was warm with the heat accumulated during the night.

The effects produced during the cooling or refrigerative stage of the pack are intensely alterative in character. All the organic processes are excited in connection with the intense thermic reaction induced, and an exceedingly powerful appeal is made to every nerve center in the body. The whole system rallies to resist the invasion of the depressing agent, cold; and if the pack is arrested during or at the end of this stage, or when reaction begins, the general effect produced will be tonic, and will be essentially the same as that of a cold bath of the same temperature, provided, of course, that reaction is fully developed by exercise, rubbing,

or other means, after the conclusion of the process. If the process is arrested as soon as the reaction begins, that is, at the end of 8 to 12 minutes, a freshly cooled sheet being applied, the effect is powerfully antithermic and antiebrile.

The *second*, or *neutral*, stage of the pack begins when the **1182** temperature of the wrappings and the warm moist air surrounding the patient reaches a point approximating that of the body, or 92°. The effect during this period is essentially the same as that of the neutral bath. It is quieting, calmative, and productive of a disposition to sleep. Renal activity is excited. When the pack is ended with this period, no other effects are produced.

When prolonged to the *third* period, that of *superheating*, **1183** the body temperature is slightly elevated as heat elimination is more and more interfered with, and the excitant effects of a temperature above 98° make their appearance, the face becoming flushed, and the brain intensely congested, unless the head is cooled by a cold compress to the head and face, frequently renewed. When the pack is prolonged, and perspiration does not promptly make its appearance, the patient experiences the same weakness and languor which result from a prolonged bath at 100° to 102°.

As excitation resulting from the accumulation of heat increases still further, the skin becomes more and more active, until the perspiratory glands are so excited that visible perspiration appears upon the brow, marking the beginning of the *fourth* stage, that of *excitation*, or the *sweating* stage. During this stage a prodigious amount of vital work is performed, not only by the skin, but by the nerve centers and internal viscera associated with it. Every cell in the body is stimulated to increased activity by the elevation of temperature and the powerful thermic impressions made upon the whole cutaneous surface. Under the influence of the elevated temperature, the elimination and destruction of tissue toxins take place with augmented rapidity; the heart beat is accel-

erated, the activity of the peripheral heart is likewise increased, and the movement of blood in the vessels is augmented, resulting in increased activity of all the eliminative processes; there is increased oxidation of albumin, and increased elimination as well as more perfect oxidation of nitrogenous wastes. Thus the sweating pack is a powerful spoliative or reducing measure.

It should be noted that the pack may not only be arrested at the end of the several stages, but that any stage may be prolonged for almost any desired length of time. For example, the first stage may be prolonged either by removing a portion of the covers so as to permit evaporation as the sheet is warmed, or by renewing the sheet, as has been described.

Instead of the long woolen blanket applied like a winding-sheet, the author prefers for the *cooling* pack two single blankets, which are laid across the couch in such a way that the patient lies in the center. In wrapping the patient, the two angles are each brought across and disposed in like manner. An extra folded blanket may be added for warmth. This plan facilitates renewal of the sheet.

The second, or neutral, stage may be prolonged by withdrawing most of the covering as soon as reaction has well set in, so that the loss of heat by evaporation will not be interfered with sufficiently to cause the temperature to rise above that of the body. Care must be taken constantly, however to see that the body is uniformly protected; the sheet must not be loosened so as to allow local air currents to be established, as this would produce local chilling and effects which might in some cases be really serious.

The third stage may be prolonged by withdrawing a small portion of the covers, as by taking off the outside blanket and by bathing the head and face almost continually with cold water so as to produce a slight refrigerant effect, by cooling the brain. A cold towel may also be wrapped about the neck. Thus the extreme excitant effects of the pack may be checked and sweating delayed.

The fourth, or sweating, stage may be prolonged almost indefinitely by making the patient drink every half hour a glassful of water, either hot or cold, or some suitable beverage prepared with water and fruit-juice. The head should not be cooled excessively, and extra blankets may be applied, if necessary to increase accumulation of heat. In cases in which the skin is very inactive, so that perspiration is long delayed, several hot-water bottles may be placed about the patient inside the dry blankets, and he may be made to drink copiously of hot water or hot lemonade.

Therapeutic Applications.— From the foregoing it will be **1184** readily seen that the wet-sheet pack is an exceedingly useful hydriatic procedure, and that it is capable of ready adaptation to a great variety of conditions. If a *tonic effect* is desired, the pack may be interrupted soon after the beginning of the second stage, or when reaction is well established. Employed in this way, the pack may be made useful in a great variety of conditions; but it is far less valuable for securing tonic effects than the douche, the half-bath, the wet-sheet rub, and other procedures of briefer duration, and in which the thermic irritation is supplemented by the mechanical stimulus of friction, and the percussion effect of the douche.

The *tonic* pack is indicated in all forms of wasting disease, as in *anemia*, *tuberculosis*, *convalescence* from *fever*, and *chronic toxemia* connected with dyspepsia, as well as in *chronic disorders* of the *liver*, and especially in the *toxemia* of *chronic malarial infection*. Its value in the treatment of *infectious fevers* is largely due to its tonic effects.

The pack may be employed in many cases in which the shock of the cold bath could not be well borne by the patient. Employed for tonic effects, the wet-sheet pack, continued well into the second stage, is of great value in *anemia*, *chlorosis*, *diabetes*, *nervous dyspepsia*, *neurasthenia*, *scurvy*, *chronic gastritis*, *hypopepsia*, *constipation*, and *general paresis*. The tonic pack also renders most valuable service in the intervals of *intermittent* and *relapsing fever*.

1185 The *neutral* pack, that is, the wet-sheet pack, continued until the end of the second stage, is of much value in a great variety of cases, being especially useful in *insomnia*, *acute mania*, *melancholia*, *neurasthenia* with nervousness and depression, and in cases of *cerebral irritation* of whatever origin. The neutral pack is an excellent measure of treatment in the class of cases mentioned, since it is not only tranquilizing but tonic in its effects. The excitation resulting from the tonic effects of the first stage is calmed by the tranquilizing influence of the second period, which is terminated before the development of depressant effects, thus adapting this measure to the class of patients with whom purely tonic measures, such as the cold rubbing wet sheet and the douche, produce unpleasant effects by exaggerating symptoms due to irritability of the nerve centers.

Schüller's experiments showed the wet-sheet pack to be one of the most effective of all means for quieting the general nervous system, which it accomplishes by lessening the blood supply of the brain, slowing the respiration and heart beat, lessening the reflex irritability and activity of the cerebral ganglia, increasing the quantity of lymph in the brain, and thus supplying a condition essential for sleep.

The wet-sheet pack is of special service in the *insomnia* and *delirium* of *typhoid* and *typhus fevers*, and in *pneumonia*. The author has more than once seen a delirious fever patient who had not slept for several days, while in a pack fall into a tranquil slumber from which he awoke refreshed and quiet.

The neutral pack is of almost equal service in the treatment of *epilepsy*, *chorea*, and *tetany*.

1186 The *heating* pack, that is, the cold wet-sheet pack continued until the end of the third stage, is perhaps most useful as a preparation for tonic applications, such as the shallow bath, the cold douche, the pail douche, the wet-sheet rub, and the cold immersion in cases in which powerful derivative measures are required. If interrupted before the exciting effects are pronounced, it may be usefully employed in *cerebral*

congestion, *hepatic* and *splenic congestions* from chronic malarial infection, *constipation* accompanied by *hemorrhoids*, *abdominal dropsy*, and as a means of developing the eruption in eruptive fevers. For the last-named purpose this procedure is unexcelled, producing powerful cutaneous stimulation.

The pack is also of especial service in the early stage of *eruptive fevers*, when the skin is hot, dry, and congested, and before the eruption has fully appeared. It not only relieves the patient's discomfort by lessening the cutaneous congestion, but evidently aids, as above pointed out, in developing the eruption. Hence its value in measles, scarlet fever, and smallpox.

The *sweating* pack, or fourth stage of the process, is a **1187** highly spoliative and eliminative measure.

The efficiency of the wet-sheet pack as a means of stimulating the elimination of poisons is well shown in persons addicted to the tobacco habit. In such cases the sheet often smells strongly of nicotine after having been wrapped about the patient for an hour, even a week or two after he has discontinued the use of the weed.

Indeed, the wet-sheet pack is one of the most useful of hydrotherapeutic procedures, as it combines at once very powerful effects, great convenience and universality of application, and remarkable flexibility for modification to suit different pathological conditions. It is a powerful means of influencing the general nutrition through its effects upon the sympathetic nervous system, and through it upon all the processes of secretion, circulation, assimilation, and excretion. While less perturbing than the douche, it is still capable of producing in a more gradual, gentle, but none the less effective manner, most profound impressions upon the whole vital economy.

In the absence of more ready means of heating the skin, the wet-sheet pack, continued until the skin becomes well warmed, or until very gentle perspiration shows upon the

face, is an excellent preparation for the cold douche or other cold application. The electric-light bath, the vapor bath, fomentations to the spine, the hot-air bath, and other heating measures are, however, generally more convenient than the wet-sheet pack as a means of accumulating heat in the skin; and there is danger, especially in the case of feeble patients, that the prolonged character of the application may excessively fatigue the patient or exhaust the nerve centers.

One of the characteristic physiological effects of the wet-sheet pack is increased activity of the mucous membrane. This effect is produced only when the application is carried to the stage of reaction. Thus used, the pack is invaluable in cases of chronic constipation and hypopepsia. It is equally valuable in many cases of *chronic bronchitis*, with dry cough, and in *chronic pneumonia* and *pleurisy*.

By its *derivative* effect the wet-sheet pack removes visceral irritation and congestion, and its beneficent influence is indicated by the fact that the patient from day to day gains in power to warm the sheet, thus showing that his power to react is increasing, and that the blood is being strongly diverted toward the skin. When the visceral congestion and irritation are removed, as indicated by the disappearance of symptoms directly due to these conditions, the wet-sheet pack may be exchanged for a more highly tonic measure, as the shallow bath, or the cold or Scotch douche. As a derivative measure it is of great service in *intestinal catarrh*, *congestions* of the *spleen* and *liver*, and in *cerebral hyperemia*.

The leathery, dry, hide-bound skin of the chronic dyspeptic becomes clear, supple, and active under the influence of the wet-sheet pack employed tri-weekly, followed by oil rubbing. For the most rapid effects, the pack should, in these cases, be carried just to the point of beginning reaction; but perspiration should not be induced unless the patient has a considerable amount of flesh; and then great care must be taken to avoid too long continuance of the pack, as when thus used, it is a very exciting measure, and the majority of

patients suffering from chronic indigestion have but little recuperative power and small capacity for tissue production.

In *jaundice* the wet-sheet pack affords an excellent method for relieving the extreme itching and irritation which usually accompany this condition, at the same time aiding in the elimination of morbid elements from the blood. In these cases the pack may be carried to the point of slight perspiration, if irritation is not thereby induced. In cases in which the itching is very pronounced, care should be taken to avoid perspiration; the pack must terminate at the end of the neutral stage, which may be prolonged if desirable (page 608).

Contraindications and Precautions.— The cold wet-sheet 1188
pack can not be employed for patients whose vital resources are so small that they are unable to react without the aid of friction or other mechanical means. It must also be avoided in eruptive disorders of the skin, and in the exanthemata after the eruption occurs, being too strongly exciting to the skin.

It is possible to use the pack in many cases in which it would otherwise be contraindicated, by previously subjecting the patient to some mild heating procedure, as a short hot immersion bath (3 to 5 min., at 104° to 110° F.), the electric-light bath, fomentation to the spine, hot water drinking, a short hot sitz bath, or a hot blanket pack.

By the aid of special precautions the pack may be employed without difficulty in cases in which untoward effects might otherwise be produced. Parts that are sensitive to cold may be covered with a dry cloth. Parts requiring special protection are: the spine in spinal irritation; the chest in asthma; the heart when very excitable; sensitive surfaces in neuralgia; and in certain cases, the genitals.

For example, in cases of so-called spinal irritation or spinal neuralgia, in which the contact of cold water with the skin produces severe pain, the spine may be protected by a strip of flannel six or eight inches in width and of the proper length. This should be laid in the proper position on the sheet just before the patient lies down to be enveloped.

In asthmatics, in whom cold applications to the chest produce paroxysms of dyspnea, the chest should be protected by a piece of flannel of proper size and one thickness.

In cases accompanied by hyperesthesia of the skin covering the abdomen, similar precautions may be employed, the dry flannel being placed over the abdomen. If the feet do not react well, they may be left out of the sheet, and warmed by means of rubber bags or bottles filled with hot water, or other similar means, or by rubbing before the pack. It is not necessary that the feet be included in the pack in order to secure the general results desired.

When applying a cold pack in cases in which a nervous state of the heart or lungs exists, place a dry towel over the chest before wrapping the patient in the wet sheet.

In the case of very feeble patients, a training for the pack may be practiced, by beginning with a narrow trunk pack, daily extending it in both directions until the whole body is involved. Or, with very feeble patients, the treatment may be begun by placing a single towel wrung quite dry out of cold water over the front of the body, enveloping the whole body with blankets. The next day a wet towel to the back may be added, then one to each of the lower extremities, and later to the upper extremities, until finally the entire body may be enveloped in the sheet.

In the use of the wet-sheet pack, headache, nervousness, fainting, vertigo, indicate that the pack has been continued for too long a time, and the circulation has been unduly excited.

A curious phenomenon which sometimes accompanies the application of the wet-sheet pack, is the appearance of a rose color, accompanied by a fetid odor, and sometimes a mucilaginous secretion. The cause of this phenomenon is not fully explained, but may be due to bacterial action.

The majority of patients who are benefited by the pack fall asleep within a few moments after reaction begins. The patient may be allowed to sleep during the pack; but the

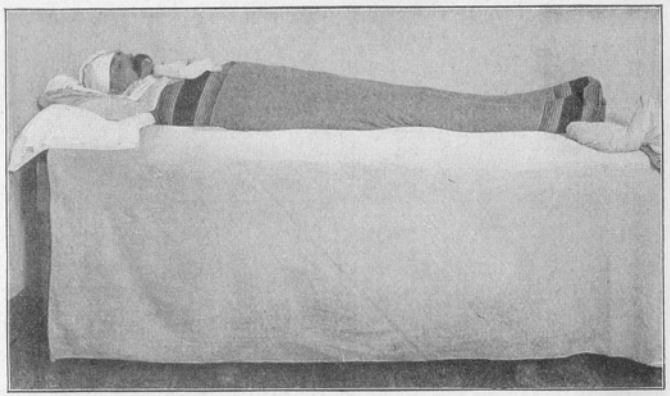


FIG. 82. METHOD OF PROTECTING SHOULDERS OF FEEBLE PATIENTS (p. 616).



FIG. 83. SHOWER PACK (p. 617).

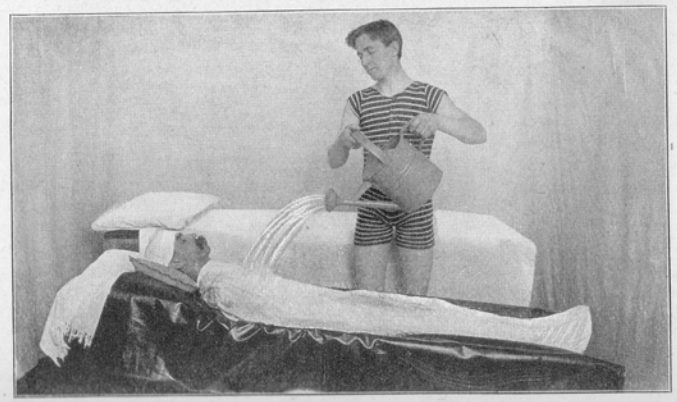


FIG. 84. SHOWER PACK (p. 618).

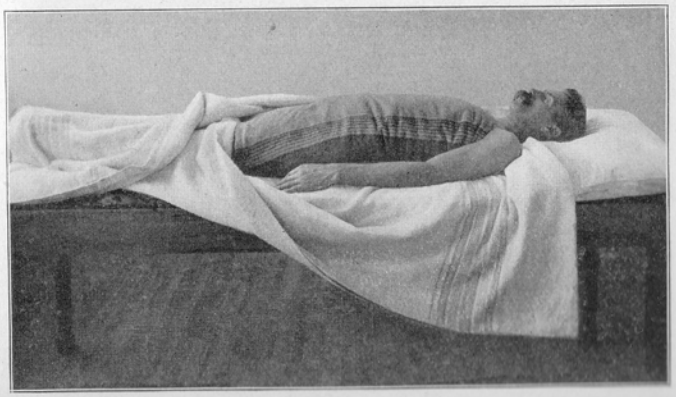


FIG. 85. HALF PACK (p. 622).

application should be terminated when the proper effects have been produced. Sometimes in cases of acute mania with insomnia, or even in ordinary cases of insomnia which do not yield to other measures, the patient may with advantage be allowed to remain in the pack for several hours if he continues to sleep, but care must be taken to remove a sufficient amount of the coverings so that he shall not be overheated, and also on the other hand equal care must be observed against chill. It is generally necessary to cover the legs and the feet somewhat more warmly than the trunk. The tendency to overheating may also be combated by cold applications to the head. If applications to the face and forehead are not sufficient, the scalp may be moistened. It is not generally necessary to use the ice-cap or ice-water. The head compress should be omitted when it causes chilliness.

A graphic proof of the tonic effect of the wet-sheet pack concluded at the first stage of the procedure is afforded by the ergograph of Mosso, which shows a decided increase in muscular capacity as the result of the tonic application of the pack (Exp. 60).

THE COOLING PACK.

If it is desired to employ the pack as an *antipyretic*, it 1189
should be applied in the ordinary way (page 608), but must be interrupted before the end of the first stage; that is, before the refrigerant effects are obliterated by the accumulation of heat. The procedure must be repeated as soon as the sheet is warmed by applying a sheet freshly wrung from water of the proper temperature. Any degree of antithermic effect desired being secured by repeating the renewal. To secure the most pronounced antithermic effects, water at 60° to 70° should be employed. There is no advantage in using water at a lower temperature. Colder water stimulates heat production to such an extent as to antagonize the effect desired. The sheet should be left very wet; and if the tem-

perature is high and the skin very hot, two sheets instead of one may be used, so as to prolong the refrigerant effect.

The patient should be covered with only two thicknesses of blanket, so as to allow slight cooling through a moderate amount of evaporation; but care should be taken to prevent the entrance of air about the neck so as to avoid undue chilling of this part, whereby congestion of the lungs and possibly acute bronchitis or even pneumonia may be produced. Fig. 82 shows a method of protecting the shoulders.

Rub the limbs vigorously for a few seconds after the application of each new sheet before wrapping the woolen blankets about the patient. This will ensure reaction and encourage heat elimination. When the patient's temperature is high and the skin very hot, it may be necessary to renew the wet sheet at the end of five or six minutes. The duration of each successive application is from five to eight minutes longer than the preceding. The first sheet may be applied at 60° to 65°, and each successive sheet 2° or 3° higher. The renewal of the wet sheet may be avoided by opening the wraps and rubbing the sheet with ice, continuing until the sheet is sufficiently cooled.

If there is prolonged chilling, or if the patient's teeth chatter, the woolen blanket should be opened, and the patient vigorously rubbed between the sheet and the blanket. As soon as the shivering ceases, he may be wrapped up again until he becomes warm. The cold wet-sheet pack managed in this way is an excellent substitute for the cold bath.

Therapeutic Applications.— The cooling pack is indicated in all cases of febrile disease, and especially in *typhoid fever*, *typhus*, *erysipelas*, *febricula*, *dengue*, *malarial fevers*, *yellow fever*, the *plague*, *acute bronchitis*, and *influenza*.

THE COLD SHOWER PACK.

1190 When antipyretic effects are desired, instead of removing the sheet from the patient for rewetting, the same results may be accomplished, though not quite so rapidly, by open-

ing the sheet and sprinkling the body as well as the sheet with cold water (Fig. 83). The patient should be made to turn first on one side and then on the other, so that the whole body may be exposed to the cold application. A better method still is to place the patient upon a cot covered with rubber cloth so arranged in relation to a tub placed at the foot of the cot that any surplus water may be caught as it runs off (Fig. 84). Water may be turned over the patient from a sprinkler or any convenient vessel. By this means the cooling effect of the sheet may be continued, and may be made almost as intense as the cold bath. The temperature employed should be from 60° to 65° F. If the patient does not well tolerate very cold water, a temperature of 70° to 80°, or even 85°, will be found efficient if the application is prolonged.

Nearly twenty-five years ago the author made use of this form of pack as an antithermic means in the treatment of some fifty cases of typhoid fever in an epidemic of this disease. Every case recovered, although the type of the disease was in several cases very grave.

Therapeutic Applications.— The practical applications of the shower pack are the same as those of the cooling pack (**1189**). It need only be added that the shower pack, being a measure which may be made almost as powerfully antipyretic as the Brand bath, is especially suited to cases in which the temperature is persistently high, and does not yield to more moderate measures.

Contraindications.— These are the same as those pointed out for the Brand bath.

THE SWEATING PACK.

1191 When it is desired to produce powerful eliminative effects by means of the wet-sheet pack, the application may be made in the manner already described (**1179**), with the exception that more covers are employed, to encourage reaction, and it is generally wise to place hot bags at the patient's feet and sides. He should take a glassful of hot water before the

pack, and two or three glasses while in the pack. In cases in which perspiration is not easily induced, the pack may be preceded by a hot bath for 3 or 4 minutes. The temperature of the bath should be from 105° to 110°. The patient's skin should be so well heated that he will anticipate the contact of the cold sheet with pleasure. There should not be the slightest delay between the hot bath and the cold sheet. The hot-blanket pack may be used in case of the hot bath when the latter is not convenient.

When it is desirable to prolong the perspiration, the patient may be removed from the wet-sheet pack after the activity of the skin is well established, to be at once wrapped in dry blankets surrounded by bottles or rubber bags filled with hot water. He should be induced to drink at intervals of 10 to 15 minutes a half glass of hot water or weak hot lemonade. Rubbing the limbs and trunk outside the wrappings will stimulate perspiration. The patient may increase heat production by contracting and relaxing the muscles without changing the position of the limbs.

Therapeutic Applications.— This procedure is one of the most powerful of spoliative and eliminative measures. It is invaluable in *jaundice*, *dropsy*, *syphilis*, and most other maladies in which eliminative effects are indicated. It may be employed with very great advantage in cases of *obesity*, *rheumatism*, *gout*, *dyspepsia*, *chronic toxemia*, *neurasthenia* with inactive skin, *chronic nephritis*, enfeebled chronic invalids whose habits have been sedentary, *alcoholics*, victims of the *tea* and *coffee habit*, and *tobacco users*, especially smokers, and in *malarial fever*, *catarrhal jaundice*, *septicemia*, *ascites*, *amyloid liver*, *Bell's palsy*, *acute* and *chronic myelitis*, *leptomeningitis*, *epilepsy*, *neuralgia*, *migraine*, *tetany*, and *Raynaud's disease*.

Any degree of depletion or eliminative effect desired may be produced by prolonging the sweating process.

A cold application should always follow the sweating pack. In rheumatism, neuralgia, Bright's disease, and feeble heart,

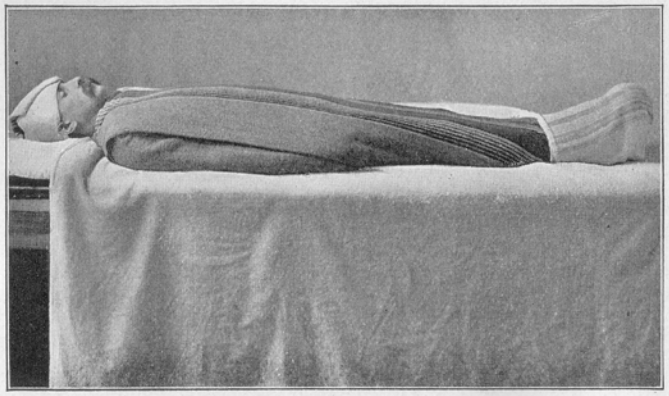


FIG. 86. HOT-BLANKET PACK (p. 623).

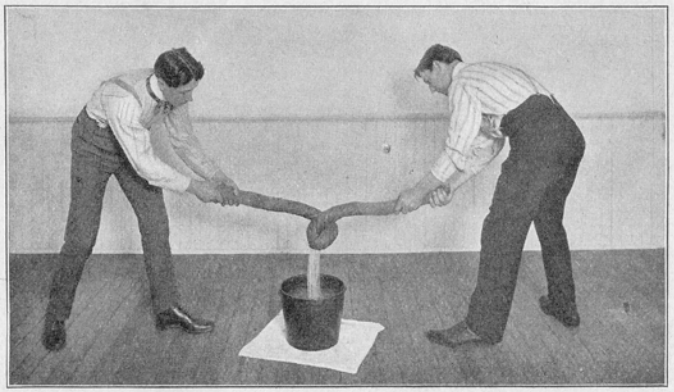


FIG. 87. WRINGING BLANKET FOR HOT PACK (p. 624).

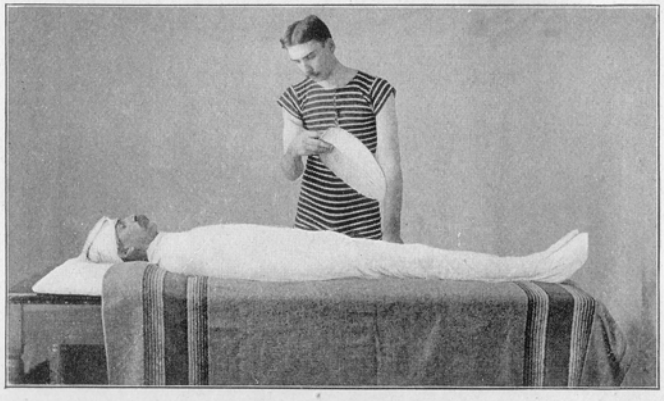


FIG. 88. EVAPORATING WET SHEET (p. 625).

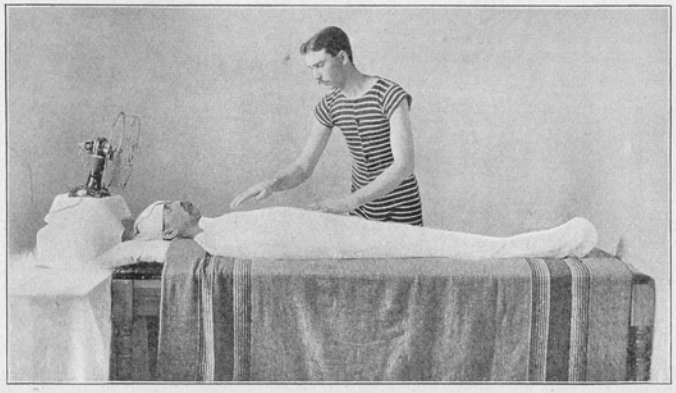


FIG. 89. EVAPORATING SHEET — Employing Electric Fan (p. 626).

cold wet friction may be employed safely, even when more vigorous measures are contraindicated.

Contraindications.— The sweating pack must be avoided in eruptive disorders, in the exanthemata after the eruption appears, in advanced cases of *cardiac* or *Bright's disease*, in *anemia*, feeble *neurasthenics*, *diabetics* with *emaciation*, *rheumatic gout*, general *cutaneous hyperesthesia*, and in febrile states in which accumulation of bodily heat is decidedly contraindicated.

THE DRY PACK.

In this application the patient is completely enveloped in **1192** dry blankets, the head only being excluded, the purpose being to lessen heat elimination, and thus produce an accumulation of bodily heat, and in some cases to induce perspiration.

Requisites.— A bed or couch with a comfortable mattress, a number of dry woolen blankets, bottles or rubber bags for hot water, hot sand bags, or other convenient means of applying dry heat to the body.

Method.— The pillow and several woolen blankets are arranged upon the bed or couch, as directed for the wet-sheet pack. The patient, divested of his clothing, lies down, and the blankets are quickly applied as directed for the wet-sheet pack, care being taken to tuck the edges in well about the head and feet, so as to avoid the circulation of air. If the patient is very feeble, very cold, or deficient in ability to generate heat, several hot-water bottles or bags may be placed at the feet and sides next to the first blanket, beneath the other coverings. The patient should drink one or two glasses of water before entering the pack, and while in the pack half a glass of hot or cold water should be swallowed every 15 or 20 minutes. The temperature of the room should be not less than 70°. If simply an accumulation of heat is desired, the patient should be removed from the pack before perspiration begins. If diaphoresis is sought, the application may be continued for two to five hours, or as long as necessary.

The dry pack may be applied to a portion of the body only, as the trunk, the lower half of the body, one or both legs, the knee, ankle, or elbow joint, or a paralyzed limb.

If used as a means of preparing the skin for a cold application, by storing up in it a quantity of bodily heat, the result sought may be facilitated by vigorous rubbing of the limbs outside the coverings.

In certain countries a dry pack is administered by enveloping the patient in dry hot sand. The effect is the same as though blankets were wrapped about the patient. Ruschpler introduced the methodical use of the sand bath in 1831. It is still employed in Germany. The temperature of the sand is from 118° to 122° F.

1193 **Physiological Effects.**— The effect of the dry pack is first to secure an accumulation of heat by lessening the heat elimination, and in extreme cases to augment the heat of the body by the application of artificial heat through the aid of hot-water bottles, hot bags, the drinking of hot water, etc.

The natural result of this accumulation of heat is to increase the temperature of the blood. The body temperature often rises two to four degrees. The elevation of temperature is doubtless due not only to the accumulation of heat, but to an increase of heat production, the natural result of the continuous exposure of the body to a high temperature.

With the elevation of body temperature, perspiration is induced. Before perspiration begins, the face is often flushed, the patient experiences an uncomfortable sensation of fulness in the head, and the pulse rate is decidedly increased. With the beginning of perspiration the patient becomes more comfortable; but the dry pack, as a sweating process, is by no means the most agreeable of thermic applications.

1194 **Therapeutic Applications.** — The dry pack is especially indicated in *shock*, *collapse* after hemorrhage, anesthesia, or a severe surgical operation. It is also of great value in the treatment of the cold stage of *intermittent fever*. It is useful in all cases in which there is a subnormal temperature.

In cases of *paralysis*, applications of the dry pack, sometimes general, but more frequently local, as in *paraplegia* and *hemiplegia*, may be used to great advantage.

In the absence of better means, the dry pack may be used as a preparation for the cold douche and other cold procedures. Care must be taken, however, to make the cold application instantly on the removal of the patient from the pack; otherwise a slight chill will be produced, and the effect will be spoiled. The dry pack may also be used with advantage for "breaking up a cold," for which purpose it is often very successful when applied within a few hours after the exposure. In cases of *collapse*, *arteritis*, or *phlebitis* in *typhoid*, in *septicemia*, *malarial* and *typho-malarial fever*, *malarial neuralgia* and in *obesity*, the dry pack is useful.

In *chronic rheumatism*, when the patient is not able to secure the advantages of the hot-air, vapor, Turkish, electric-light, or hot immersion baths, the dry pack may be employed with advantage. It may also be used in chronic rheumatism for continuing the effect of the hot bath, the patient being immediately after the bath wrapped in dry warm woolen blankets, and left to continue perspiring for an hour or two.

The dry pack is frequently employed as a means of promoting reaction after a cold bath in feeble patients.

Contraindications and Precautions.— 1. In the application **1195**
of the dry pack, the fact that heat elimination is diminished should be borne in mind. If the application is continued too long, or if too great an amount of heat is applied, the body temperature may rise to an injurious degree. This is especially true in its use to abort a malarial chill.

2. When employed for the relief of chronic rheumatism, or for sciatica and other neuralgias involving large nerve trunks, the dry pack can not be followed by extremely cold applications without running the risk of producing severe pain and other inconveniences. In cases of this sort, the wrappings may be removed gradually, so that the patient may be cooled off by degrees, or partial cold friction may be employed.

3. When employed in cases of paralysis, the application should not be continued so long as to induce profuse perspiration. When the normal heat of the skin is restored, a portion at least of the wrappings should be removed.

4. When employed to produce perspiration, the dry pack should not be used more frequently than once or twice a week, except in cases of obesity.

5. The dry pack is contraindicated in cases of chronic *cerebral congestion*, *irritable heart*, *eruptive disorders* of the skin, and in cases in which patients are extremely nervous or excitable. It can seldom be employed to advantage with children as a means of inducing perspiration, and except when used to combat *collapse* or abort a *malarial paroxysm*, is not very frequently called into use, as the hot-blanket pack and other heating procedures are more convenient.

THE HALF-PACK.

1196 This procedure (Fig. 85) is precisely the same as the wet-sheet pack (**1179**), with the exception that it is confined to the trunk of the body and the hips, the arms and legs being excluded from the application. It may be confined to the trunk only, and is then called the trunk pack.

The same materials are needed for the application, the only difference being in their disposition ; the same temperatures are employed, and the remarks made with reference to physiological effects and therapeutic indications are equally applicable. It may be added simply that the half-pack is attended by less inconvenience to the patient, while its therapeutic efficiency is almost as great as that of the full pack.

The half-pack is of special value in *insomnia* and the *nervous affections* growing out of. indigestion with resulting irritation of the abdominal sympathetic. When employed for insomnia, the pack should be applied at bedtime, and may be kept in place during the greater part of the night if necessary to enable the patient to sleep.

The contraindications are the same as for the pack (**1188**).

THE HOT-BLANKET PACK.

The hot-blanket pack (Fig. 86) consists in the envelop- **1197**
ment of the body in a woolen blanket wrung out of water as hot as can be endured by the patient without pain or injury.

Requisites.— A couch or bed with a good mattress, a small hair or cotton pillow, four or five woolen blankets, a rubber blanket, two or three bottles or rubber bags filled with hot water.

Method.— The pillow is laid upon the couch, the rubber blanket is first spread out, the upper edge overlapping the pillow, and all but one of the woolen blankets are spread out smoothly, one after the other, in such a manner as just to cover the pillow. Another blanket, having been placed in water at a temperature of about 160°, is then wrung out. The most convenient manner of wringing out blankets is shown in Fig. 87. The blanket should be rapidly wrung as dry as possible. After wringing, it is spread out upon the dry blanket as quickly as possible, and the patient, having previously disrobed, lies down at once in the center of the blanket and is quickly enveloped as directed for the wet-sheet pack (**1179**). Hot water bottles or bags are placed at the feet for additional heat.

Physiological Effects.— The hot-blanket pack is an excit- **1198**
ing and heating measure of great power. It communicates heat to the body, diminishes heat elimination, and increases heat production. Its application excites the circulation, increases the pulse-rate, raises the temperature two to three degrees, and when sufficiently prolonged, induces profuse perspiration. It differs from the sweating wet-sheet pack in that its action as an exciting procedure is direct, whereas the wet-sheet pack is primarily sedative, the exciting effects being secondary, as the result of the reaction.

The hot-blanket pack is followed by an atonic reaction through which the circulation is slowed, nerve tension lowered, and the activity of the vital processes diminished. Its

frequent repetition produces depression of nerve tone, lowers vital resistance, and enfeebles the circulation.

The effects of the hot-blanket pack differ from those of the dry pack in that the application of the dry pack is not followed by atonic reaction, the heating being gradual.

The hot-blanket pack, after the first moment, is essentially a vapor bath. The loose meshes of the wrappings are filled with warm vapor, which is retained by the rubber sheet. The effects are essentially the same as those of a vapor bath.

1199 **Therapeutic Applications.**— The hot-blanket pack is especially useful in cases in which the temperature is subnormal, as in cases of *collapse*, *surgical shock*, etc. It is useful in all cases for which the dry pack is indicated, and is generally to be preferred to the dry pack except in the cold stage of intermittent fever, when the dry pack is preferable, because of the danger of provoking chill through the evaporation which takes place from the moistened skin when a hot-blanket pack is administered.

The hot-blanket pack is a valuable procedure in cases of *acute Bright's disease*, in the *albuminuria* of pregnancy, in *eclampsia*, in *convulsions* of children with pallor, to induce perspiration in *subacute rheumatism*, in *chronic toxemia*, in *infectious jaundice*, in nephritis complicating *typhoid*, *scarlatina*, *yellow fever*, *measles*, and other *infectious fevers*, in *influenza*, *malarial* and *uremic coma*, *malarial hematuria*, *septicemia*, *muscular rheumatism*, *dengue*, *collapse* of *cholera* and *cholera morbus*, *peritonitis*, *renal calculus*, *acute myelitis*, and as a derivative in *lobar pneumonia*.

The hot-blanket pack is also useful as a preparation for cold applications, especially in adynamic febrile types, when the skin is cold, to insure good reaction, and thus aid heat elimination. It is almost equally useful in cases in which heat production is much increased as a means of lessening thermogenesis by atonic thermic reaction. In the first class of cases, the duration of the application should be just long enough to warm the skin; in the second class, the application should not continue more than from 2 to 4 minutes. In

all cases the temperature should be as high as the patient can bear without burning.

Contraindications and Precautions.— Most of the suggestions made in relation to the dry pack are applicable here.

1. Extreme care must be taken to prevent increase of body temperature, especially when employed as a means of increasing heat elimination in fevers. The body temperature must be taken in the mouth, before, during, and after the application.

2. Care must be taken not to burn the patient by wringing the blanket out of water at too high a temperature. This is especially likely to occur in cases of paralysis in which there is found not only diminished sensibility of the skin, but lowered vitality of the tissues, and hence a double risk of injury from the application of too high a temperature. This danger is also very great in cases in which the circulation is greatly slowed in consequence of the administration of an anesthetic for surgical purposes and in cases of collapse in cyanosis and anasarca.

3. It must not be forgotten that the hot-blanket pack, like other general hot applications, although primarily stimulating, is ultimately exhausting and depressing; hence it must be carefully employed, especially in the case of chronic affections. It affords so much comfort in many cases that patients often call for its too frequent repetition.

Recent observations afford ground for the belief that disease germs are eliminated in great numbers by the skin, especially during very vigorous perspiration. This fact renders this procedure useful in all the acute infections.

THE EVAPORATING SHEET.

The evaporating sheet (Fig. 88) is one of the simplest of **1200**
cooling procedures. It consists in wrapping the patient in a sheet wrung out of hot or cold water, as the indications may require, and allowing cooling by evaporation. The sheet should be wrung moderately dry, and should be applied next

the skin. The cooling is the result of the absorption of heat due to the evaporation of the water contained in the sheet.

Physiological Effects.— The evaporation of one pound of water will absorb about one thousand heat units, which for a patient weighing 160 pounds, would amount to a lowering of the body temperature six degrees. Such an effect is never produced, however, for the reason that heat production is constantly going on, and is replacing the heat loss at the rate of 7.2 units per minute or more. With a febrile temperature of 103°, spontaneous evaporation takes place at a very rapid rate from the surface of the sheets wrapped about the body; and when the evaporation is aided by means of vigorous fanning, as with a current of air from an electric fan (Fig. 89), most powerful refrigerative effects are produced. The patient should be gently rubbed continuously.

Therapeutic Applications.— The evaporating sheet is a useful measure in certain cases of fever. Either the cold or the hot evaporating sheet may be used, according to the indications present. The hot evaporating sheet is, however, most commonly employed. It is especially useful in adynamic cases, or where the patient is very nervous, depressed, apprehensive, and distressed at the thought of contact with the cold water. The hot evaporating sheet should be wrung very dry out of very hot water; the attendant should wrap the sheet about the patient very quickly, so that a strong impression of heat may be made upon the skin. As the evaporation takes place, the sheet will be rapidly cooled, and heat should thus be removed from the body.

The first impression of the hot sheet lessens heat production by reflex influence and dilates the surface vessels. While the vessels remain dilated, heat elimination takes place at ten times the ordinary rate (Conrad Klar). At the end of 3 to 5 minutes, the vessels become contracted so as greatly to lessen the rate of heat elimination, and hence the application should be renewed at short intervals (1 to 3 min.).

Evaporation is on the whole not a desirable or valuable mode of refrigeration except in cases in which there is very

excessive activity of the surface circulation, with abnormal heat and no tendency to chill. Slow cooling of the skin by evaporation causes a contraction of the surface vessels which is not followed by reaction, and which is accordingly not only accompanied but followed by congestion of internal parts. Therefore this method of cooling is rarely indicated.

The cold sheet should be resorted to only in cases in which the surface congestion is so excessive that the contraction occasioned by cooling will be only sufficient to establish a normal condition of the vessels, and without inducing retrostasis of blood and congestion of the viscera. Active cutaneous circulation should be maintained by rubbing.

WET-HAND RUBBING.

This procedure (Fig. 90) consists simply in rubbing the 1201
cutaneous surface with the wet hand.

Method.— Water at 40° to 75°, with plenty of Turkish towels, a Turkish sheet, and a woolen blanket, are the only requisites for this bath. In beginning the application the attendant stands with his side to the couch, facing the patient, dips both hands into the water, then applies them, one to each side of the patient's face, covering as large an area as possible. Friction is made from the median line outward, the tips of the fingers sweeping over the brow and describing a sort of semicircle along the cheeks to the under side of the jaw. Repeat the movement three to six times. In men, wet the hair by shampooing with wet fingers or a wet towel.

Before wetting the face, a dry Turkish towel should be folded about the head in such a way as to protect the ears, and if the patient is a lady, the hair also, a precaution which will be much appreciated by nervous patients (Fig. 91).

Next the application is made to the chest, both hands being employed, first the upper part, then the sides of the chest being rubbed vigorously, then the abdominal surface. After the entire chest has been gone over three or four times with quick, short movements and considerable pressure, the

towel is thrown over the chest and the surface dried quickly, the rubbing being continued until the surface is reddened. The face and head are not to be dried until the end, as it is desirable that these parts be cooled by evaporation.

The prolonged application to the head is to protect from congestion; the application to the chest before proceeding to other portions of the body is to stimulate the heart and lungs to increased activity, thereby promoting reaction.

The arms, first one, then the other, next receive attention. The attendant grasps the patient's hand with his left hand, while with the right he vigorously rubs the arm with long rapid strokes reaching from the shoulders to the wrist, his hand being kept cold and moistened by dipping in the basin after every four to six strokes. If the patient is fairly vigorous, he may hold his arm perpendicular while the attendant rubs with both hands.

On finishing the arm, the attendant rubs the hand between both his own, and ends with one or two smart blows upon the palm with the flat of his hand. The arm is quickly enveloped with a Turkish towel (Fig. 92), the patient holding one end, and is rubbed until the reddening of the skin indicates the establishment of reaction. The blanket is then drawn over it, and the other arm is treated in like manner.

Next give attention to the abdomen. Apply the friction first transversely, the rubbing being done alternately with the two hands, then in a circular manner, following the course of the colon. The thighs are next treated, but one being uncovered at a time. Then follows the treatment of the legs and feet, each of which should be rubbed until the circulation is well established.

The patient should now turn upon his face, and fold his arms beneath his forehead, thus drawing the shoulder-blades upward and outward, so as to flatten the dorsal surface as much as possible. The attendant then dips his hands and applies them first to the back and sides of the neck, extending the fingers around so as to reach the front of the



FIG. 90. WET-HAND RUB (p. 627).

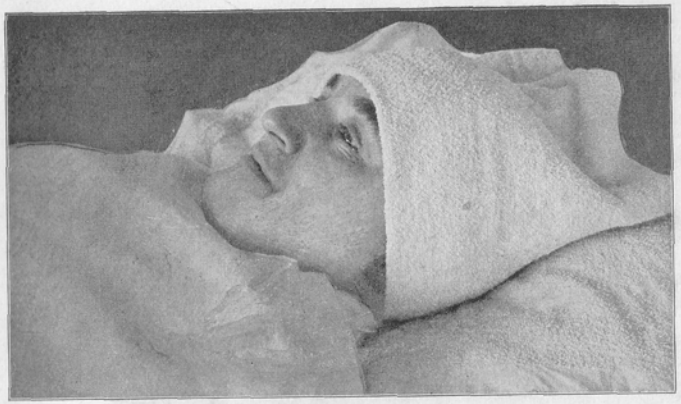


FIG. 91. WET-HAND RUB — Protection of hair and ears (p. 627).



FIG. 92. WET-HAND RUB — Drying Arm (p. 628).

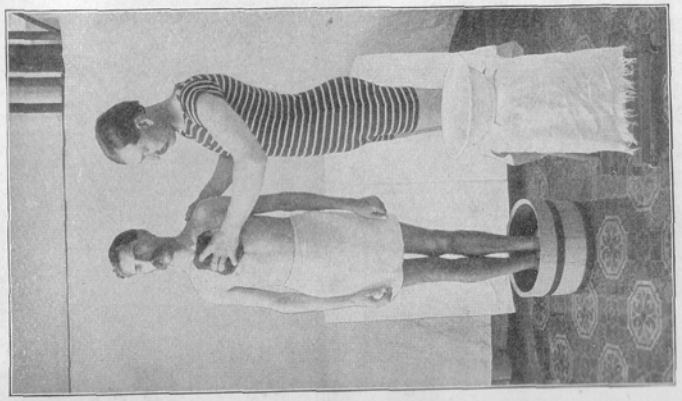


FIG. 93. SPONGE BATH (p. 634).

neck. The upper part of the back, the shoulders, and the outer portion of the upper arm should next receive attention, then the middle and lower parts, and the sides of the trunk. Lastly, apply to the whole length of the spine a few vigorous strokes. As fast as any part is dried, it should be covered.

The treatment concludes with an application to the feet of water at the same temperature as that applied to the head. The ankles and dorsum of the feet should be vigorously rubbed, and the sole percussed with energy, but not rubbed, on account of the unpleasant tickling sensation induced.

Not more than 5 to 15 seconds should be occupied in rubbing any part with the wet hand before the application of the towel. If the rubbing is insufficient to produce reddening of the surface, light spatting or percussion should be applied after drying. Good reaction should be secured in each area treated before proceeding to another portion of the surface.

The skin must be warm at the time of the application. An excellent hour is before rising in the morning.

The temperature employed and the duration of the treatment must depend upon the individual case. The temperature most frequently employed is from 65° to 75°, or the ordinary living-room temperature. Generally the hands of the attendant are simply dipped into water so as to moisten their surfaces, no more water being applied than is naturally carried by the moist hand. In certain cases, however, as when this procedure is employed as a general antipyretic or antifebrile measure, a larger quantity of water should be employed. The bed of the patient in such cases should be protected by a rubber blanket and the patient should be wrapped in a Turkish sheet. Instead of simply dipping his hand into the water, the attendant cups his hand in such a manner as to dip up all the water possible. This is quickly thrown upon the portion of the surface under treatment at the moment, which is at once vigorously rubbed. This alternate deluging and rubbing of the skin may be repeated from one to half a dozen times. In certain cases hot instead of cold water is employed.

1202 **Physiological Effects.**— Wet-hand rubbing is an efficient means of producing strong circulatory reaction with moderate thermic reaction by the combined influence of cold and friction. The reaction is still further encouraged by rubbing with the dry towel, and afterward applying friction and percussion with the hand.

The physiological effects of wet-hand rubbing are mixed in character, owing to the mixed nature of the application, the friction giving rise to mechanical effects, while the hydric effects proper are purely thermic. Employed at a temperature considerably below that of the skin, the application energizes both the cardiac and the respiratory functions, and thus a mild general tonic effect is produced. The friction as well as the cold impression increases blood pressure. The activity of the peripheral heart is increased, while the central heart is energized, often to a remarkable extent. By the employment of ice-water, the tonic effects may be considerably intensified, while on the other hand, by the employment of very hot water or even that at a neutral temperature, quieting effects are produced, with relief of pain when this symptom is present.

It is interesting to note that *while hot applications generally produce lowering of blood pressure, when the application is accompanied by moderate friction, there may be a moderate increase of tension.*

1203 **Therapeutic Applications.**— The cold wet-hand rub combines tonic, restorative, and derivative effects. The intensity of the effects produced depends upon the temperature of the water and the vigor of the friction. The colder the water, and the more vigorous and prolonged the friction, the more intense the effects. The feeble neurasthenic patient experiences, after an application of cold wet-hand rubbing, a delightful sensation of increased vigor, and relief from malaise and mental and nervous weakness.

Wet-hand rubbing may be made a most useful means of *reducing the temperature* and *increasing vital resistance*

in febrile cases where the patient is too feeble to endure the application of the cold bath or the cooling pack, or under circumstances prohibiting these antipyretic measures. The lower the temperature of the water used, the more freely it is applied to the parts which are being rubbed, the longer the application, and the more frequent its repetition, the greater will be the antithermic or antifebrile effect produced (40° 65°). This means of reducing temperature is very appropriate for children and aged persons, and in cases of typhoid and other continued fevers in which the cold immersion bath can not for any reason be employed, as in cases of *intestinal perforation*, *myocarditis*, *nephritis*, *collapse*, and other complications.

Wet-hand rubbing with water at a temperature of 85° to 95° is a quieting measure of value in *feverishness* due to nervous excitability rather than to actual elevation of temperature. When employed for this purpose, the rubbing should be very gentle, and the passes should be in the form of stroking, the direction being, so far as possible, from the center toward the periphery. The surface may be left moist or may be dried by simply covering with a towel and gently passing the hand over the surface. The effort should be to avoid both thermic and circulatory reaction or stimulation of the heart.

Wet-hand rubbing is a measure of less power than the rubbing wet sheet, cold friction, and most other tonic applications, and hence its use is naturally limited to cases in which other more vigorous and more efficient measures can not be employed. It is well adapted to *very feeble neurasthenics* who dread water and have but little power to react. The warmth of the hand of the attendant, the rubbing, and the small amount of water employed when used for tonic effects, all tend to promote reaction, so that it may be said that there is no patient too feeble to admit of the application of this measure. Even very weak patients allow the application of ice-water when applied to the surface by the medium

of the hand, though water at a much higher temperature would not be tolerated if applied by means of a sponge, towel, wet sheet, or any other vehicle. In very feeble, nervous, and excitable patients, the application should be made at first at a temperature of 70° or even 80°, and lowered one or two degrees each day until water at a temperature of 50° or even lower can be tolerated.

By this means the patient may be gradually trained to receive at first tepid, then cool, and finally cold water; then other procedures, as the cold friction, the towel rub, the rubbing wet sheet; and later the half-bath, the cold shower, and the horizontal douche, may be employed.

Wet-hand rubbing is especially indicated in the cases of very feeble invalids who, being entirely unaccustomed to cold water, have a dread of its application, which might almost be termed a species of hydrophobia.

Wet-hand rubbing is useful in *fever* cases in which the circulation of the skin is deficient, as shown by pallor, coldness, and *cyanosis*, as a preparation for more vigorous antipyretic measures. Each part must be rubbed until red. It may be appropriately employed whenever it is desirable to encourage cutaneous reaction, either alone or following a hot bath of some sort. This measure is especially useful in *chilblains* (40° to 50°).

For very feeble patients wet-hand rubbing may be applied to the back only. Very cold water applied to the back in this way is an excellent tonic. Cold wet-hand rubbing is also useful in aiding the circulation in the lower extremities in dyspeptics and neurasthenics troubled with cold feet and legs. In these cases the circulatory disturbance is not due to weakness of the heart, but to vasomotor spasm in the cold parts. Rub first with ice-water, then with warm flannels until red and warm.

There is no procedure of more general value than this simple measure. It is applicable to almost every form of acute and chronic disease. It is of special service in all

forms of chronic disease accompanied by *anemia* or *low nerve tone* and *feeble vital resistance*, the number of which is too great to mention. It may be so graduated as to constitute the most mild and gentle measure possible, or a most vigorous and thoroughgoing hydriatic procedure.

Vigorous rubbing of the surface with the hand while cold water is poured upon the patient from the height of a few feet, is the most efficient means of combating sunstroke. This method was first used by Paulus of Ægina, A. D. 660 (Winternitz). It has been advocated in recent years by a number of writers on hydrotherapeutics.

Wet-hand rubbing is constantly employed in combination with many other baths. For instance, in the application of heating compresses, if the patient does not react promptly, the surface should be first rubbed with the hand dipped in cold water. Rubbing the chest with cold water is a valuable means of accelerating the heart's action before a general cold application, and thus increasing the patient's ability to react. Rubbing the face, head, and neck with cold water is the usual preparation for cold baths of all kinds.

Wet-hand rubbing is employed in connection with the shallow bath and the shallow foot bath, and rubbing with the hands is practiced in connection with nearly all cold baths excepting packs, compresses, and the different forms of the douche. In general, cold friction applied locally is an excellent means of protecting an internal part against congestion from the cold douche. The water employed should be very cold, and the application should be made to the cutaneous area in reflex relation with the internal part which it is desired to protect; as, for example, if it is desired to protect the liver, the application should be made over the region of the liver just before the douche. The stomach, bowels, chest, and heart may be protected in like manner.

Contraindications. — Wet-hand rubbing should not be employed for the reduction of temperature in *smallpox*, *scarlet fever*, or other *exanthemata*. It is also contraindicated

in *eczema* and other non-inflammatory types of eruptive diseases of the skin.

THE SPONGE, ABLUTION, OR TOWEL BATH.

1204 This (Fig. 93) is a general hydriatic measure consisting of an application of water to the surface by means of a wet sponge or towel.

Requisites.— A basin of water at the proper temperature; a large bath-sponge or coarse towel; Turkish towels; a foot tub if the patient is able to stand erect.

Method.— The foot-bath tub should contain water at a temperature of 104° to 110°. With the patient standing in the foot bath bending forward, his head, face, and neck are thoroughly and repeatedly drenched with cold water (50°) by means of a saturated sponge or towel. The attendant then applies the saturated sponge (60° to 70°; average 65°) first across the chest and abdomen, then the back, the arms, and the legs. The sponge should be applied with moderate pressure, and should be rewet as often as emptied of water. The whole surface of the body should be gone over very rapidly.

The sponging being completed, a dry sheet is thrown about the patient, who steps out of the foot bath, and holds his feet in alternation over the foot bath each two or three seconds, while cold water is poured over them. The patient is quickly rubbed dry, assisting himself as much as possible in the rubbing so as to encourage reaction by exercise. After the bath the patient should take moderate exercise, or if unable to do so, dry friction should be applied (**1221**).

The patient whose strength is at least moderately good may administer this bath to himself by means of a towel, following as nearly as possible the order just indicated as regards the application. The application to the back may be easily made by grasping the towel by its ends, throwing it over a shoulder, and making a seesaw movement.

To a patient who is unable to stand, this bath may be

administered in bed (Fig. 94). Care should be taken that the feet are not cold, and that the whole surface of the body is warm. The application is made when the patient is reclining in essentially the same manner as when in the standing position. A rubber blanket must be placed beneath him on the bed, and so arranged that the surplus water may run away into some proper receptacle, to prevent wetting of the bedclothing. The rubber sheet should be covered by a Turkish sheet, which for simple sponging with a well-wrung sponge may be sufficient. The patient having been undressed and covered in the bed, the attendant begins the application by first sponging the face and neck, then the following parts in succession: One arm, the other arm, the chest and abdomen, the front side of the legs, the back, the back side of the legs. No portion of the body should be exposed to the air except the portion under treatment, and this should be covered as quickly as possible after drying. Not more than 3 to 5 seconds should be employed in the sponging of each part, the same length of time in rubbing the parts with the hands, and 5 to 10 seconds in the drying and rubbing of each part.

The temperature of the bath and its duration depend upon the effect sought. If the desired effect is the reduction of temperature and the stimulation of vital resistance, water at a temperature of 60° to 70° should be employed, and a basin of water should be placed near the bedside so that as much water as possible may be lifted in the towel or sponge and applied to the patient. Each part should be sponged and rubbed thoroughly so as to induce good reaction; and after the whole surface has been gone over, the application may be repeated as many times as is necessary to secure the effect desired. When employed for tonic effects, the amount of water should be small, the temperature low (50° to 35°), and the rubbing and spatting vigorous.

The whole body should be kept warmly covered, except the part being rubbed, in all cases other than those in which

reduction of temperature is the object sought, and even in these cases so much exposure should not be allowed as to prevent reaction by the disturbing effects of evaporation.

The patient, if feeble and with defective circulation, should be prepared for the bath by an accumulation of heat in the skin in any convenient manner, as by the dry pack, that is, wrapping with warm blankets with a hot bag to the spine and feet; by a hot-water bath; by hot-water drinking; or by a fomentation over the abdomen.

1205 **Physiological Effects.**— The physiological effects of the sponge or towel bath, or ablution, as the application is sometimes termed, are essentially the same as those of wet-hand rubbing, and depend upon the same conditions. The difference is simply that this application is more vigorous; a larger quantity of water is employed, more heat is abstracted from the body, the general thermic and circulatory reactions are more intense, and the application is in every way a more vigorous one than the simple rubbing of the surface with the wet hand. The procedure is also somewhat more strongly refrigerant, and hence better adapted for use in febrile conditions. Very hot and very cold applications contract the vessels of the limited area to which the application is being made, but this is so small compared with the whole cutaneous surface that no perceptible retrostasis toward the viscera occurs, as in the cold immersion, the cold douche, and many other forms of cold application; while by successive applications to different parts of the surface, the whole body is gradually brought into a state of vigorous reaction. This is one of the chief characteristics of the bath, and constitutes its leading distinguishing feature.

1206 **Therapeutic Applications.**— The therapeutic effects of the sponge bath are likewise essentially the same as those of wet-hand rubbing. It is simply a somewhat more vigorous application, which may be employed for the production of tonic, antipyretic, analgesic, calmative, and other therapeutic effects, both general and local. It is one of the most use-

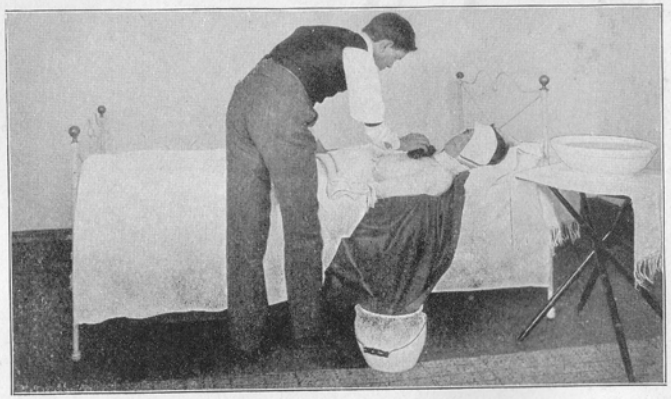


FIG. 94. SPONGE BATH IN BED (p. 635).

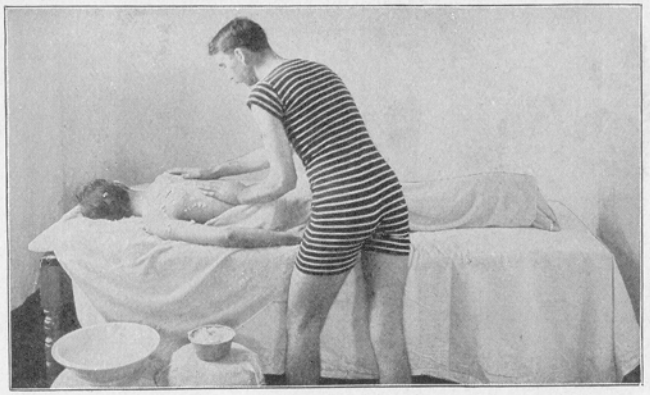


FIG. 95. SALT GLOW (p. 641).



FIG 96. COLD MITTEN FRICTION (p. 642).



FIG. 97. FRICTION MITT (p. 643).

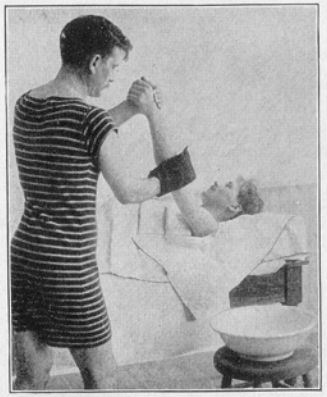


FIG 98. COLD MITTEN FRICTION TO ARM (p. 644)

ful of hydric applications because readily available under almost any circumstances demanding the employment of water as a therapeutic means.

The *cold* ablution or sponge bath is highly advantageous in all cases in which the skin is anemic, as in *chlorosis*, *myxedema*, *anemia*, cases of *cardiac* and *renal dropsy*, and in all cases to which cold friction and cold towel rubbing are applicable. Skilfully applied, it is a good refrigerant measure, but when used to reduce fever, it must often be employed almost continuously for several hours in succession, or until the desired effect has been obtained. The work should be done so briskly and energetically that good cutaneous circulation is maintained, and shivering prevented. The beginning of pronounced shivering is an evidence that the full effect of the bath as an antipyretic has been obtained. The cool sponging should be continued in fever cases until shivering or other evidences of secondary chill appear, notwithstanding the most active efforts to postpone the same by rapidly going over the whole surface, first with the very wet sponge, then rubbing with the hands and drying with the towel, and finally rubbing with the warm hand, then repeating the process.

The cold sponge bath is useful in *adynamic febrile states*, as in typhoid fever, when the extremities are cold. The water employed should be quite cold (50° to 60°). The sponge should be wrung quite dry, and should be rubbed quickly over the limbs, which should then be rubbed vigorously with the warm hands until reaction occurs. The success of this measure depends upon using very cold water and making the application very short and vigorous.

Currie called attention to the value of the sponge bath in mild cases of fever in children and in very feeble patients, and also pointed out that this measure may be advantageously employed in cases of general fever due to some internal inflammatory process in which the cold bath can not be safely used on account of the condition of the blood-vessels of the affected part.

This bath is an excellent one for self-application when the patient is able to administer the treatment to himself at home. It may be employed every morning, on rising, with advantage. As the patient becomes accustomed to the application of cold water, more vigorous measures, such as a sponge or towel bath, a cold friction bath, or cold immersion, may be employed.

Hot sponging is sometimes advantageous in fever as a means of reflexly lessening the tendency to heat production; the water employed should be very hot (130° to 140°), and the application should be very rapidly made.

Local ablutions are valuable in many conditions, as in hot sponging of the spine for the relief of so-called *spinal irritation*, *headache*, *intercostal neuralgia*, *sleeplessness*, and the general nervousness so often encountered in *neurasthenia*.

The general hot sponge bath is of value in relieving the *night sweats* of consumption. The water should be applied as hot as can be borne, especially over the chest and abdomen.

The *hot alkaline* sponge bath is of service in *urticaria*. In this the application should likewise be made as hot as the patient's skin will bear; that is, 130° to 140°. The water employed should be rendered alkaline by the addition of a teaspoonful of soda for each pint of water. Very hot sponging is highly useful as a means of relieving itching of the skin when not accompanied by eruption.

When warm or hot water is employed, vigorous rubbing after the bath is not required. If a towel is used to dry the parts, it should be simply laid upon the surface and gently rubbed or patted with the hand outside. Wrapping the patient in a Turkish sheet is the best method of drying.

The very hot sponge bath is much employed for *hemostatic effects*. The application may be made directly to the bleeding surface, as in capillary oozing, for which it has rendered most efficient service in abdominal surgery, or through the remote effect of the stimulus of heat upon the vasomotor nerves, as in the stoppage of nosebleeding by sponging the

face with very hot water. When used for hemostatic effects, very high temperatures must be employed,—from 140° upwards. When directly applied, the sponge must be only half wrung, and must be held with firm pressure in close contact with the bleeding surface, but great care must be taken to avoid injury to the parts.

Recent results show that local septic processes may often be checked by the application of water at a temperature of 180° to 212°, by means of a saturated sponge held for a few seconds in contact with the suppurating surface. Care must be taken to avoid injuring the healthy tissues adjacent. The object sought is not simply destruction of the pyogenic microbes, but a slight cooking of the devitalized and degenerated tissues upon the pyogenic surface, and a powerful stimulation of the circulation and the nerves of the part.

The *tepid* sponge bath is a very grateful application in feverish conditions, especially in cases in which the temperature is not sufficiently high to admit of more vigorous measures. If the skin is kept moist by frequent sponging, evaporation is promoted and the patient is thus cooled without producing the thermic reaction and consequent elevation of temperature likely to result from cold sponging. The purpose of tepid sponging is simply to restore the natural cooling process which has been interrupted by suspension of perspiration.

The *neutral* sponge bath at a temperature of 90° to 98° is a quieting, sedative measure of great service in nervous states accompanied by feverishness without elevation of temperature. It is also useful in mild *febricula*, and in fevers in which the temperature is only slightly above normal, and in which the skin is flushed and dry.

Alternate sponging of the spine is a powerful excitant of the cardiac and respiratory centers, and may be employed with wonderful advantage in cases of *opium poisoning*, *asphyxia* from coal gas, and in cases of *toxemia*, in which the heart's action is greatly weakened. This application

is also valuable for its remarkable tonic effects upon the central nervous system; for the relief of *headache* and the *pains* at the back of the head and neck of which neurasthenics often complain, there is no better palliative than hot and cold sponging to the cervical and dorsal spine. When used for such excitant and revulsive effects, two sponges are employed, with one of which hot water is applied, with the other cold, the two being used in alternation. Ice is sometimes used in place of the cold sponge.

Sponging the parts with either hot or cold water is an exceedingly valuable measure for *sprains* and *bruises*. The water employed should be either very hot or very cold, or *revulsive* hot and cold applications may be made (130°, 2 min.; 60°, 20 secs.) If the sprain is recent, having occurred within a few hours, the ankle and foot should be sponged with water as hot as can be borne, the temperature being raised as the skin becomes tolerant. In cases of neglected sprain, in which the parts have become swollen and acutely inflamed, sponging with ice-cold water, gently passing the sponge over the part and squeezing the water upon it, may be employed for an hour or two at a time several times a day until the acute stage of the inflammation is passed, or during twenty-four or forty-eight hours. In the interval between the applications, the cooling compress should be applied.

Alternate hot and cold applications may be applied to joints in which exudates have occurred as the result of *rheumatism*, *sprain*, or *traumatic arthritis*. Alternate applications are not useful in cases in which the parts are very painful. Neither cold nor alternate applications of this sort should be made to joints which are the seat of a tubercular process.

1207 **Contraindications.**—The cold sponge bath should be avoided in cases of fever accompanied by cyanosis with coldness of the surface. In such cases, cold friction following a hot application is indicated. The surface must be warm and

the movement of blood active in the skin to secure good reaction to a cold application. It must also be avoided in feeble cases when the patient is perspiring. This precaution does not apply when perspiration is the result of exercise without exhaustion or after a sweating process.

Sponging, as well as other procedures accompanied by friction, is generally inapplicable to cases in which the skin is irritable, as in cases of cutaneous disease and the eruptive fevers.

THE SALT GLOW.

In this procedure (Fig. 95), salt of medium fineness and 1208
slightly moistened is applied to the surface of the body with friction movements, the amount of pressure being adjusted to the patient's sensation. With very thin-skinned persons, abrasion and irritation of the skin may be very easily produced. Persons of dark complexion, whose skins are usually thick, bear more vigorous applications than blondes.

The patient prepares for the treatment by lying down upon a slab or bed covered with a sheet, having previously been divested of his clothing. The sheet is drawn over the patient to prevent chilling. One part after another is then exposed and rubbed with the moistened salt, two or three pounds of which should be conveniently at hand in a basin. When this treatment is given in an institution, the patient may sit upon a stool, lie upon a slab, or stand upon a low stool, while receiving the application, in a room especially arranged for the purpose, and at a temperature sufficiently high to prevent chilling.

After the application, the salt which adheres to the surface is removed by the cold affusion, shower, or spray. The patient is quickly dried and rubbed in the usual manner. It will be noticed that the skin is hard and almost as smooth as marble after this application. In cases of feeble patients, a dash of hot water or a warm shower should be given just before the final cold application.

Physiological Effects. — The salt glow is an admirable means of producing circulatory reaction, without thermic reaction if the temperature employed is not very much below that of the surface of the body. The salt acts as a chemical irritant to the skin, in addition to the mechanical stimulus produced by the rubbing of the sharp crystals in contact with the surface of the body.

The salt glow produces to an intense degree the circulatory stimulation of the brine bath, the sea-water bath, the effervescing bath, and the saline sponge, and with little thermic effect, provided the temperature of the salt when employed is not much below that of the body. By moistening the salt with ice-cold water, it is possible, however, when desirable, to produce most powerful thermic effects in addition to the circulatory reaction produced by the chemical effect of the salt and the friction.

Therapeutic Applications.— The salt glow is a tonic measure of high value, and also produces valuable derivative effects; it is especially valuable in feeble patients whose heat-making powers are small, and in whom thermic reaction does not readily occur, or if it does, the cold bath still has the effect to exhaust the patient and produce loss of heat. The salt glow is valuable in cases in which the skin is very inactive, a condition commonly found present in *chronic indigestion.* It may be usefully employed in cases of *Bright's disease*, and in *diabetics*, conditions demanding increase of skin activity, but contraindicating the cold bath.

The salt glow must be avoided in *eczema* and most other forms of skin disease, and must not in any case be used so frequently as to produce cutaneous irritation. This measure is rarely of use in any form of acute disease.

COLD FRICTION.

1209 By the term "cold friction" (Fig. 96) is designated a procedure which consists in the application to the surface of the body of a series of partial wet rubbings, one part after

another being taken in systematic order until the whole cutaneous surface has been brought into vigorous reaction.

Requisites.—A vessel containing a few quarts of cool, cold, or very cold water; ice-water may be employed in many cases. A mitt (Fig. 97) consisting of rough material of some sort,— ordinary rough linen or Turkish toweling is not desirable. Coarse mohair answers fairly well for the purpose; but the best fabric is a closely woven woolen cloth resembling hair-cloth, but slightly rougher to the touch, which is manufactured in Egypt and Turkey, where the author became acquainted with it in the Turkish baths of Cairo and Constantinople. It is there used for a sort of preliminary shampooing applied after the sweating process is completed and before the application of soap. This material possesses just the right degree of roughness, stimulating the skin without irritating it, and is so closely woven that it may be made to hold just the right amount of water for the purpose for which it is designed. A Turkish sheet and one or two towels are also required.

Method.—The patient is undressed, and lies upon a bed or a massage couch wrapped in a Turkish sheet. First of all, the head, face, and neck should be wet with cold water. If the hair is not wet (ladies often object to this), a napkin wet with cold water should be placed over the face. The vessel containing the cold water is placed at one side, near the head of the couch; the attendant places the mitt upon the right hand, and then uncovers a small portion of the patient's body, preferably the front of the trunk. He then dips the mitt into the cold water, and proceeds to rub the surface until reddened, redipping the mitt one or more times, covering the whole surface rapidly. Care should be taken to secure reaction in each part before proceeding to the next. Then with his left hand the attendant extends the arm and treats it in like manner, drying rapidly and covering. The other arm is then treated, and then in succession, the legs, and back,

the hips, and back of the legs, and lastly the feet. The soles of the feet should be spatted, not rubbed (Fig. 98).

This application is graduated by the temperature and the degree of saturation of the mitt,— "moist mitt," "wet mitt," and "filled mitt." The mitt is first saturated with water, then well wrung, and slipped on the hand. For the (*a*) "moist mitt" the palmar surface is merely touched to the surface of the water; for the (*b*) "wet mitt," the hand covered by the mitt is quickly dipped in the water two thirds its length, then shaken to remove surplus water; for the (*c*) "filled mitt" the whole mitt is immersed and filled with water, and quickly carried to the part to be treated; the water flows out while the surface is being rubbed, and the effect is thus almost as vigorous as that of the half-bath, only that it is partial in its application, and hence may be employed in cases in which the shock of a cold application to the whole surface simultaneously would be injurious.

By this means it is easy to bathe a fever patient with ice-water or water at a temperature of 35° to 45° without the production of shock or other undesirable effects, while securing the tonic effect upon the heart and the increase of general vital resistance, which are the most desirable effects.

In cases in which cold is positively contraindicated, hyperemia of the skin may be induced by hot mitten friction, using water at as high a temperature as possible.

This method, which the author has systematized and introduced within the last year (1899), he has found among the most useful of all cold applications, both as a tonic and as an antipyretic. One of the great advantages of the method is that it lends itself so readily to all the various conditions arising in the treatment of pathological states.

1210 **Physiological Effects.**— The act of rubbing the surface produces mechanical effects similar to those from the impact of water under pressure, as in the douche, although the effect is certainly much less pronounced than that of water at the same temperature in the form of the douche; however,

a much lower temperature may be employed with cold friction than with the cold douche (32° F.), and hence the reaction induced may be even more powerful, and indeed, according to the author's observation, is more quickly secured, than with the cold douche. Indeed, there is no form of douche, except the author's percussion douche, which produces so vigorous and prompt reaction as does the cold friction applied with a mitt of proper texture. Reaction occurs with great rapidity in this procedure for the reason that the delay which commonly follows the thermic impression of cold before reaction begins, is prevented by the application of vigorous friction simultaneously with the thermic impression. Circulatory reaction is also stimulated to a high degree, and a large amount of blood is rapidly brought to the skin.

The stimulation of the peripheral nerves induced by cold friction produces most profound reflex effects upon the nervous system, the heart, the glandular structures, and indeed the whole organism. It is a most powerful tonic; hence a regulator of nutrition and a potent vital stimulant.

The friction mitt may be advantageously employed in the rubbing sitz, the rubbing shallow, or the Brand bath, and all other forms of cold baths in which rubbing is desirable. In mixed applications of this sort it may be advantageous to employ a mitt for each hand. In general, however, the bare hand is better in these cases, as its warmth helps to secure the circulatory reaction which is one of the essential objects of the application. The use of the mitt somewhat intensifies the thermic effect of the bath.

Therapeutic Applications.— Cold friction may be locally **1211**
applied over any part desired. When applied to the lower extremities, for example, the effect is revulsive or derivative. Cold water applied to the precordial region with friction influences the heart in a powerful manner. Cold friction applied to the back and scalp powerfully stimulates the cerebral functions.

Cold friction is indicated in all cases requiring tonic appli-

cations; hence it is invaluable in *neurasthenia*, and especially with very feeble neurasthenics who are either too weak to receive the douche or too exhausted to react to this powerful tonic procedure. Cold friction affords the best of all means for training patients to endure the contact of cold water with the surface. It has no equal as a measure for graduated hydriatic training.

This procedure may be advantageously employed in cases of *anemia*, *chlorosis*, in all forms of *wasting disease*, as *tuberculosis*, and in *convalescence* after fevers; in *cardiac dropsy*, as a means of stimulating the peripheral circulation; in *anasarca* from renal disease; in *chronic toxemia* accompanied by spasm of the peripheral vessels; in all cases of *cardiac insufficiency;* in *febrile conditions*, to reduce temperature, whenever cold in any form is indicated. It is a hydric measure of remarkable versatility, and may be employed in a vast variety of cases. There is no measure of greater value than cold friction in the treatment of *tuberculosis pulmonaris*. The application may be made twice daily with advantage, a temperature of 75° being used at first, and steadily lowered day by day until 35° can be readily endured. The "moist mitt" should be used. As it is the tonic effect which is especially desired, care should be observed that each surface treated is made to glow with vigorous reaction before proceeding to another part. This prevents pulmonary congestion.

Cold friction affords an excellent means of testing the ability of a patient to react. In *fevers*, it presents an excellent test for the state of the heart, and even affords a valuable means of prognosis. Great slowness to react, the parts remaining cold and pale, indicates excessive irritability of the vasomotor centers or nerves. This condition, which is commonly present in anemia, especially in grave cases, is often a cause of great difficulty in securing reaction. When present in acute fevers, vascular spasm is a positive indication of diminished heat elimination, and suggests at once the necessity of employing some means to increase the peripheral circulation,

such as the short, hot-blanket pack, hot immersion for 3 to 4 minutes, fomentations to the spine, or some other heating process, to be followed by cold friction, and is a contraindication for prolonged cold baths. When the skin is very slowly reheated after an application of cold water, a mottled blue appearance remaining, the indication is great feebleness of the thermogenetic functions of the body, or diminished power of calorification. In fevers, this condition indicates impending collapse.

Cold friction must be mentioned also as a measure more or less indispensable in *typhoid fever* in *aged persons*, *children*, and *diabetics*, and in this disease when complicated by *ataxic* and *adynamic conditions;* in *dicrotic pulse*, *stupor*, *subnormal temperature*, *pregnancy*, *puerperal fever*, also in *chronic dysentery*, *malarial fever*, *coma* from any cause, *whooping-cough*, *yellow fever*, *plague*, *dengue*, *influenza*, *lithemia*, *leprosy*, *emaciation*, *scurvy*, *rickets*, *purpura*, *anorexia*, *hypopepsia*, *intestinal catarrh*, *chronic nephritis*, *hysteria*, *neurasthenia*, *Bell's palsy*, *migraine*, *chorea major*, *paralysis agitans*, and *morphia* and other drug habits. A *cyanotic skin* is always an indication for cold friction preceded or followed by heat, if the patient is very feeble.

When frequently repeated or prolonged hot applications are required, cold friction should be employed every two or three hours, or at least two or three times a day, *to maintain cardiac tone and general vital resistance.*

Contraindications.— There is scarcely any condition in **1212** which the cold friction mitt may not be employed. There are almost no contraindications except cutaneous lesions, in which the wet-towel friction should be substituted.

THE COLD TOWEL RUB.

This procedure consists in friction movements made upon **1213** a cold wet towel spread out upon the surface.

Requisites.— A towel for the head, several linen towels for the application; a sheet and a towel for drying; a pail of

water at the temperature desired for the application, and a basin of water at a temperature ten degrees lower.

Method. — The patient should lie in a recumbent position with all his clothing removed, and wrapped in a Turkish sheet and a woolen blanket, a portion of the covering being laid aside so as to expose the portion to which the application is to be made. The head, face, and neck are first bathed with the colder water, in which one of the towels is also wet, and wrapped about the head. A linen towel is then wrung very dry out of the water prepared for the purpose in the pail. After being quickly shaken out, it is applied smoothly to the part to be treated; and with the hands applied in such a manner as to cover as large a portion of the towel as possible, they are rapidly moved from point to point with firm pressure, so as to bring each part of the towel successively in close contact with the skin. The rubbing should be continued until the towel is warm, when it may be removed; the dry towel is then placed upon or wrapped about the part, and it is rubbed until the skin is dry and *well reddened by reaction.* The corresponding part of the opposite side is then treated in like manner. If the patient is decidedly neurasthenic, special attention should be given to the back; while if the case is one of cardiac insufficiency, special attention should be given to the chest, arms, and legs.

The hands are rubbed upon the towel, but the towel is not rubbed upon the skin. Particular attention should be paid to this. The effect desired is not produced by mechanical irritation of the skin, but by the assistance rendered the circulation by the intermittent pressure upon the tissues. The hands are applied with long, rapid, alternating strokes, falling upon the surface with sufficient force to give a decided percussion effect. The friction movements may be alternated every few seconds with gentle percussion (**1227**). The whole surface of the towel should be gone over constantly, so as to avoid chilling by evaporation.

In order that the desired therapeutic effect may be obtained,

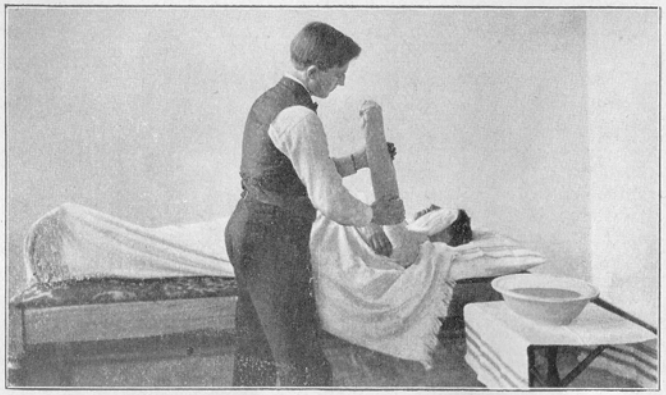


FIG. 99. COLD TOWEL RUB TO ARM (p. 649).

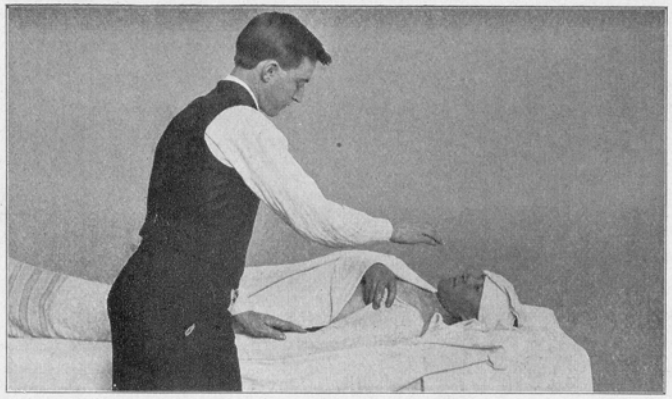


FIG. 100. COLD TOWEL RUB TO ARM — Patient Holding Towel (p. 649).

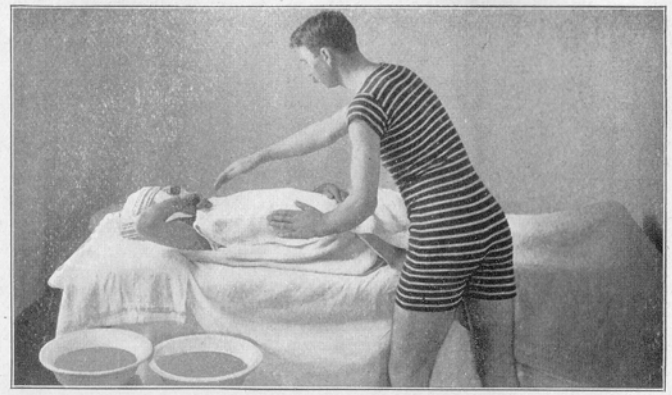


FIG. 101. COLD TOWEL RUB TO CHEST AND ABDOMEN (p. 649).

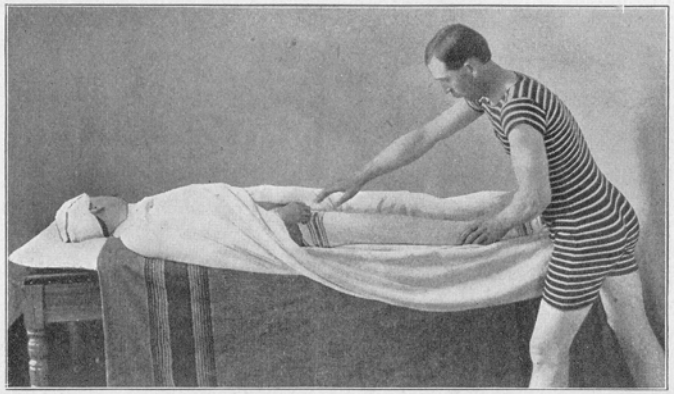


FIG. 102. COLD TOWEL RUB TO LEG (p. 649).

the temperature of the water must be maintained at the initial temperature. This may be accomplished by employing a number of towels, so that no towel is used twice in the same application. A plan which the author prefers as more practical, however, is the following: Two pails or bowls of water are prepared, one of which is ten degrees lower than the temperature at which the application is to be made. The usual temperatures will be 60° and 50°. The face, neck, and head are cooled with the cooler water. After a towel has been applied to a surface and rubbed until warm, it is dropped into the cooler water, where it remains while the part is being dried and rubbed. In preparing the towel for a new application, it is gathered and squeezed, then dipped into the other pail (60°) and wrung out.

An excellent plan for institution work, where abundant facilities are supplied, is the following: Have ready several good-sized, rather heavy linen towels. Fold each one to half the length, wet in the cold water, twist, and leave in the water ready to wring out quickly when wanted. With the patient lying on his back, covered by a Turkish sheet, and the head cooled by one of the towels, uncover the chest, apply a well-wrung towel, rub well, then dry. Then uncover one arm, let the patient hold it up, and quickly wrapping a wet towel around it, let him catch the upper end with the hand of the arm under treatment (Fig. 99), holding the other end at the shoulder by his other hand while the attendant rubs vigorously, or the patient may hold the towel at the shoulder only, the arm lying by his side (Fig. 100). Then treat the other arm, and each leg. The patient holds one end of the towel for the leg, and both ends for the trunk (Figs. 101, 102). He then turns upon his face, and passing one hand over his shoulder and the other around back of the hip, he holds the towel spread out upon his back (Fig. 103); or the towel may be held at the upper end only (Fig. 104).

If the patient is too feeble to assist, the towel may be

kept in place by making the friction movements with the two hands simultaneously and from the center toward the ends or sides. It is far better, however, that at least one end of the towel should be held by the patient, so that the attendant may make long strokes with strong pressure, thus increasing the mechanical effect, which is an essential part of this procedure, especially when employed for the excellent tonic effects to be secured by it.

A towel is applied to the back of each leg, and lastly one to the feet, as follows: While the patient lies upon his face, the feet a few inches apart and the soles turned up, a towel is prepared and spread out under the feet, extending up above the ankles. The feet are separated, and the ends of the towel turned over and wrapped around each foot (Fig. 105). The soles are then percussed, and the ankles, instep, and toes rubbed until the towel is warm. Special care must be taken in drying the feet, to rub them until warm. The soles of the feet are important vasomotor areas, and have extended reflex relations; hence the importance of keeping the feet warm.

In drying, the dry towel should be applied and held in place in the manner described for the wet towel, or a corner of the Turkish sheet may be drawn over the part in such a way that long strokes may be made without displacing it (Fig. 106), or the patient may assist by holding one side (Fig. 107).

The amount of water in the towel may be regulated to suit each case. When refrigeration or antipyretic effects are required, the towel must be very wet, and its application renewed upon the same part several times in quick succession.

If the case is one of cardiac insufficiency, the treatment should begin with a limb, and end with the application of the towel over the chest. By this means, the small vessels are first dilated and stimulated to activity, thus lessening the work of the heart before the more powerful stimulating effect of the application to the chest is brought to bear upon it.

For very feeble patients, the temperature of the water employed at first may be as high as 70° to 75°, but it should

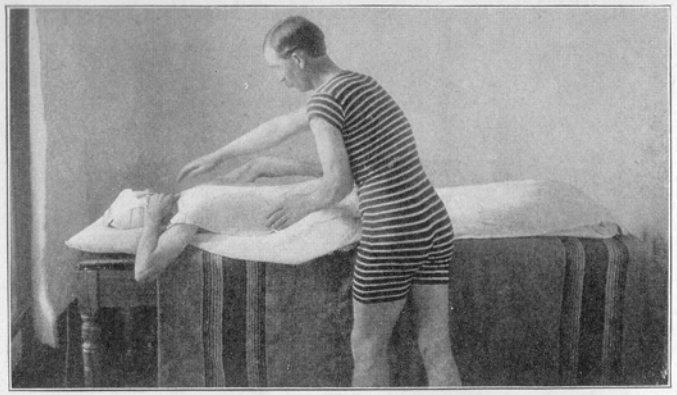


FIG. 103. COLD TOWEL RUB TO BACK — Patient Holding Towel in Place (p. 649).



FIG. 104. COLD TOWEL RUB (p. 649).

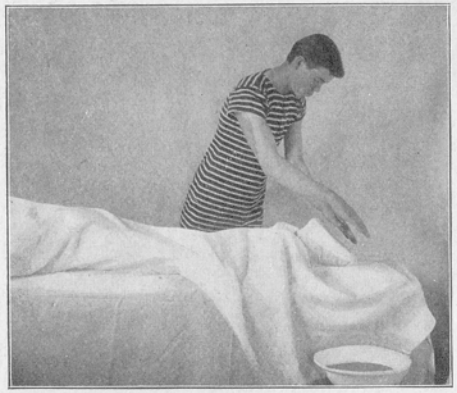


FIG. 105. COLD TOWEL RUB TO FEET (p. 650).



FIG. 106. DRYING PATIENT AFTER COLD TOWEL RUB (p. 650).

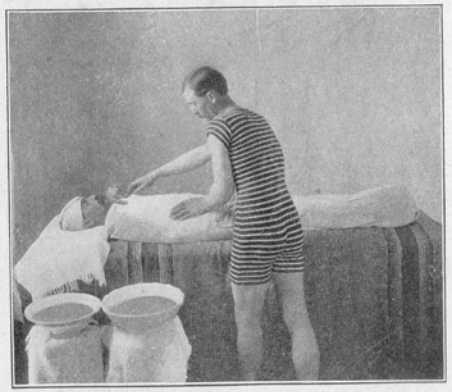


FIG. 107. DRYING PATIENT AFTER COLD TOWEL RUB (p. 650).

be lowered with each application until water at 55° or 60° may be used. Still better effects may be obtained at 50°.

The hot towel rub may be used when cold is positively contraindicated. As high a temperature as possible should be used (140° to 160°). Otherwise the method is the same.

Physiological Effects.—The physiological effects of the 1214
cold towel rub are precisely the same as those of the rubbing wet sheet, except that they are somewhat less pronounced. The nervous shock produced by the wet towel of a given temperature is very much less than that produced by the contact of the whole sheet with the surface of the body. At the same time, the reaction produced may be made just as complete as when the sheet is employed, and without producing any considerable degree of congestion of internal parts through retrostasis. As each part is successively treated, the cold application causes contraction of the vessels of the associated internal parts. As reaction occurs, the visceral vessels are dilated, and excited to increased activity. Thus vigorous fluxion is produced in one part after another until every internal organ has been awakened to new life and action, and all the bodily functions are quickened.

The fact that the inrush of blood and the succeeding reaction do not occur in all parts of the body at the same moment constitutes a most important distinction between the general rubbing sheet and the cold towel rub, the significance of which is great in the therapeutic applications of this procedure, since it renders the use of this measure possible and exceedingly useful in many cases in which the cold wet sheet as well as all other general cold applications must be interdicted, as in extreme cardiac weakness, acute renal congestion or inflammation, pulmonary or intestinal hemorrhage.

The intensity of the effect produced depends upon several factors, especially the following: –

1. The temperature of the water employed. Little effect is produced by water at a temperature above 60°, but a temperature of 70° to 75° may be used at the beginning in very

feeble patients with little power to react. The higher the temperature, the greater the amount of rubbing required to produce proper reaction.

2. The amount of water left in the towel when wrung out. The more water, the greater the thermic effect, because the greater the amount of heat abstracted from the skin. A very dry and very cold towel is very exciting, and if the rubbing is not excessive, may be even sedative and thermic.

3. The number of times the towel is applied in immediate succession.

215 **Therapeutic Applications.**—Cold towel rubbing, being simply a diminished or partial wet sheet rubbing, may be employed in precisely the same cases in which cold sheet rubbing is employed, where patients can not endure the whole sheet,

The cold towel rub is of value in fevers not only as a means of improving the skin circulation, but by moistening the skin and thus encouraging evaporation of water, it promotes heat elimination, which is one of the most positive of all indications in fever. Weyrich has demonstrated that friction alone may increase evaporation over 50 per cent. The cold towel rub, then, is not only a direct antipyretic means in febrile conditions, but promotes in a high degree heat elimination through evaporation from the skin, amounting to more than 100 heat units per hour. The cold towel rubbing, as well as cold friction, affords a valuable means of preparing the patient in adynamic febrile cases to receive the cold bath, or the cooling pack.

The cold wet towel may often be used advantageously after a fomentation to the spine either as a local or as a general application; also after fomentations to the abdomen and other parts as a means of preventing too pronounced sedative or depressing effects from the hot application. When thus used, the towel should be wrung very dry out of very cold water. If applied after a fomentation, the first application

should be made directly to the heated part. Cold wet-towel rubbing or cold friction at intervals of two or three hours is necessary to prevent depression of the heart and the central nervous system when prolonged hot applications are necessary, as in cases of acute nephritis.

This measure is of great service in the systematic treatment of chronic invalids, as a step in a progressive series of treatments increasing in vigor from wet-hand rubbing or cold friction to the shallow bath or the douche, and especially in the treatment of *anemia*, *chronic indigestion*, *neurasthenia*, and a long list of maladies requiring tonic measures, including *tuberculosis* of the *lungs*, *glands* (*scrofula*), *skin* (*lupus*), or *bones*, *chronic rheumatism* and *lithemia*, *diabetes*, *rickets*, *purpura*, *hemophilia*, *obesity*, *emaciation*, *dyspepsia*, *gastric ulcer*, and especially in cases of *cardiac weakness* either with or without organic or valvular lesion. In all these cases, great care must be taken to graduate the application, beginning with a very dry towel and lowering the temperature one degree each day till 40° is reached.

Contraindications.— In cases of asthma and cardiac affections attended by pronounced weakness of the heart or excessive compensation, the wet towel should not be applied to the chest. The chest should be rubbed with the moistened hand until good reaction is produced. Other contraindications are rare.

THE WET-SHEET RUB AND THE DRIPPING SHEET.

This procedure, perfected by Priessnitz, consists in a **1216** thorough rubbing of the body while enveloped in a wet sheet.

Requisites.— A linen sheet, a Turkish sheet, two towels, a tub containing hot water for the feet, a pail of water at 60° to 70°. Water at a higher or lower temperature may be employed when indicated.

Method.— The patient, being prepared, the head cooled in the usual way and protected with a cold wet towel, stands in the tub of hot water with the dry sheet wrapped about him.

The attendants prepare the wet sheet (Fig. 108), which should be wrung dry enough so it will not drip rapidly (Fig. 109).

When the sheet is ready, one assistant, holding one end of the linen sheet properly gathered in the right hand, and seizing the upper left-hand corner with his left hand, steps in front of the patient, while the other attendant withdraws the dry sheet and steps behind to assist. The patient holds up both arms, while the attendant in front places the upper left-hand corner of the sheet under his right arm (Fig. 110); the patient then lowers the right arm, holding the sheet in place, while the attendant passes the sheet quickly across the front of the body beneath the left arm, which is then also lowered. The sheet is then carried around the body by the assistance of the attendant who stands behind the patient, and pulls the bottom around. As the sheet is brought across the back of the patient, the attendant in front reaches over and seizes the upper edge of the sheet just above the point of the right shoulder, and pulls it first upward, then down upon the patient's chest (Fig. 111), while with his other hand he carries the sheet across the chest, covering the fold, and over the left shoulder, deftly tucking the corner under the edge of the sheet behind.

The attendant behind tucks the sheet between the patient's legs, which are then brought tightly together. The sheet is thus brought everywhere in close contact with the skin. As soon as the patient is thus enveloped,—an operation which should be completed in 5 to 8 seconds,—both attendants begin to rub vigorously, covering the whole surface as quickly as possible, one the legs and hips, the other the trunk and arms (Fig. 112). The rubbing should be continued for 1 to 3 minutes, or until the sheet is everywhere thoroughly warmed. The attendant should bear in mind that *the patient is not to be rubbed with the sheet, but over the sheet, with downward percussion strokes.* The bath does not depend for its effects upon irritation of the skin by the friction of the sheet, but upon the thermic stimulation and



FIG. 108. WET-SHEET RUB — Sheet Ready for Wetting (p. 654).

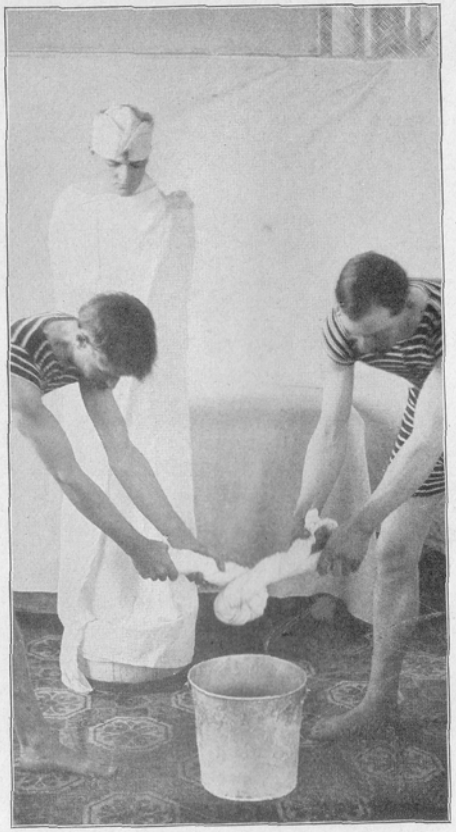


FIG. 109. WET-SHEET RUB — Wringing Sheet (p. 654).

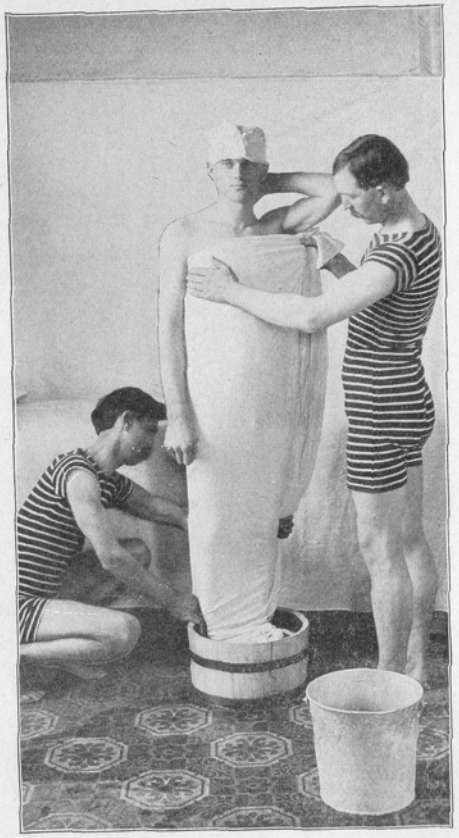


FIG. 110. WET-SHEET RUB — Applying Sheet (p. 654).

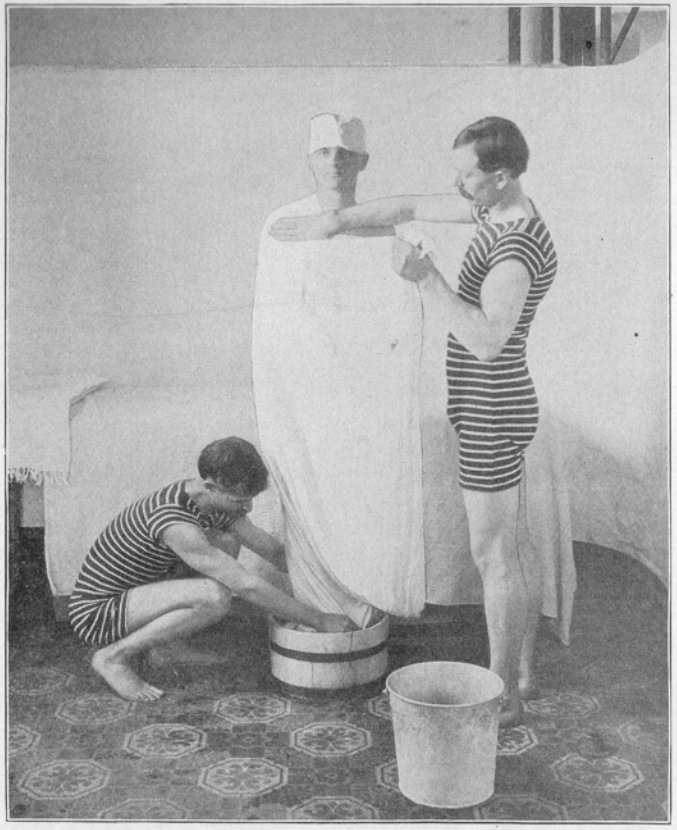


FIG. 111. THE WET-SHEET RUB. Applying the Sheet (Second Step).

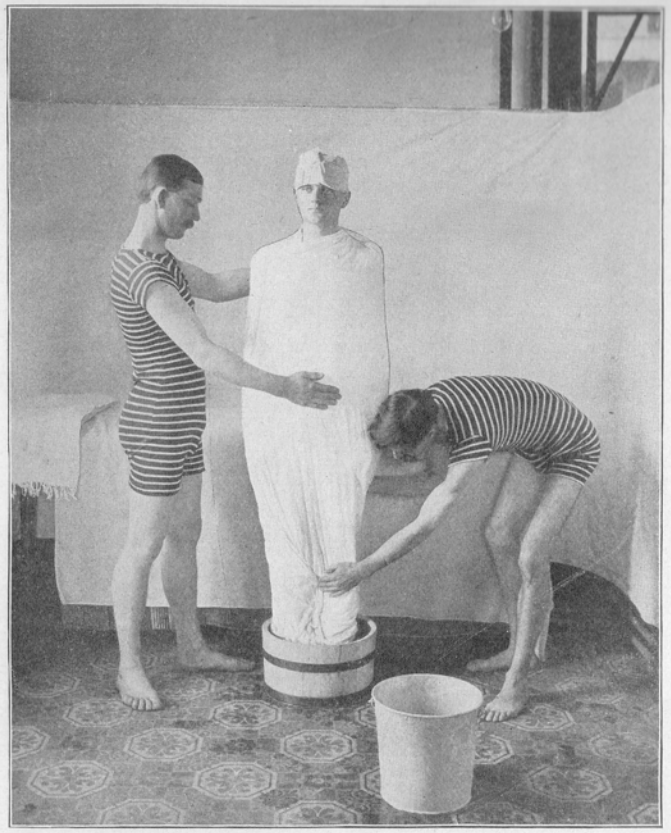


FIG. 112. WET-SHEET RUB (p. 654).

the assistance to the cutaneous circulation afforded by intermittent pressure upon the surface vessels. The rubbing movements are made with a sort of glancing percussion stroke from above downward. Percussion may be applied over the fleshy parts. Gentle patting may be applied to parts that are sensitive to rubbing. Care should be taken that the whole surface of the body is gone over many times and in rapid succession.

The rubbing must continue with vigor during the entire application. Very strong attendants are required, as a vigorous bath-man will usually find himself quite out of breath at the end of the procedure, if he has done his duty. When the sheet is well warmed, it is dropped, the Turkish sheet thrown about the patient, and the bath completed by vigorous rubbing over the Turkish sheet, followed by dry friction with the hand, with or without oil rubbing. Sometimes a Scotch douche follows the wet sheet before the drying.

The intensity of the bath may be readily varied in a number of different ways: (1) By the temperature of the water employed; (2) by the amount of water left in the sheet; (3) by using a thinner or thicker sheet; (4) by employing two or more wet sheets in succession, changing as soon as warm; (5) by the vigor of the friction movements applied; and (6) by the duration. This fact renders the rubbing wet sheet a most convenient measure for use outside of a regular hydriatic establishment, or where convenient appliances of various sorts are not at hand.

The longer the duration of the bath, the greater will be the thermic effect produced. Hence, when excitement of the nerve centers and tissue change is undesirable, the sheet should be wrung dry, the temperature of the bath should not be too low, the duration should be short, and the rubbing should be vigorous.

For very feeble patients the rubbing wet sheet may be applied in bed. Care should be taken to apply hot bags or hot fomentations to the feet during the application. For bed-

ridden patients the sheet may be applied in much the same way as when the patient stands. The sheet being spread upon the bed over a blanket, the patient is placed upon it, and raises his arms above his head while one side of the sheet is passed across the body, the edge being tucked under the trunk and between the legs. The arms are then lowered, and the other half of the sheet is drawn across the body in such a way as to include both arms and to cover the shoulders, the free corner being tucked well under the shoulder, and care being taken to exclude the air. The patient is then vigorously rubbed from head to foot, the whole surface being gone over as rapidly as possible. If there is a tendency at the first to chill from too rapid evaporation, a warm blanket should be drawn across over the wet sheet, and the friction applied beneath it. The rubbing should continue until the whole surface of the body is well reddened and the sheet warmed, usually 1 to 3 minutes. The sheet should then be removed and the patient at once covered with a linen or Turkish sheet and a blanket, and dried beneath the blanket.

When it is necessary to avoid retrostasis in the use of the rubbing wet sheet, as in cases of cerebral hyperemia and marked visceral congestion, the patient should stand in very hot water (104° to 110°) during the application.

The rubbing wet sheet may be applied several times daily when necessary to procure the desired effect. When a saturated sheet is employed, it is sometimes necessary to apply vigorous percussion in addition to friction in order to secure proper circulatory reaction. In applying the cold rubbing sheet, care must be taken to see that the patient's skin is in a condition to receive a cold application with benefit. If the surface is cold, it must be warmed by a hot shower or some other heating bath. The wet-sheet rub should never be given when the skin is cold, or the patient chilly or apprehensive of a chill.

1217 **The Dripping Sheet.**— In giving the dripping sheet, which is a much more vigorous thermic application than the rub-

bing wet sheet, two or three pailfuls of water at different temperatures should be in readiness. The sheet is applied thoroughly saturated with water, and dripping. The patient is not rubbed, but vigorously spatted for 20 to 30 seconds. Then a half pailful of water at a little lower temperature than that in which the sheet was originally wet may be poured over each shoulder, and the spatting or percussion resumed. When evidences of reaction appear in returning warmth, another pailful of water at a still lower temperature may be poured over the patient if desired; but so vigorous an application is seldom indicated. The usual temperatures employed are 70° for the sheet, 65° for the first pail, 60° for the second pail. When higher temperatures are employed, it is difficult to get good reaction, since the exciting effect of cold is necessary to arouse the nerve centers to the requisite degree to produce the thermic and circulatory reaction which this procedure is intended to provoke.

By energetic percussion outside the sheet, the cutaneous circulation is maintained, and so the bath may be prolonged until the desired effect has been attained. Care must, however, be taken to terminate the application at once when the slightest symptoms of secondary chill appear; that is, when the patient begins to lose the sensation of glow and warmth which follow the first chill from the contact of the cold sheet, and is threatened with shivering, with goose-flesh and blueness of the skin. The full development of these symptoms should not be allowed to occur.

In cases in which it is unwise to allow the patient to stand erect, the application may be made thus: Place upon a bed a rubber sheet for protection. Spread upon this a linen sheet wet in water at 75°, and slightly wrung. Place the patient on the sheet, envelop him quickly as for a wet-sheet pack (**1179**); then let two attendants proceed to encourage circulatory reaction by moderate percussion and gentle rubbing of the whole surface, giving special attention to the extremities. As the sheet is warmed, cool by splashing over it water at

60° to 70°, continuing the spatting, and cooling by rewetting, until the patient begins to shiver. Then remove the wet sheet, wrap in a dry linen or Turkish sheet, cover with a woolen blanket, and after fifteen minutes take the rectal temperature. Renew when the temperature reaches 102° F.

In fever cases with extremely feeble heart, the hot reclining dripping sheet is sometimes useful as a preparation for the cold towel rub or cold friction. The sheet should be very hot, and should be applied quickly.

1218 **Physiological Effects.**—This procedure slows the pulse and energizes the heart, at the same time that respiration is increased, contrary to the usual physiological law. Pleninger noted a slowing of twenty beats a minute, while respiration increased five breaths per minute. Thermic reaction is usually less marked than in the immersion bath, circulatory reaction predominating; but thermic effects are obtainable at will in any degree of intensity. As the result of an ordinary application the rectal temperature falls two tenths to five tenths of a degree, while the axillary temperature is elevated. The very pronounced and lasting circulatory reaction produced, secures a vigorous cutaneous circulation and an increased rate of blood movement in the whole body. The effects of this procedure are intermediate between the douche and the wet-sheet pack; it is a sort of wet-sheet pack in the first stage, with mechanical effects added.

At the first moment, the application causes deep, gasping respiration, and sometimes slight shivering; but these sensations quickly give place to more prolonged and deeper respiratory movements, with slowed heart action and general feeling of warmth and glowing of the skin, as reaction begins. This procedure, combining, as it does, the mechanical effect of friction with the thermic effect of cold, produces at first a general contraction of the small vessels of the skin, very quickly followed by active dilatation.

During the first period of contraction there is dilatation of the vessels of the brain, lungs, and abdominal viscera, quickly

followed by contraction when the blood returns to the skin with the reaction. Blood pressure is increased, as is also muscular capacity; there is improved assimilation of nitrogen, with increase of appetite and temporary lowering of temperature.

The most pronounced antipyretic effects, shown by lowering of temperature, are obtained by the use of a very wet sheet, a double sheet, repeated wetting of the sheet, by prolonged application, and by the use of the dripping sheet. By means of these several variations any degree of antipyretic effect may be produced. The most pronounced excitant effects are produced by a sheet wrung dry out of very cold water. The temperature ordinarily employed is 60°, but a lower temperature may be employed in robust patients, and a higher temperature (65° to 70°) with persons who are not accustomed to the use of cold water.

Therapeutic Applications.— A most important use for the 1219
cold dripping sheet is the lowering of temperature in cases in which the cold bath can not be readily employed. It may be used in such a manner as to secure all the good effects of the Brand bath without any of the inconveniences of that procedure. The author has employed this measure, with modifications, for more than twenty-five years in the treatment of continuous fevers, with excellent results.

Wet-sheet rubbing is a most excellent tonic procedure following the heating pack, the wet-sheet pack, the electric-light bath, and sweating procedures of all sorts. It has the advantage that it may be employed almost anywhere, as no apparatus is required; hence it is an especially valuable measure for use in the home. When tonic effects are desired, the sheet should be wrung very dry out of cold water (60°).

The fact that this procedure is capable of producing both thermic and mechanical effects of the most powerful character, and the readiness with which the intensity of the application may be modified, enables the physician to produce by this simple means alone nearly all the effects obtainable

by hydric applications; hence the rubbing wet sheet may be properly designated as a pre-eminently useful hydriatic procedure. If the occasion requires strong derivative effects, with the minimum amount of metabolic change, as in the case of feeble, bloodless patients, with small heat-making capacity, very thin sheets wrung very dry out of water of low temperatures (50° to 60°) may be employed. The rubbing will be very vigorous, and the duration short (1 to 2 min.).

If, again, it is desired to produce decidedly alterative effects, through the production of strong tonic thermic reaction, a thicker or double sheet, wrung less dry, and renewed if quickly warmed, the application prolonged to 3 or 4 minutes, affords a means for securing any degree of effect which may be desired. The continued friction of the surface maintains the movement of blood in the skin, and thus prevents the shivering and other unpleasant symptoms arising from the internal congestion, which would otherwise require a speedy termination of the application before sufficient reduction of the temperature had been secured to call forth the requisite degree of heat production and accompanying tissue change.

Further, if it is desired to produce antiphlogistic effects, the dripping sheet prolonged to 10 or 15 minutes, or the rubbing wet sheet, if sufficiently long continued, is capable of producing any degree of refrigerant effect desirable. There are few other therapeutic measures, and certainly no medicinal agent known to man, capable of producing such versatile and desirable therapeutic effects.

The rubbing wet sheet is an excellent tonic measure for those unable to endure the douche. It is especially valuable as a derivative measure in cases of *cerebral congestion* and in *disorders* of the *liver*, *spleen*, *lungs*, and *digestive viscera*, in which congestion is a prominent symptom, as in *chronic gastritis*, *chronic bronchitis*, the chronically disordered *liver of dyspeptics*. It may also be used in some cases of chronic *congestion* of the *pelvic viscera* in which pain is not a prominent symptom.

The inactive skin of *dyspepsia*, *rheumatism*, *gout*, and ***diabetes*** may be excited to activity by this procedure. In cases of *anemia*, *chlorosis*, and *neurasthenia*, aged persons and feeble women, the wet-sheet rub affords an excellent tonic measure, which may be employed anywhere, and without apparatus. It is particularly valuable in relieving the passive hyperemia of so-called *chronic gastritis* or *gastric catarrh* and allied affections of the small and large intestines, known under the various names of *chronic enteritis*, *intestinal catarrh*, *pseudo-membranous colitis*, etc. It is applicable likewise to the *chronic splenic* and *hepatic congestions* which follow and accompany *malarial infections*. In *congestion* of the *spinal cord*, in *hypopepsia*, *apepsia*, *constipation*, *dilatation* of the *colon* and *stomach*, and most other functional disorders of the digestive organs, the powerful derivative effects of the rubbing wet sheet are indicated. The dripping sheet may be employed in all cases in which it is desirable to increase metabolic activity, as in cases of slowed nutrition (Bouchard). It is hence valuable in *obesity*, *chronic rheumatism*, *gout*, and *diabetes*. Under its influence, the dry, dingy, inactive, hidebound skin of the chronic dyspeptic and the arthritic becomes clear, transparent, supple, moist, and elastic after a daily application for a few weeks, especially when accompanied by the use of some suitable sweating procedure once or twice a week, as the electric-light or vapor bath, or the wet-sheet pack.

The wet-sheet rub affords an excellent remedy in *insomnia* due to *cerebral congestion* without special irritability of the cerebral cells. The effect of the application in stimulating circulatory reaction may be increased without thermic reaction by the addition of common salt to the water in the proportion of two pounds to the gallon (60°, 1 or 2 min.).

The rubbing wet sheet is especially indicated in insomnia when the skin of the sleepless patient is hot and dry. A temperature of 75° to 85° should be employed rather than a lower temperature, so that thermic reaction may be avoided.

When the skin surface is cool, the rubbing wet sheet produces undesirable effects in insomnia, increasing the wakefulness by exciting reflexes from the skin.

In cases of *cardiac insufficiency* due to valvular disease of the heart, the rubbing wet sheet renders valuable service as a means of stimulating the peripheral heart and fixing a considerable amount of blood in the skin. The dilated central heart is thus relieved, its action is slowed and energized, the whole circulation is improved, and the author has seen not a few cases permanently helped by this means when other measures had failed to afford more than temporary relief.

It may be applied twice daily in cases of *cardiac dropsy* if the patient has a fair degree of vigor. Generally it should be preceded by a short heating of the skin by means of the electric-light bath for 3 to 5 minutes, the vapor bath for 4 minutes, or a very short hot immersion bath (104° to 106°, 2 min.). Great care must be taken to avoid weakening the heart by overheating the patient. If necessary, an ice-bag may be employed over the heart during the heating process.

Gilles de la Tourette * has successfully employed the rubbing wet sheet to combat the febrile symptoms which occur in *exophthalmic goiter.*

This procedure furnishes also an excellent substitute for the spray or shower douche as a means of fixing the blood in the skin after a sweating pack, a vapor or an electric-light bath, or other heating processes, when a douche apparatus is not available. It may be advantageously used in cases of *myxedema*, and especially during the febrile exacerbations which frequently occur in this disease.

In the adaptation of the temperature of baths to different cases, it should be borne in mind that a low temperature is necessary for good effects with wet-sheet rubbing, on account of the quick reaction required. The body is exposed during the application to the cooling effects of evaporation, which to

**Progrès Médical*, 1890, p. 101.

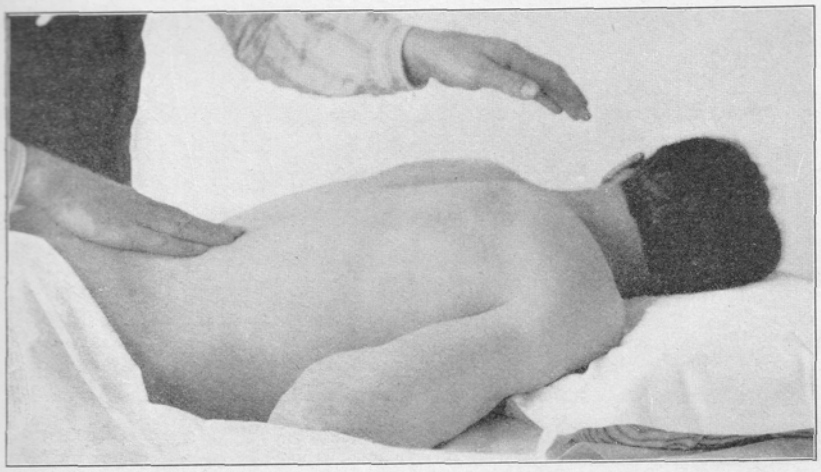


FIG. 113. FRICTION OF SPINE (p. 663)

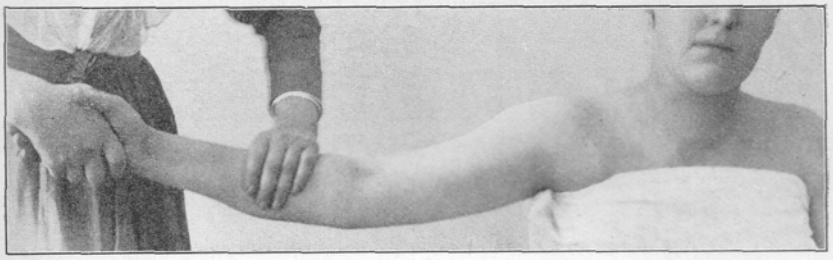


FIG. 114. CENTRIPETAL FRICTION (p. 664).

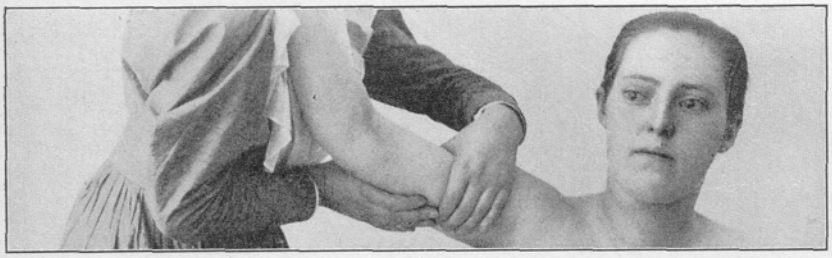


FIG. 115. CIRCULAR FRICTION (p. 664).

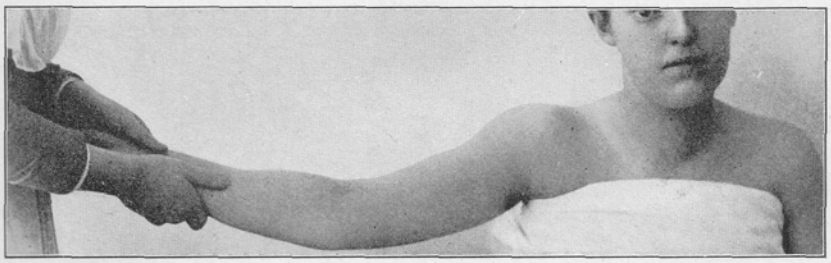


FIG. 116. SPIRAL FRICTION (p. 664).

a considerable degree interferes with reaction; hence the powerful influence of a low temperature, as well as the mechanical effects of friction and percussion, is necessary to secure the prompt return of blood to the surface after the primary contraction of the peripheral vessels occasioned by the first contact of the cold sheet with the skin. The best effects are obtained by temperatures between 50° and 60°.

Contraindications.— The principal contraindications for 1220
the rubbing wet sheet and dripping sheet are *cutaneous eruptions*, *extreme hyperesthesia* of the skin, *acute visceral inflammation*, *general neuritis*, severe *neuralgic affections* involving large nerve trunks, and such extreme feebleness of the circulation that proper reaction can not be secured. Persons who can not endure temperatures below 80° should not receive this bath, as reaction will be deficient. Other measures should be applied until reaction is improved, such as the cold wet-hand rub, cold mitten friction, and the cold towel rub.

DRY FRICTION.*

Massage is the natural accompaniment of hydrotherapy. 1221
The following procedures,— fulling, tapping, hacking, kneading, together with friction and joint movements,— encourage and assist in the development of the processes of accelerated tissue change and restorative metamorphosis which are set up by tonic hydriatic processes. Massage may be employed in such a way as to produce sedative as well as tonic and alterative effects of both a remote and a local nature, the same as hydriatic procedures.

Friction (Fig. 113) is simply one of the several valuable procedures of massage which may be advantageously employed in connection with hydriatic measures. It consists in systematic rubbing of the surface with the bare hand.

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* For a full description of the forms and methods of massage, see the author's work, "The Art of Massage," Modern Medicine Publishing Company, Battle Creek, Mich.

Method.— In the ordinary employment of friction, as in drying a patient after a bath, the rubbing should be applied in both directions, as the effect desired is not only mechanically to assist the blood movement toward the heart, but to stimulate the cutaneous circulation.

In the systematic application of friction, the movements should, as a rule, follow the blood-vessels. This is especially true in friction of the extremities. We quote the following brief description of friction from the author's work on massage: —

"In this procedure the whole or a part of the hand is moved over the surface with a considerable degree of pressure, the pressure varying in different parts — heavy over thick, fleshy masses, light over bony surfaces and thin tissues. The pressure, however, should never be so great that the hand will not readily slip over the surface, nor sufficient to interfere with the movement of the blood in the arteries.

"The principal effect of friction is upon the superficial veins, the large venous trunks, and the lymph spaces and vessels. In the application of friction, the thumb only, or the whole or a greater part of the palmar surface of the hand, is brought in contact with the part operated upon. Five different forms of friction may be described, as follows: —

"*Centripetal friction* (Fig. 114), in which the movement is in the direction of the blood current in the veins, chiefly applicable to the extremities, the movement being from below upward, and from the hands and feet toward the body, the thumb or palmar surface of the hand being employed.

"*Centrifugal friction*, in which the movement is opposite to that of the blood current.

"*Circular friction* (Fig. 115), applicable to the extremities. The limb is grasped by both hands, which make an alternate wringing or twisting movement, beginning at the hand or foot and extending upward.

"*Spiral friction* (Fig. 116), a sort of combination of the preceding, executed with one hand, which progresses from

the lower, or distal, to the upper, or proximal, end of the part with a sort of spiral movement.

"*Rotary friction* (Fig. 117), in which the hands are made to move over a broad surface in an elliptical, circular, or semicircular direction; especially applicable to such fleshy areas as the hip and that portion of the back lying above the spines of the scapulæ. In applying rotary friction, it is often necessary for one hand to support the tissues while the other hand is executing the movements.

"*Rate of Movement.*—The rate of the movement will necessarily vary according to the length of the strokes, and hence differs in different parts of the body. The rate may be from thrity to one hundred and eighty strokes per minute.

"*Direction of Movement.*—The direction of the movement in friction must necessarily vary more or less, according to the part operated upon. The general rule is to follow the large veins. Special care should be taken, in the treatment of the extremities, to follow the large venous trunks, making firm pressure directly over the large veins with the thumbs, passing from below upward.

"In the treatment of the forearm, the masseur will give special attention to the *radial* vein, which runs along the outer and anterior portion of the forearm; the anterior and posterior *ulnar*, which course along the anterior and posterior aspect of the inner border of the arm; and the *median*, which lies along the middle of the anterior surface of the forearm (Figs. 118 and 119).

"In the upper arm, special attention will be given to the *cephalic* along the outer side, and the *basilic* along the inner side, of the arm (Fig. 120).

"In applying friction to the leg, the thumb should at first be passed with firm pressure over the *long saphenous*, the course of which is from the instep along the anterior inner portion of the leg to the groin and the *short saphenous*, the course of which is from below the outer malleolus along the outer and posterior portion of the leg to the bend of the knee (Fig. 121).

"Centripetal friction is applied to the following parts in the direction designated: —

"*Head*, from before backward, and above downward.

"*Neck*, downward.

"*Back*, above shoulder-blades, circular; from shoulder-blades to sacrum, down; in the region of the loins, from the sides toward the spine.

"*Hips*, circular.

"*Chest*, from the sternum toward the axilla.

"*Abdomen*, upper part, from above downward and outward; lower part, from the median line downward and outward.

"*Arms and legs*, from below upward.

"*To promote absorption*, rub toward the heart (centripetal friction).

"*For sedative and derivative effects* upon the viscera and nerve centers, rub downward (centrifugal friction).

"Rubbing upward, or in the direction of the venous blood current, *increases the activity* of the circulation.

"Rubbing downward *decreases vascular activity.*

"In the application of friction, pressure should always be uniform for the part operated upon, and should be carefully graduated to meet each particular case.

"As a rule, some lubricant should be used, — fine vaseline, cocoanut oil, cacao-butter, or talcum powder.

"Friction is applicable to all parts of the body, but is especially useful to the limbs, head, and neck. It should always be used at the beginning of the application of massage, if the surface is cold.

"In the application of friction to large parts, both hands should be used either together or in alternation. In the treatment of a part which is small, it may be steadied by one hand while being treated by the other.

"*Mode of Applying Friction to Different Parts.* — A systematic order and method is essential in the application of friction to different parts of the body, which may be described for the chief divisions of the body as follows: —

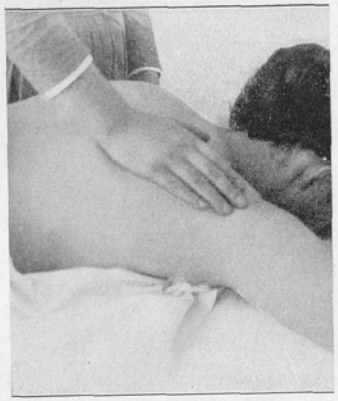


FIG. 117. ROTARY FRICTION (p. 665).

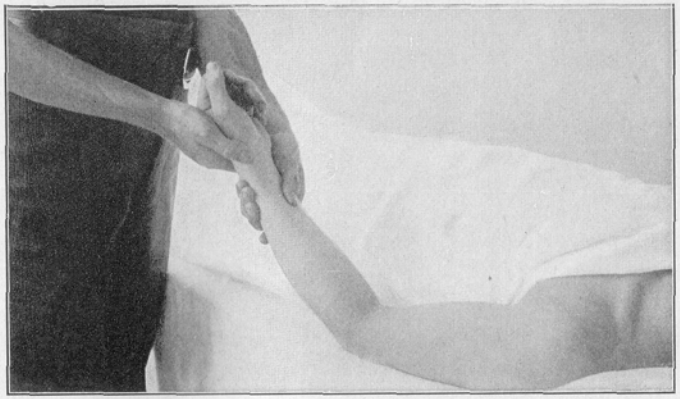


FIG. 118. FRICTION — Emptying Veins of Forearm (p. 665).

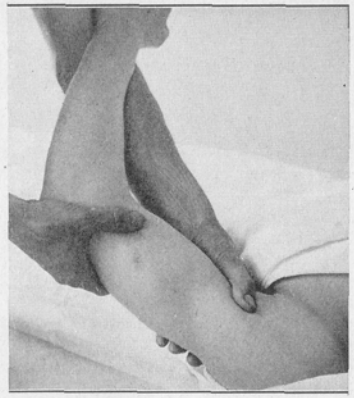


FIG. 120. FRICTION — Emptying Veins of Upper Arm (p. 665).

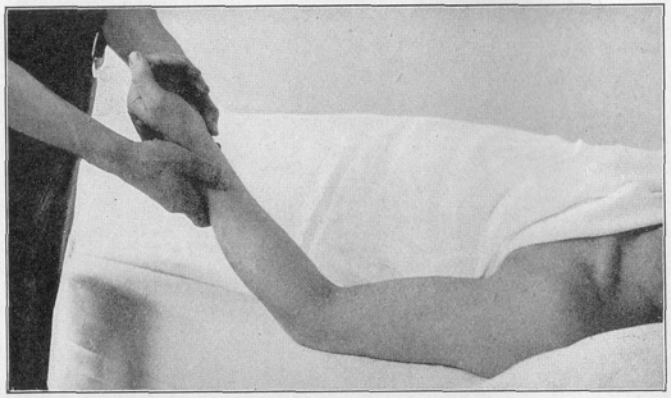


FIG. 119. FRICTION — Emptying Veins of Forearm (p. 665).

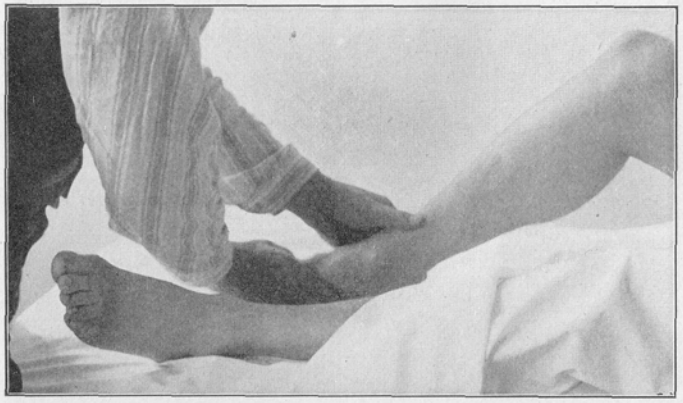


FIG. 121. FRICTION — Emptying Veins of Leg (p. 665).

"*The Hand.*— The patient's extended hand being allowed to rest in one hand of the operator, with the dorsal surface up, the masseur, holding the fingers of his other hand firmly extended, applies the tips of his fingers to the patient's hand in such a way that they will fall into the grooves between the adjacent fingers and metacarpal bones. The fingers are then pushed along in these grooves from the roots of the nails to the wrists. After repeating the movement several times on the back of the hand, the patient's hand is turned so that the palmar surface will be up, and the same movement repeated as before, with the modification that the fingers are carried a little farther up the wrist until the heel of the operator's hand rests in the hollow of the patient's hand, when slight rotary movement and firm pressure should be made, for the purpose of compressing firmly and emptying the numerous veins of the fleshy portion of the palm.

"The movements upon the back of the hand should be at the rate of sixty a minute; on the palmar surface a smaller number of movements will be executed per minute on account of the pause for one or two seconds in making rotary friction in the palm after each centripetal stroke.

"*The Forearm.*— With the arm of the patient half flexed, the masseur, facing the patient and operating with both hands, should make strokes from wrist to elbow, first with one hand upon one side, and then with the other hand upon the other side of the arm, in such a manner that each hand will include one half the circulation of the forearm, both thumbs resting upon the front of the arm. The operator may, if he prefers, stand with his back to the patient, making the strokes alternately with the two hands, as before.

"The masseur should keep constantly in mind the fact that firm pressure is to be made only with the ascending friction stroke. The hand is allowed to glide lightly over the surface in the descending or stroking movement, as a soothing measure, and not for the purpose of applying friction.

"In the treatment of very feeble persons, the patient may

be too much fatigued if the operator works with both hands at once, thus leaving him to support his own arm. In such case the patient's arm should be supported by the masseur, who will grasp the patient's hand with his own right hand, or the left hand with his left, applying spiral friction with the other hand upon the front side of the arm, then changing hands to operate upon the back surface of the arm.

"*The Arm.*— Work the arm in a manner similar to that described for the forearm.

"*The Shoulder.*— In applying friction to the shoulder, the masseur faces the side of the patient, operating with the two hands in alternation, following the surface of the joints, and always taking care to work centripetally; that is, toward the heart or toward the center of the body, and taking pains to follow the irregularities of the surface. The under as well as the upper side of the shoulder should receive attention.

"*The Foot.*— Begin with the hand, by friction with the ends of the fingers upon the dorsum of the foot, the operator standing in such a position as to face the sole of the foot. After finishing the dorsal surface, change the position so as to face the side of the foot, and make alternate transverse movements with the two hands on both sole and dorsum, working vigorously from toes to heel and instep. Lastly, extend the friction movements to the ankle, working with both hands, and following the grooves on each side of the tendon Achilles.

"*The Leg.*— With the leg half flexed upon the thigh, standing facing the patient, the masseur applies friction to the calf of the leg from ankle to knee, making eight or ten strokes, then turns his back to the patient, and operates upon the front of the leg by means of the thumbs working in alternation.

"*The Thigh.*— Standing with his back to the patient, the masseur grasps the leg in such a manner that the fingers fall behind and the thumbs in front, and makes very firm but

rather slow strokes from knee to groin, not forgetting to give the knee due attention.

"*The Chest.*— The patient's arms should be separated a little from the sides, so as to straighten the outer portion of the pectoral muscles. The masseur, standing at one side, and facing the patient's feet, makes strokes from the insertion of the pectoral muscles at the humerus toward the median line, beginning at the upper border, just below the clavicle. The two sides may be operated upon simultaneously, or in succession, both hands being employed upon one side, one hand following the other in the movements. In progressing downward, the movements should be reversed below the pectorals, and the hands should be carried as far around the sides as convenient, care being taken to work toward the axilla above, and to follow the direction of the ribs and cartilages, until the whole surface has been covered, from the clavicle to the lower border of the last ribs

"*The Abdomen.*— Facing the patient, the masseur first makes long strokes from the upper to the lower portion of the abdomen, one hand following the other over the recti muscles, the two hands operating simultaneously over the lateral portions. After covering the whole surface six or eight times in this manner, strokes should be made more exactly in the direction of the veins, as follows: At the upper part of the abdomen, make strokes downward and outward, following the direction of the lower cartilages; for the middle portion, make strokes from the median line outward, reaching around as far as possible; for the lower portion, make the strokes downward and outward, in the direction of the hip joints.

"*The Neck.*— Facing the patient, place the hands one on each side of the head in such a manner that the little fingers will rest in the groove behind the lower jaw, the other fingers resting upon the mastoid processes and the inner border of the heels of the hands touching. Move the hands downward, and at the same time rotate them inward, so as to bring as large a portion of the palmar surface as possible in contact

with the neck. At the lower border of the neck, move the hands outward toward the shoulders. After a few strokes, carry the hands a little farther back around the neck, so that as they move downward, the thumbs will rest one on each side of the larynx, thus compressing all the veins of the neck, both the superficial and the jugular, which lie deep. Finish with a few strokes applied to the back of the neck, starting at the occiput, and carrying the strokes downward and outward to the point of the shoulder.

"*The Face.*— Standing facing the patient, the operator places the palmar surfaces of his hands in contact, then applies them to the patient's face in such a manner that the little fingers touch the forehead at the median line. Separating the hands at the ulnar border, they are gradually spread out, as in opening a book, until the little fingers rest upon the temples, and the tips of the thumbs fall at the middle of the forehead.

"Fixing the thumbs at this point, the outer borders of the hands are moved downward by lateral flexion at the wrist until the forefingers fall at a level with the eyes. The whole hand is then moved downward in such a way that the nose is grasped and compressed between the thumbs while the palms of the hands and the fingers cover the cheeks. The movement is continued downward and finished by bringing the hands together below the chin. The object kept in view should be to bring as much of the hand as possible in contact with the face, and to touch every portion of its surface.

"*The Head.*— With the patient sitting or half reclining, and the masseur standing behind, the ends of the fingers and thumbs, with the fingers slightly flexed, are placed firmly in contact with the scalp, and a movement executed similar to that employed by a barber in shampooing. The mistake must not be made of applying the friction to the hair instead of the scalp. The movement begins at the vertex, gradually extending to the borders of the hairy scalp.

"*The Hip.*— In friction of the hip a very considerable amount of pressure is admissible, as the muscles and fleshy masses are very thick and firm. In applying friction to the hips, the masseur may face either the head or the feet of the patient.

"1. Make rotary friction upon the two sides simultaneously or in succession. In very fleshy persons it will be found necessary to support the tissues with one hand while operating with the other, on account of the great mobility of the muscular mass and the roughness of the skin, so frequently encountered in this region of the body.

"2. Apply centripetal friction, working from the great trochanter toward the crest of the ilium, and along the crest of the ilium from behind forward.

"*The Back.*— The patient lies upon his face, the masseur facing his head.

"1. A few light strokes are first applied from the occiput to the sacrum, along the center of the back, one hand following the other. The lateral surfaces are then covered by the two hands working simultaneously from above downward, and rotary friction is administered with greater pressure to the fleshy mass lying above the shoulder-blade. The two sides may be treated simultaneously or in succession, one hand being used to support the tissues. The latter method is usually necessary in very fleshy persons.

"2. From the shoulder-blades to the hips, lateral strokes are made, the masseur standing with his left side to the patient, facing his feet, the hands being placed as far around the sides as convenient, and simultaneously drawn toward the spine, the movement ending with the hands in contact. Great care should be taken to follow the ribs in the region of the thorax, which will give the movements a semicircular direction.

"3. Separating the index and middle fingers of the right hand, place one on either side of the spinous processes, and making firm pressure, move the hand downward from the occiput to the sacrum. The object should be to crowd the

ends of the fingers as deeply into the tissues as possible on either side of the spinous processes, so as to influence the dorsal spinal veins. If necessary, the left hand may be used to increase the pressure.

"4. Finish the back by a few light strokes from above downward, using both hands simultaneously, covering as much surface as possible with the fingers in contact."

In the employment of friction in connection with hydrotherapy, the deliberate and elaborate methods above described are not always necessary or advisable. In cases in which the purpose is simply to encourage circulatory reaction and warm the skin, the whole surface should be gone over in a very vigorous manner, employing the larger movements as above indicated, while omitting the finer details, so that too much time shall not be lost, thus giving opportunity for chilling by evaporation. In many cases, however, it is advantageous to apply thorough and systematic friction after the patient has been well dried, not only as an aid to complete reaction, but as a means of supplementing the effects of the hydriatic application. In such cases, the methods described for different parts of the body may be followed out in detail.

When dry friction is quite disagreeable or produces marked irritation of the skin, the surface may be lubricated with talcum powder, fine vaseline, or cacao-butter.

If it is desirable to increase the stimulating effect of the friction to some degree, vinegar, or mustard water (a tablespoonful of ground mustard infused for ten minutes in a pint of hot water) may be employed, but these chemical stimulants are rarely needed.

222 **Physiological Effects.**— The physiological effects of friction have been dwelt upon at length in an earlier chapter (**591**). Briefly summarized, these effects, as determined by Naumann* and Röhrig,† are as follows:—

1. Very light friction causes contraction of the surface

* Naumann, Prager, Viert, 1867.

† Röhrig, *Deutsche Klinik*, p. 254.

vessels, rise of blood pressure, and slight elevation of temperature.

2. Moderate friction causes, first, contraction of the blood vessels, with rise of blood pressure, then dilatation of the cutaneous vessels, with increase of blood movement and fall of temperature.

3. Very vigorous friction produces, almost from the very beginning, extreme dilatation of the small vessels, the stage of contraction being so brief as to be scarcely distinguishable; the pulse is slowed to a marked degree, also the respiratory movements. Heat elimination is so increased that the temperature is lowered to a very marked extent, one observer reporting a lowering amounting to 1.8° F. The amount of oxygen consumed as well as CO_2 is increased by friction, also the quantity of urea. When extremely violent friction is applied, albumin has been known to appear temporarily in the urine; in experiments upon animals the general temperature falls very decidedly, while both heart and respiration fail.

In hydrotherapy the effect usually sought is that of moderate friction; namely, preliminary contraction of the blood-vessels, followed by dilatation. By this means, the reaction which follows the cold application will be encouraged. The vigor of the application should be just sufficient to slightly encourage heat production without at the same time increasing heat elimination to such a degree as to cause an excessive loss of heat. In this regard, friction seems to operate in precisely the same manner as exercise. Too violent exercise after a cold bath, for example, causes an excessive loss of heat, and consequently, exhaustion. The same may be true of friction, whether the patient rubs himself or is rubbed by an attendant, if the application is too vigorous and long continued.

All the cutaneous functions are excited by friction. The skin becomes oily through stimulation of the sebaceous glands; and, according to Weyrich and Winternitz, perspiration may be increased more than 50 per cent. The tempera-

ture of the skin is elevated from two degrees upwards. Winternitz has shown that heat elimination may be increased more than 95 per cent. The powerful influence of friction in promoting heat elimination is readily shown by a simple observation based upon a method of determining the amount of heat elimination elsewhere pointed out (page 316). Increase by friction of the skin temperature of a patient with a warm skin, amounting to two degrees (95° to 97°), increased his heat elimination to the extent of 7 per cent.; while in the case of a patient with a cold skin warmed to the extent of ten degrees by friction (85° to 95°), the increase in heat elimination amounted to 66.6 per cent.

The mechanical effects of friction depend upon the direction in which it is applied.

1223 *Centripetal* friction, that is, dry friction movements made in the direction of the blood current in the veins, accelerates the movement of the blood toward the heart, and thus increases the vital activity in the part to which it is applied, the movements constituting a sort of pumping process by means of which the arterial as well as the venous circulation is accelerated. The lymph spaces and channels, as well as the blood-vessels, are emptied, and the lymph circulation is thus encouraged. The activity of the vital exchanges is increased, the tissues are rapidly freed from the waste matters produced in them, an increased amount of oxygen and of nutritive materials is brought to the part, and thus all the metabolic processes are encouraged.

1224 *Centrifugal* friction, in which the movements are made in a direction opposite to that of the venous blood current, retards the circulation, lessens vital activity, and hence produces a sedative effect.

In hydrotherapy the friction is for the most part applied either centripetally or in both directions.

1225 **Therapeutic Applications.**— Either moist or dry friction is employed in connection with nearly all hydrotherapeutic procedures. Dry friction naturally follows nearly every appli-

cation of water. After cold baths, friction must always be employed for 3 to 5 minutes or longer. It may be moderate in intensity, so that the loss of heat shall not be so great as to induce secondary chill or vital exhaustion.

After a hot bath, vigorous friction movements are sometimes needed to encourage the effect of the bath by increasing cutaneous circulation and inducing perspiration. Care must be taken to protect the patient by warm covers. If the purpose of the hot bath is simply to produce a derivative effect, general perspiration being undesirable, care must be taken to avoid violent friction.

Light friction is applicable to cases in which the skin is congested and contraction of the blood-vessels desirable, such a condition as exists, for example, in the "feverishness" experienced in connection with a severe cold. This fact seems to have been discovered by the native masseurs of China, to whom the world is very largely indebted for the art of massage. A traveler in China informed the author that when at one time suffering from a severe cold, he employed a blind Chinese masseur, who immediately proceeded to administer very gentle centrifugal friction, and refused to employ centripetal movements, notwithstanding the request of the gentleman that he should do so, the latter supposing that the operator through ignorance was giving to his movements a wrong direction. Evidently the experience of the native manipulator had taught him that a hot, flushed skin should be stroked in a centrifugal rather than a centripetal direction. In the application of friction, either moist or dry, this principle must be kept in mind. If the tissues have been overexcited by excessive manipulation, if pain has been induced, or if excessive reaction has been occasioned by a Scotch douche, or the skin overexcited by a vapor, Russian, electric-light, hot immersion, or other heating process, an excellent antidote is offered in centrifugal friction applied in the form of gentle stroking.

A hot, flushed skin resulting from vasomotor disturbance

rather than a rise of temperature, is a condition not infrequently met in neurasthenics, and is often a distressing symptom in connection with the menopause. Centrifugal friction is indicated.

Friction is especially indicated in cases of *inactive, hide-bound skin*, when the skin is dingy, jaundiced, pale, cold, or insufficiently lubricated, the result of deficient activity of the oil glands.

Dry friction is excellent in *Bright's disease* and *diabetes*, either with, or independently of, appropriate water applications. It is also of great value in cases of very weak and feeble patients, in fever *convalescents*, in *consumptives* when in a nonfebrile state, in *asthmatic* persons suffering from *chronic bronchitis*, who often have a very strong antipathy to cold water, and are very sensitive to weather changes; also in *emaciation* and *dyspepsia.*

Dry friction may be advantageously employed as a means of lowering temperature in cases of *fever* in which the surface of the body is cold. The skin should be rubbed, preferably in a centripetal direction; that is, in the direction in which the venous blood flows; and the rubbing should be continued until the surface is warmed. The elevation of the surface temperature to the amount of ten or twelve degrees by rubbing may increase the rate of heat elimination 60 or 75 per cent. Lubrication of the surface with oil in connection with the rubbing enhances its effect, not only by facilitating the friction, but by increasing the loss of heat by radiation (**1232**).

In rubbing the patient, both in the bath and afterward, it is well to keep in mind the fact that rubbing is of special value at certain points. These points are as follows: First, the extremities; second, the back; third, the chest; fourth, the parts which are in immediate relation with external pain or internal congestion. For example, in cases of cerebral hyperemia, special attention must be given to rubbing the legs and arms. Again, in case of *pelvic* pain, the lower part of the back should be rubbed vigorously; for *ovarian* pain,

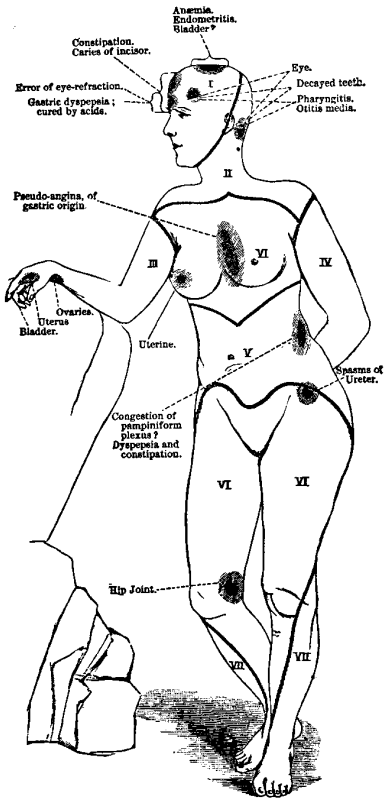


FIG. 122. Cutaneous Areas which are the Seat of Reflex Pain (p. 677). (Dana)

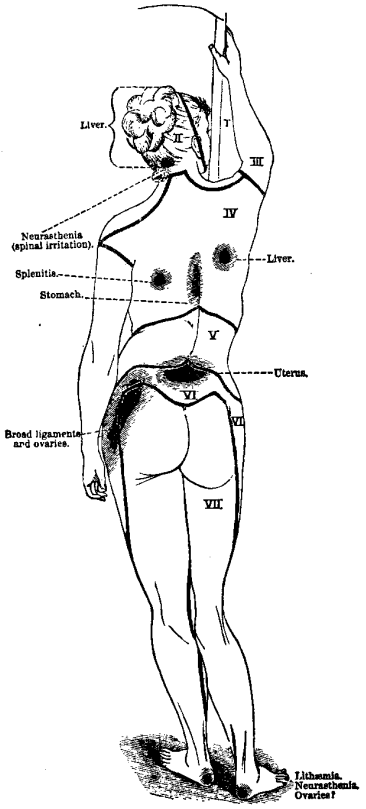


FIG. 123. Cutaneous Areas which are the seat o Reflex Pain (p. 677). (Dana)

the outer surface of the hips; for *gastric* pain, the dorsal region of the back; for *splenic* pain, under the left shoulder-blade; for *hepatic* pain, under the right shoulder-blade; in *neurasthenia*, the back of the neck, a common seat of pain, should receive especial attention; in *cerebral anemia* and in *uterine* disorders, the top of the head; in *constipation*, the abdominal surface; in *hypopepsia*, the epigastric region; and in *eye strain*, the supra-orbital and temporal regions; in certain *ovarian* disorders and some forms of *neurasthenia*, the hands and feet, especially the heels, wrists, and finger joints. These areas are shown in Figs. 122, 123, copied from Dana.*

A most valuable application of friction is in the treatment of *sprains*. At first, centrifugal friction — gentle downward stroking — should be applied. After the first forty-eight hours, centripetal friction may be used to increase the movement of blood through the part. The application should be made, not to the joint at first, but to the surfaces above the joint or between it and the heart, thus causing dilatation of both the arteries and the veins connected with the part. The blood channels being enlarged by this means, the movement of blood is accelerated and the healing process facilitated.

Contraindications and Precautions.— In some persons the 1226
skin is so sensitive that friction proves too exciting, giving rise to *insomnia*, *nervous irritability*, and general discomfort. Such persons are generally good subjects for the neutral bath and very gentle tonic measures.

Very light friction of the general surface hinders reaction by causing contraction of the blood-vessels. The effects on both the surface vessels and the heart are essentially the same as the first effect of a short, cold application. Hence, very light friction should be carefully avoided after a cold application, but may be employed with possible advantage after a hot application. On the other hand, energetic, but not violent, friction encourages the tonic reaction of cold, acting

* "A Clinical Study of Neuralgias."

in harmony with the vital movements of normal reaction, and hence naturally follows the cold bath.

Excessively severe or violent friction after a cold bath occasions depression of both heart action and respiration, and also gives rise to excessive loss of heat and too great activity of tissue change, producing various untoward effects, such as, (1) a secondary chill or succession of chills; (2) sweating and consequent depression, thus converting an application intended to secure a tonic effect into a reducing or sedative application; (3) nervous exhaustion and fatigue from excessive demands upon the reflex centers of the spine.

Care must be taken after cold applications of any sort, to avoid such vigorous friction as to induce perspiration.

It is especially necessary to avoid too vigorous rubbing after cold baths during the hot season, when the heated atmosphere encourages excessive reaction and perspiration. Gentle centrifugal friction may be properly and profitably employed as a means of combating excessive reaction, when this has been produced by a too cold bath, by too warm wrappings after a bath, by excessive exercise, or even by too prolonged or violent friction following the cold bath. If after tonic applications, perspiration appears, the effect of the bath has been spoiled, and the patient will be weakened instead of strengthened by it; hence it is easy to convert a tonic application into one of a very different character, thus producing most undesirable results, by neglecting properly to supervise the drying and rubbing of the patient after the bath.

On the other hand, care must be taken to avoid the opposite error. Very light, inefficient friction after a cold bath results in contraction of the blood-vessels, whereby reaction is hindered instead of encouraged; and the more prolonged an inefficient application of this sort, the more pronounced will be the ill effect produced.

It should be remembered that the effects of friction upon the heart closely resemble those resulting from irritation of

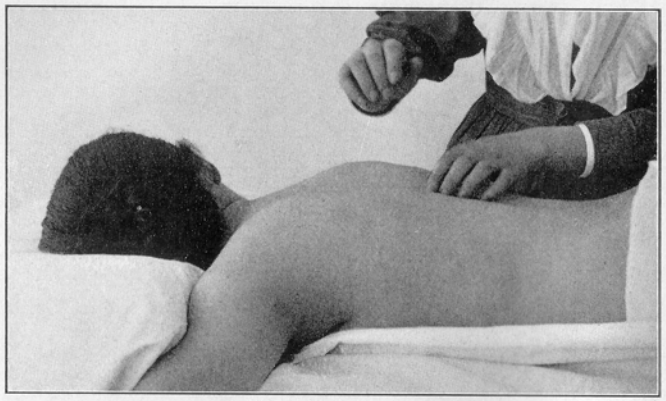


FIG. 124 (*a*). PERCUSSION — Tapping (p. 681).

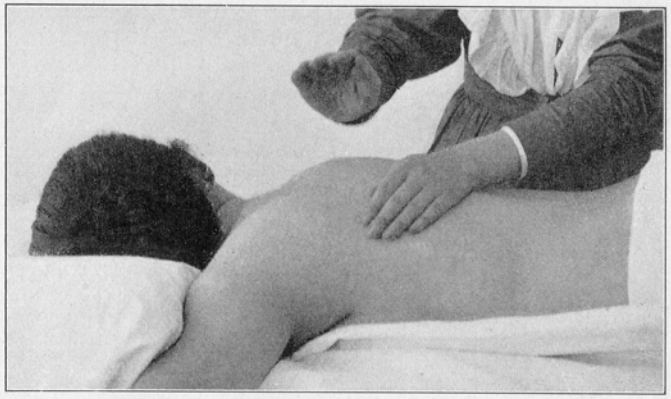


FIG. 124 (*b*). PERCUSSION — Clapping (p. 681).

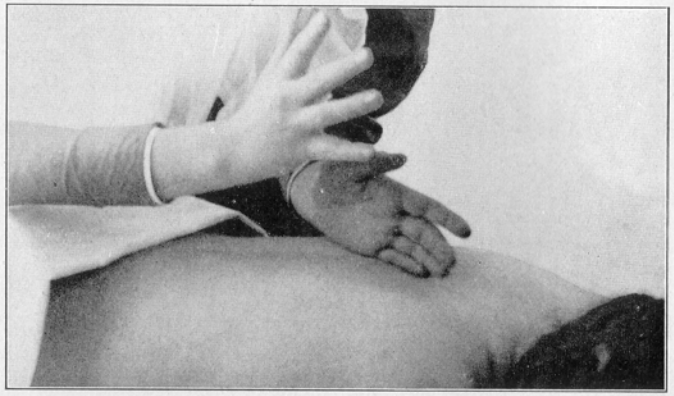


FIG. 124 (*c*). PERCUSSION — Hacking (p. 681).

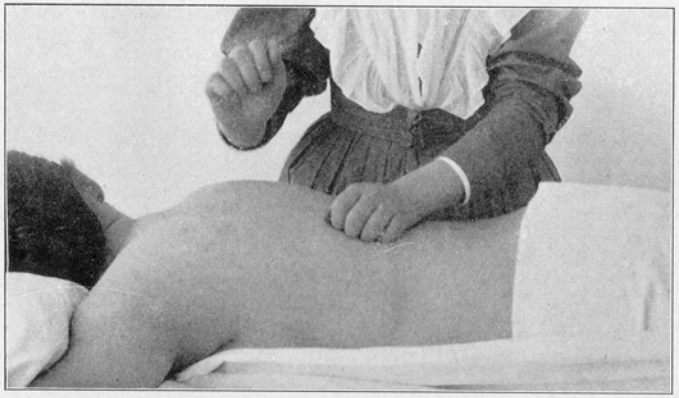


FIG. 124 (*d*). PERCUSSION — Beating (p. 681).

the pneumogastric. Slight irritation increases the heart's action, whereas violent irritation slows or depresses it.

Light rubbing or stroking should be employed only for the purpose of diminishing a tendency to excessive reaction. The stroking should then be centrifugal in direction, or from the center of the body outward.

If there is a tendency to excessive reaction, with a disposition to perspire, energetic rubbing should be avoided, and the patient should be dried by gentle patting over a towel, and the surface should be exposed now and then for a few seconds; or if considerably overheated, it may be cooled by a current of air set in motion by a fan or a towel. If the patient has a very sensitive skin which is irritated by rubbing with the dry hand, the hand may be moistened, or friction may be practiced with a wet napkin or a sponge, or talcum powder may be applied to the skin.

In rubbing the skin when slightly moist, it is very easy to produce abrasion by using too much force, as the hand often adheres quite tenaciously to the surface of the patient's body. This difficulty may best be remedied either by sprinkling a little talcum powder over the surface operated upon, after drying, or by using a little vaseline or cacao-butter.

During the friction, the attendant should take care that his own hand is thoroughly dry. If there is a tendency to perspiration of the palm of the hand, it should be dried with a towel, then well covered with talcum powder.

Friction can not be applied to an area of dry skin not lubricated more than six or eight minutes without producing irritation. It should be remembered that irritation of the skin may mean much more than simply a slight inconvenience — it may result in profound nervous disturbance, and may seriously interrupt a course of treatment which is very essential to the patient's welfare. In fever cases an abrasion may be the beginning of a bed-sore. Recent observations suggest the necessity of the same precaution in cases which have been subjected to examination by the X-ray.

There are cases in which light friction may be employed to very great advantage as an alternative with hydriatic procedures, when the patient's vital forces are too much reduced to allow of the daily employment of cold douches or similar applications. The author has not infrequently found it advantageous to suspend hydrotherapeutic measures for a short time almost altogether, substituting dry friction with the hand, a soft brush, or a linen, flannel, or Turkish cloth mitt.

In very sensitive patients, as certain neurasthenics, gentle patting over the sheet must take the place of friction as a means of drying the skin.

When patients are suffering from *rheumatic joints*, the parts should not be rubbed vigorously, but strong friction should be applied to each limb at a point just above the affected joint and in a centripetal direction. In cases of *acute inflammation* of any sort, the friction must be at first centrifugal, and on the distal side of the affected part.

Vigorous friction *after* the Brand bath is usually avoided, although a slight increase in temperature lowering might be effected thereby. There is a real gain in the omission, however, in the greater permanence of the temperature reduction.

Friction must be avoided altogether in cases of *eruptive disorders* of the skin, in *eruptive fevers*, also in cases of *erythema*, *dermalgia*, and *cutaneous hyperesthesias*. When the skin is hot, flushed, and dry, gentle friction may sometimes be employed, but as a rule, friction is to be avoided; also when perspiration is profuse. Gentle friction or stroking must be avoided when it is desirable to promote reaction; vigorous friction should be avoided when strong reaction is undesirable.

After a neutral bath, in which it is desirable to suppress both thermic and circulatory reaction, care should be taken to avoid friction as far as possible. The patient should be dried with gentle pressure with the hand outside the sheet, so as to bring it in close contact with the skin, the sheet being continually readjusted so as to bring new portions into contact with

the moist surfaces. The same measures should be adopted after hot baths in which it is undesirable to further stimulate the cutaneous circulation, and after a short cold bath when there is a tendency to excessive reaction.

PERCUSSION.

Massage is the natural adjunct of hydrotherapy. It pro- **1227**
duces both mechanical and reflex effects which result in the development of powerful circulatory reaction. The circulatory reaction produced by massage is very prompt, no delay being occasioned by contraction of the blood-vessels due to chilling of the patient, as when cold water is applied. Of the various procedures of massage, nearly all are efficient promotors of circulatory reaction; but aside from friction, the effects of which have already been described, percussion is the only form of manual manipulation which is systematically associated with ordinary hydric applications. In the massage douche, deep kneading in its various forms is also advantageously utilized, as elsewhere mentioned (**1066**).

Method.— "This procedure consists of blows administered by the hand in various ways and with varying degrees of force, the two hands being used in alternation [Fig. 124]. The movement is always from the wrist joint, which gives to the blow the quality of elasticity. The inexperienced operator holds the wrist rigid, and pummels the patient, much as a pugilist would do, thus producing disagreeable and painful effects; while a dexterous and experienced operator maintains a flexibility of the wrists which adds greatly to the good effects of the treatment.

"A stiff blow bruises the surface tissues without producing any beneficial effect upon the deeper structures, the force of the blow being expended upon the surface. An elastic blow, executed in the manner described, penetrates deeply without injuring the superficial structures. A skilled masseur gives springy blows, the movement being chiefly at the wrist

joint. As a rule, the hand should strike the body transversely with relation to the muscles." *

Of the various forms of percussion, *spatting* and *clapping* are the only ones which are especially valuable in connection with hydrotherapy.

Spatting consists of percussion with the palmar surface of the extended fingers held rigid. This is the form in which percussion is most frequently employed. It is applicable to most parts of the body.

In clapping, the whole hand is employed, the palmar surface being so shaped as to entrap the air as it comes in contact with the skin, producing a sort of explosive effect and a loud sound. Clapping is used on fleshy parts where strong surface stimulation is desired.

1228 **Physiological Effects.** — The physiological effects of percussion are practically identical with the mechanical and reflex effects produced by friction (**591**). This procedure is a powerful excitant, acting not only upon the skin, but upon the tissues beneath. A short, light application produces spasm of the superficial vessels. It may be said that *light* percussion produces much the same effect as light friction; *moderate* percussion, the effect of moderate friction; and very *vigorous* and *prolonged* percussion, the effects of vigorous and prolonged friction (**1222**). Friction differs from percussion chiefly in the fact that by the movements made in friction, the blood is forced along the venous channels, thus mechanically aiding the circulation; while in percussion the mechanical effect is less, but the sensory impression is much stronger, and hence the reflex effects are more marked. Percussion and friction may be combined, as in the percussion friction stroke employed in the cold wet-towel rub and the wet-sheet rub.

1229 **Therapeutic Applications.** — Percussion, both spatting and clapping, may be usefully employed to intensify the effects of

* "The Art of Massage," Modern Medicine Pub. Co., Battle Creek, Mich.

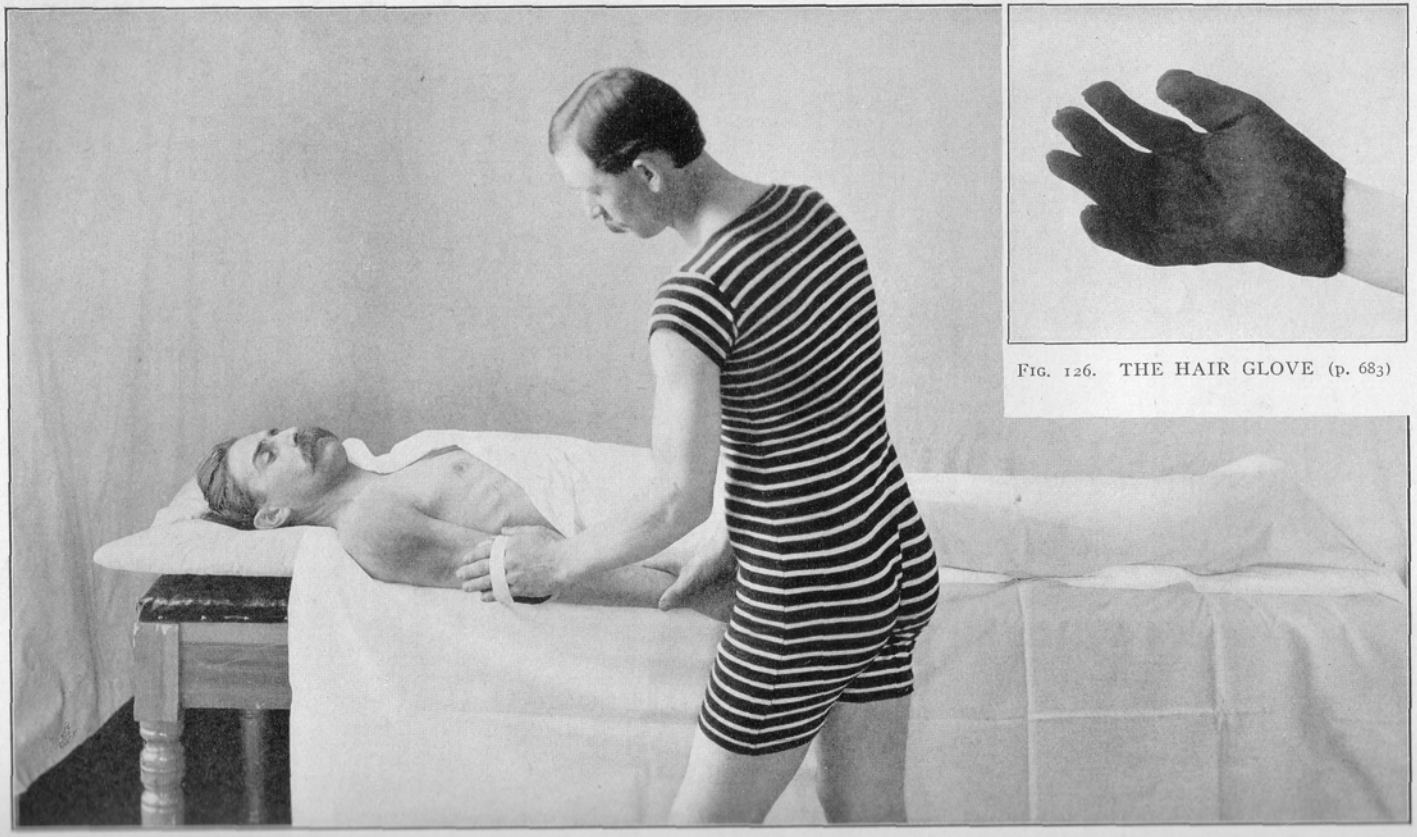


FIG. 126. THE HAIR GLOVE (p. 683)

FIG. 125. DRY SHAMPOO WITH FLESH BRUSH (p. 383).

friction in cases in which reaction does not promptly occur, or where the brief application of a more powerful stimulus than that induced by moderate friction is desirable, as in the wet rubbing sheet and the dripping sheet, and after a general cold application.

The suggestions made with reference to the therapeutic use of friction are also applicable to this procedure. It may be mentioned, in addition, that in *chronic sciatica* and *lumbago*, special attention should be given to these regions. In cases of *cirrhotic liver* or *spleen*, vigorous percussion is applied to the surface overlying these organs.

In *chronic constipation*, the effect of the cold douche to the abdomen may be intensified by vigorous percussion of this region. Percussion over the sacrum is an effective means of stimulating the genito-urinary organs in *atony* of these parts. In cases of *pleuritic adhesions*, *chronic pneumonia*, and *dropsy* of the *chest*, make percussion over the affected part.

Contraindications.— The contraindications are essentially 1230
the same as for friction. Special care must be taken to avoid severe percussion in cases of *arteriosclerosis*, and when febrile conditions exist, with a hot, flushed skin.

DRY SHAMPOOING.

This consists of friction of the surface with the flesh-brush 1231
(Fig. 125), the friction mitt (Fig. 97), or the hair glove (Fig. 126). The effects are identical with those described under the head of friction. The dry shampoo especially encourages circulatory reaction. The friction is applied with short and rapid to-and-fro strokes and little pressure ; hence the effects are largely reflex.

Therapeutic Applications.— Dry shampooing is sometimes useful in the treatment of patients who manifest great intolerance to hydric applications. It is especially adapted to persons with thick, tough, inactive skins. It may often be

applied with advantage in alternation with hydric applications. It produces good circulatory reaction almost without thermic effect; hence is well adapted to persons who have little heat-making capacity, and who have habitually a cold skin. The author has made great use of this measure as an introductory application in the day's program, administered to the patient while still in bed before rising in the morning.

Rough treatment of the skin should always be avoided. Such an amount of friction, with the brush, the hair glove, or the hand, as gives rise to abrasion, eruption, or persistent redness of the skin, is harmful instead of helpful.

OIL RUBBING.

1232 This is one of the most ancient procedures used in connection with hydrotherapy. The old Romans always had themselves rubbed with oil after their baths. Oil rubbing is much practiced by the natives of savage countries, especially in tropical Africa.

Method.— The oil or unguent is applied by simple friction movements, generally centripetal in character, such as have already been described (**1223**).

The best effects are obtained when the application is made after a warm or tepid bath, as the epidermis then more readily absorbs the oil. The application of oil to the dry skin is generally disagreeable. Care should be taken to avoid the application of too much oil, and the surplus should be removed by gently wiping the surface with a soft towel at the end of the application. Care must be taken to avoid such vigorous friction as to induce perspiration.

Vegetable oils or fine vaseline should be employed, rather than animal oils of any sort. Cacao-butter is especially serviceable. Care should be taken that the oil used is not in the slightest degree rancid, and the patient should receive a thorough soap shampoo at least twice a week.

Physiological Effects.— The effects of oil rubbing are essentially the same as those of moderate friction, except

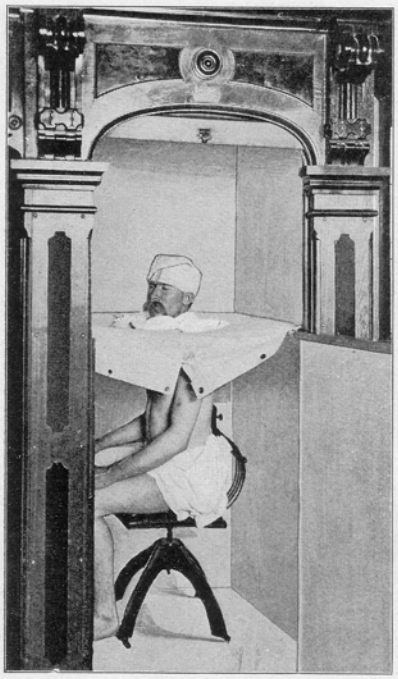


FIG. 127. HOT-AIR BATH (p. 687).

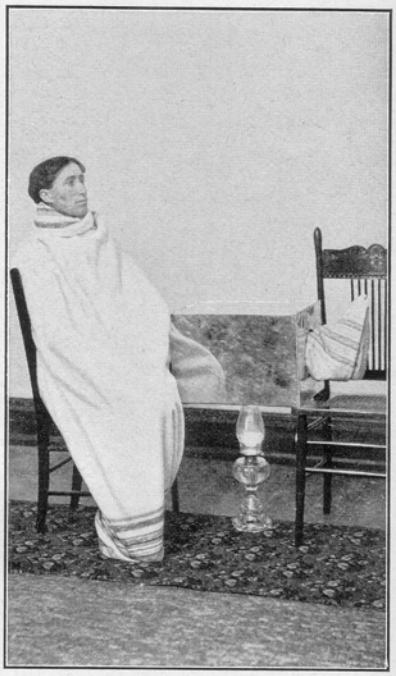


FIG. 129. LOCAL HOT-AIR BATH APPLIED TO KNEE JOINT (p. 692).

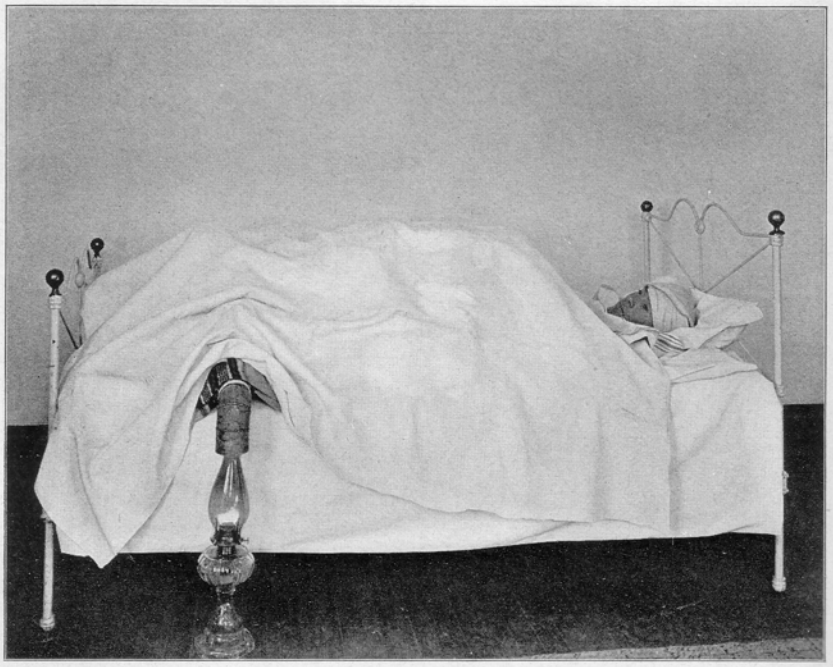


FIG. 128. HOT-AIR BATH IN BED (p. 688).

that it is a milder measure. The lubrication of the surface lessens the degree of reflex stimulation. The mechanical effects are the same as in ordinary friction. Oil rubbing may accordingly be practiced in cases where dry friction would be too exciting.

An important physiological effect which must be remembered in connection with oil rubbing is that the application of oil to the surface of the body to a marked degree lessens heat elimination by conduction while increasing radiation (Exp. 61). The natives of Samoa and other South Sea islands, who are great swimmers, and spend much of their time in the water, habitually smear themselves with oil before entering the water. On the other hand, heat radiation by the skin is very considerably increased by the application of oil. Peclet has shown (Schumann) that an oil surface radiates heat 50 per cent. more rapidly than a water surface. The amount of heat lost by radiation when the body is exposed is about twice that lost by conduction. The increase of heat loss by radiation thus overbalances the diminution of heat elimination by decreased conductivity.

The natives of Africa, when exposing their nude bodies to the direct rays of the tropical sun, habitually protect themselves by smearing the skin with melted fat of some sort. Smearing the skin with oil in cold weather affords protection only through the fact that the body is covered with clothing.

The popular supposition that the body may be nourished by the application of oil to the skin is an error. Probably very little, if any, of the oil applied to the skin enters the circulation; nevertheless, great care should be taken that the unguent used is not in the slightest degree rancid, for the poisonous fatty acids are apparently quite readily absorbed by the skin.

Therapeutic Applications.— Lubrication of the surface with oil facilitates the application of dry friction, and prevents the irritation likely to result from repeated and long-contin-

ued rubbing of a circumscribed area, as is often necessary in the treatment of joints for the removal of chronic exudates. Oil should also be applied to the surface as a protection for the skin against excessive masceration in cases in which the general or partial continuous bath is employed. Prolonged and vigorous friction of the feet and limbs with oil may be used with excellent effects for the relief of *cold feet*, a condition exceedingly common in *gastric neurasthenia*, and as a preparation of the feet for a cold pack if they are inclined to be cold.

Oil rubbing may be employed advantageously in most cases to which dry friction is applicable. It is a good plan to apply a little oil to the surface at least two or three times a week in most cases in which daily baths are administered, especially in cold weather. Oil or an unguent of some sort should always be applied after a shampoo in which soap has been used, as the removal of the natural oily covering of the skin increases heat elimination by conduction and the liability to take cold.

Patients who react poorly, and who are very susceptible to cold, should be rubbed with oil after each bath. Oil rubbing is especially needed in cases in which the skin is dry, through deficient activity of the oil glands of the skin. Great care, however, should be taken to avoid too vigorous rubbing in the application of the oil, as sweating from too strong reaction is very easily produced, to the disadvantage of the patient. In the treatment of infants and children, a marked and most favorable effect upon nutrition is produced by oil rubbing. Application of oil after cold baths encourages reaction. In most cases of *chronic dyspepsia* when accompanied by emaciation, in *diabetes*, and in most cases in which malnutrition with dryness of the skin. is a prominent feature, oil rubbing is a valuable therapeutic resource.

Oil rubbing has been used in scarlet fever and other infectious fevers as a means of lowering the temperature, with some success.

THE HOT-AIR BATH.

This bath consists in exposure of the entire body, with **1233**
the exception of the head (Fig. 127), to a superheated atmos-
phere.

Method.— The patient, undressed, is placed upon a stool **in a** suitably constructed cabinet inclosing the entire body **with** the exception of the head. The air of the cabinet is gradually heated to the desired degree by means of a steam coil, or a kerosene or gas stove; or the heating may be accomplished by means of alcohol or strong whisky burned in a cup or saucer placed in a basin of water. Burning alcohol or whisky does not, however, give an ideal hot-air bath, because of the large amount of watery vapor produced by the combustion of these substances. When an open flame of any kind is employed, great care should be taken to avoid burning the patient or setting fire to the cabinet.

The temperature employed is from 120° to 200°; a temperature of from 140° to 180° is usually sufficient to produce profuse perspiration.

Perspiration should be encouraged by making the patient drink a glass of water just before going into the bath, and if possible, one or two more during the bath.

The hot-air bath should nearly always be followed by a cold bath of some sort. This may be a wet-sheet rub, the shower or horizontal spray, the affusion, the full bath, or a sponge bath. In cases in which the bath has been employed for eliminative purposes, and has been continued for a half hour or more for the purpose of prolonging the sweating process, care must be taken not to make the cold application too abruptly. The cooling must be gradual, the initial temperature being a little below that of the body (about 98°), and somewhat rapidly but gradually lowered to 75° or 80°, at which point it may be continued for 30 to 60 seconds, or until the pulse becomes tranquil, the skin smooth and free from moisture, and the vascular excitement of the skin quieted.

The hot-air bath is not infrequently employed as a means

of heating the skin preliminary to a cold application of some sort. It may in this way precede a cold douche, a cold wet-sheet pack, a cold immersion, a cold sponge, or a wet-sheet rub. When used for this purpose, the bath should be continued just long enough to induce gentle perspiration. If continued longer, a sedative effect may be produced which will antagonize the tonic effect desired from the cold application which follows. As a means of inducing perspiration, the hot-air bath is inferior to no other measure except the electric-light bath.

Before the patient enters the cabinet, the hair of the scalp should be thoroughly wet and the face and neck well bathed with cold water. If there is a great tendency to cerebral congestion during the bath, a towel saturated with cold water or an ice collar may be placed about the neck.

If a regularly constructed cabinet is not available for a bath, an efficient hot-air bath may be administered by very simple means which can be improvised almost anywhere; for example, the patient may be placed in an ordinary cane-seated chair, the seat of which is covered with a moist napkin. Underneath the chair may be placed a kerosene oil stove or even an ordinary kerosene lamp, or alcohol or brandy may be burned in an open dish. Below the seat of the chair should be placed a sheet of metal, so that the patient will not be burned by the ascending current of superheated air. The hot air is retained about the patient by surrounding both the patient and the chair by a rubber blanket; or in the absence of this, several ordinary blankets, with newspapers placed between, may be substituted.

It is even possible to administer a hot-air bath in bed by building over the patient a sort of canopy by means of blankets spread upon hoops, as shown in the accompanying cut (Fig. 128). The hot air is conducted into the space about the patient by means of a metal pipe four or five inches in diameter, and connected with a kerosene stove or a large kerosene lamp. Care should be taken to protect the bed

clothing from the hot pipe, by means of asbestos or other fire-proof material.

Care must be taken in administering the hot-air bath to avoid such sudden and excessive applications of heat to the skin as to cause dilatation of the surface blood-vessels before there has been time for the adjustment of the circulation of the viscera. Neglect of this precaution sometimes gives rise to vertigo and fainting. This danger may be obviated by the application of the cooling compress to the head, face, and neck of the patient. Excessive cold applications to the head and neck may, however, antagonize the effect of the bath by opposing the sweating process. The hot-air bath must not be employed too often, as it is a depleting or sedative measure, and if too frequently resorted to, may give rise to nervous exhaustion and debility.

The purpose of the cold application following the hot bath is to increase the tonus of the blood-vessels, to energize the nerve centers, and to change the condition of passive congestion of the skin to one of active vascular excitability.

In very susceptible persons, fainting sometimes occurs on the application of very cold water in the form of a shower, spray, or affusion, on emerging from a hot-air or other hot bath. The cause of this is the strong contraction of the blood-vessels of the brain the instant the cold water comes in contact with the skin. In persons liable to this inconvenience, the graduated shower or some other form of the graduated bath should be employed for cooling off.

In cases in which the hot-air bath is employed to induce sweating, the patient, after remaining for 15 or 20 minutes in the bath, may be removed and wrapped in warm blankets for half an hour or longer to continue the sweating. The sweating process may be encouraged by making the patient drink freely in the pack as well as in the hot-air bath. A quarter or half glass of water should be swallowed every five minutes.

1234 **Physiological Effects.**— The first effect of the hot-air bath is to heat the skin and the body. The heat is communicated to the skin by the dry, hot air, the temperature of the successive layers of the skin being elevated until finally the blood-vessels are reached and the temperature of the blood is raised to a sufficient degree to cause perspiration. The skin becomes red through the dilatation of the surface vessels, which are in a state of passive congestion. The temperature of the blood is generally elevated from two to five degrees according to the duration of the bath. When the bath is continued for some length of time, or for a short time at high temperature, respiration becomes very short, difficult, and thoracic. There is headache, and intense thirst, with nausea and vertigo. Quickening of the pulse and respiration nearly always occur in the hot-air bath. These symptoms usually disappear with dilatation of the surface vessels and the beginning of perspiration. They may be largely prevented by vigorous friction of the skin before the bath, and by raising the heat slowly until perspiration begins.

The temperature of the bath should usually be from about 130° to 160° F.; duration, 20 to 30 minutes. Local applications may continue for an hour or more at moderate temperatures.

The hot-air bath causes an elevation of the body temperature, and hence is not adapted for use in cases in which febrile action is present. This fact, however, gives it special value in the treatment of rheumatism, through the increased oxidation of proteid wastes (**567**).

1235 **Therapeutic Applications.**— The hot-air bath is seldom employed except in connection with other baths, though its effects may be either primarily or secondarily the object desired. The hot-air bath is one of the most convenient means of inducing perspiration. It is on this account quite liable to abuse. Perspiration is far less useful as an eliminative measure than is generally supposed, the perspiration usually containing but a small amount of toxic substances.

The chief value of the hot-air bath is perhaps as an exciting measure for the purpose of stimulating the skin during an application, and for some time after, if desired.

This bath is much employed in *rheumatism.* It is of service in the *toxemia* of chronic dyspepsia, biliousness, etc. It may be used in *obesity*, and with caution in certain cases of *Bright's disease.* It is useful in *cardiac dropsy*, but must be employed with great care and moderation to avoid depressing the heart. High temperatures must never be employed in cardiac cases, and the temperature must be very gradually raised. It must be wholly interdicted in cases of extreme *cardiac dilatation.*

The hot-air bath may be used to excellent advantage for revulsive effects in *sciatica*, *lumbago*, and other painful nervous affections involving large nerve trunks. In these cases the bath should be continued only long enough to heat the skin sufficiently to induce gentle perspiration, and should then be immediately followed by a very short cold general application with special attention to the part affected. For example, in sciatica a cold spray or douche would be employed over the course of the nerve in the affected limb, or a towel wrung out of cold water might be applied over the part, and the part vigorously rubbed for 30 to 60 seconds.

In making a cold application after a hot bath in rheumatism, an excessively low temperature must be avoided. Very cold applications in such cases have the effect to cause an immediate return of the pain and stiffness, which the hot bath usually relieves. A prolonged tepid spray may be safely employed in these cases, at a temperature of about 80° to 85°, the time, from 1 to 3 minutes, and followed by a gentle spray, shower, or a graduated immersion. Beginning at 95°, the temperature may be lowered to 80° within 2 minutes, with rubbing.

In extreme cases of *rheumatism* and *Bright's disease* in which cold applications can not be tolerated at all, the patient, on leaving the hot bath, should recline upon a cot,

wrapped in a linen sheet, which should be partially opened now and then to admit of evaporation. After the first minute or two, a warm blanket may be thrown over him, which should be removed every five minutes for a few seconds, the covering being lessened as the patient gradually cools off. In the course of half an hour or an hour, when the pulse has become normal and the skin cool and smooth, the patient may be allowed to dress, but not before. Tepid sponging, fanning, etc., may also assist in the cooling.

Severe cold applications must likewise be avoided after a hot-air bath in Bright's disease, also in cases of weak heart. The sudden afflux of blood to the internal viscera may produce so intense a congestion of the kidneys as to damage these organs, and may so distend the right side of the heart as seriously to cripple its action.

1236 **Contraindications.**— The hot-air bath should be avoided in *eruptive skin disorders*, in cases of extreme *cardiac weakness*, in the *febrile condition*, in *diabetes* with emaciation, in *exophthalmic goiter*, in *arteriosclerosis*, and in advanced cases of *nephritis*.

In the employment of sweating processes of every kind, it must be constantly borne in mind that the natural effect of these applications is to produce inactivity of the bowels, as pointed out by Röhrig. The intestinal inactivity is of course caused by diminished secretion of moisture from the intestinal mucous membrane. The constipating tendency of the sweating processes may be largely overcome by copious water-drinking. Cold water is preferable to hot as a means of stimulating peristaltic activity. Cold water may be taken freely at proper hours (**1423**).

THE LOCAL HOT-AIR BATH.

1237 This measure consists in the application of superheated air to circumscribed portions of the body, as an arm, a limb, a knee-joint, etc. By means of a properly arranged chamber connected with a kerosene or gas lamp or other source of heat (Fig. 129), it is easily possible to bring to bear upon a

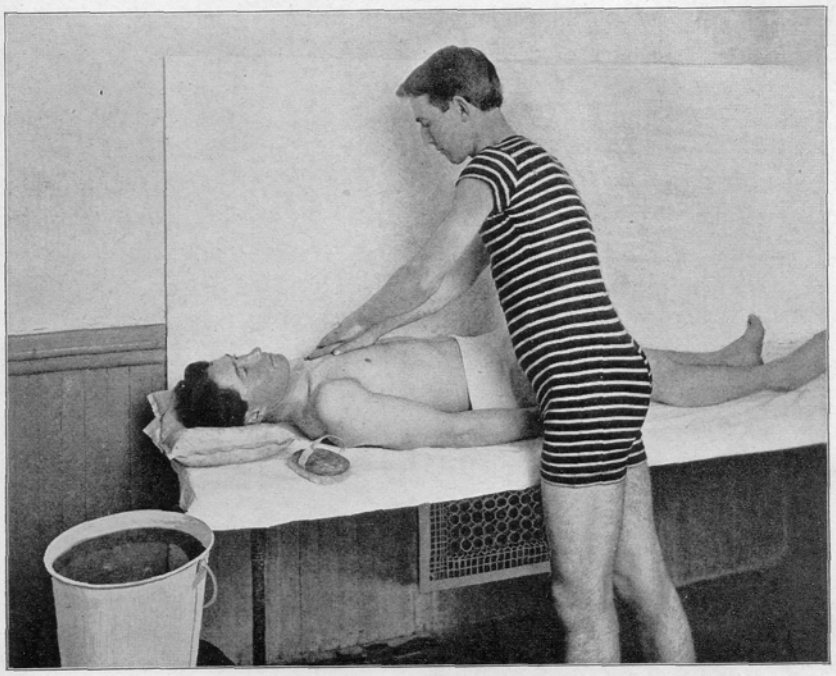


FIG. 130. TURKISH BATH — Shampooing (p. 695).

FIG. 131 (*a*). VAPOR BATH.

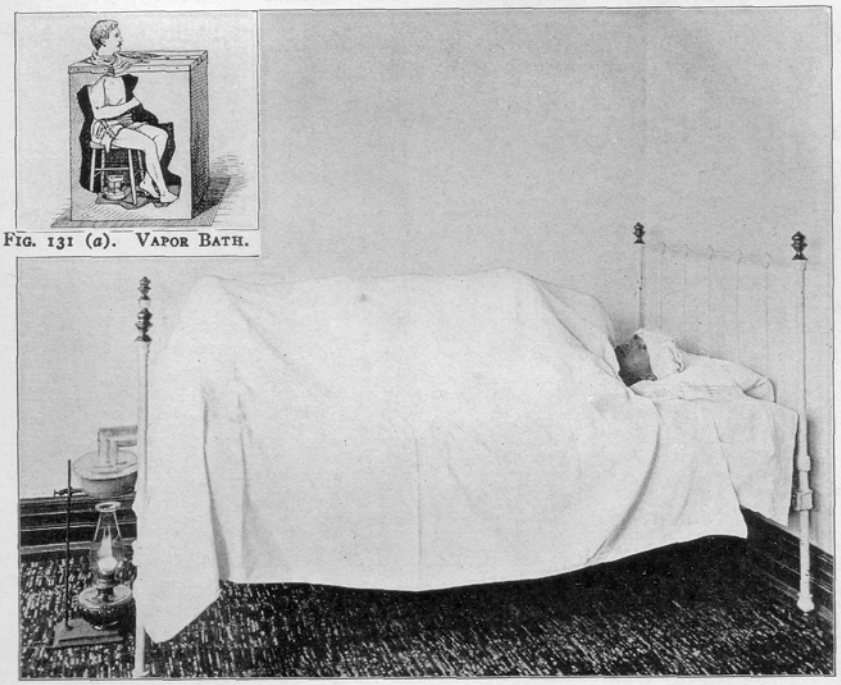


Fig. 131 (*b*). VAPOR BATH IN BED (p. 701).

circumscribed portion of the body a temperature of 300° to 400°.

The Japanese administer the local hot-air bath in a very simple manner. A properly constructed box is placed over a quantity of live coals until it is thoroughly heated. The limb to which the application is to be made is then placed in the box, and properly covered so as to retain the heat. As general perspiration is always induced when the application is prolonged, the patient should be undressed in preparation for the bath, and at its conclusion a short cold application should be made to the entire surface of the body as well as to the part treated. A cold mitten friction, a cold towel rub, or a wet sheet rub are the best measures for this purpose. Care should be taken to avoid chilling the patient. Immediate and thorough reaction should be promoted by careful drying and thorough rubbing.

Therapeutic Applications.—Remarkably excellent effects 1238
are certainly obtainable by the daily or frequent application of the localized hot-air bath, especially in cases of *rheumatic joints, chronic inflammation* of the joints with exudates, and allied affections. The duration of the application may be a few minutes to several hours, according to the intensity of the application, the sensations of the patient, and the nature of the case under treatment. In very chronic affections, prolonged applications are usually necessary. In more acute cases, short applications are preferable and sufficient.

When the limb is removed from the hot-air chamber, it may be wrapped in a large mass of cotton or wool, covered with oil or rubber cloth, then with flannel, to continue the effect of the bath. Before the dry pack is applied, a towel wrung very dry out of cold water may be wrapped about the part and vigorously rubbed for 10 or 15 seconds to secure a strong circulatory reaction whereby the blood will be fixed in the skin and the revulsive effect rendered more permanent. The localized hot-air bath is contraindicated in cases of acute inflammation, in general fever, and in cases in which the skin of the parts is diseased.

THE TURKISH BATH.

239 This is a very old procedure, dating back to the time of the Romans. The author, with thousands of others, has explored in Rome and Naples the ruins of baths which were in active operation in the time of Nero; and while once wandering about the ancient places of Jerusalem, he one day accidentally stumbled upon an old Turkish bath which was built and used in the time of Herod, and after the lapse of nearly nineteen centuries is still in active operation. In this bath the air is heated by means of a huge brick furnace, the body of which is exposed in the room, the door for introducing fuel being outside the wall of the house. In a little grotto dug out of the limestone rock at one side, a man lay upon the floor perspiring, while an attendant, reclining by his side, supported himself upon his right elbow while leisurely kneading and shampooing the bather with his left hand.

The modern Turkish bath requires an establishment especially fitted up for its application, the essential features of which are: dressing-rooms, a warm room, or tepidarium (temperature 110° to 130°), a calidarium, or hot room (temperature 150° to 170°), a shampoo-room, a douche apparatus, a plunge bath, and a cooling-room.

The air of the rooms may be heated by steam coils, or so-called direct radiation, or by currents of hot air, or indirect radiation. The latter means is the most desirable, and is essential to good ventilation. Usually, Turkish bath rooms are provided only with steam-coils or pipes; and no provision being made for change of air, the atmosphere soon becomes so impure by emanations from the body that the good effects which otherwise might be secured by the bath are largely spoiled by the poisons inhaled.

Method.— The Turkish bath is similar to the hot-air bath, but differs in that it includes the whole body, and that it is accompanied by friction, kneading of the muscles, and shampooing. As practiced by the Turks at Constantinople and

the Arabs at Cairo, the bath also includes joint movements of various sorts,— stretching, twisting, flexion, etc.

Before entering the bath, the patient should drink freely of either hot or cold water, as he prefers. A few minutes after entering the bath, another glass of water should be taken. Three or four glasses of water should be taken at intervals during the bath. During the first 10 or 15 minutes, the patient is frequently rubbed by the attendant for one or two minutes, to encourage dilatation of the surface vessels, and to induce perspiration. If perspiration is long delayed, apply a hot foot bath or a hot fomentation to the spine. If there is a disposition to cerebral congestion, the hair and the scalp may be moistened, and a cold towel may be placed about the head and neck. When the patient begins to perspire, he should enter the second apartment, the intense heat of which will give less discomfort after perspiration is well established than if entered at the beginning.

From the hot room the patient goes to the shampoo-room, where, lying upon a slab, he is first gone over from head to foot by the attendant with the hands dipped in water, the manipulations being calculated to remove as thoroughly as possible the layer of cuticle which has been loosened by the free perspiration. The first two manipulations are for the purpose of loosening the dead cuticle, the last removes it. These rubbings and strokings are continued until the skin is smooth and polished like marble. (Fig. 130.)

These movements are not easily described. They consist substantially of three sorts of manipulations: —

1. Simple firm pressure with the hand spread out and held firmly in contact with the skin with much pressure and with slight lateral movement.

2. Rapid to-and-fro movements, systematically applied to small areas in succession, as an arm, half the chest, the abdomen, etc.

3. Long stroking movements, applied after laving the part with water.

The next step is shampooing the patient with soap and water by the aid of a shampoo brush, a wad of horsehair or fiber, the hair mitt, or a mitt of Turkish cloth especially adapted to the purpose.

When the whole surface has thus been shampooed, the douche is administered. It is well to begin the douche with a warm shower, which should be heated to 104° to 106°. When the patient's skin has become well heated, and he feels a thirst for cold water, the hot water is suddenly turned off and the horizontal jet, spray, or multiple circle douche administered. After the shower, the patient enters the plunge bath for a few seconds if he desires. The temperature of the plunge should not be above 70°, and better effects are secured by a short plunge in water at 60°.

In the famous Hammam Turkish Bath in Paris, the author found the temperature of the water of the plunge to be 54°. A temperature even lower than this is sometimes employed, but is not to be recommended.

After the plunge, the patient is quickly dried, rubbed vigorously, then lies for 15 or 20 minutes, lightly covered, in the cooling-room. He should not leave the bathing apartments until the pulse has returned to the normal rate, and the skin is cool and perfectly dry.

1240 **Physiological Effects.**— The physiological effects of the Turkish bath are not very different from those of the hot-air bath. The body being completely surrounded with superheated air, so that the pulmonary mucous membrane as well as the cutaneous surface is exposed to its influence, somewhat more pronounced systemic effects are produced than by the hot-air bath, especially at the beginning of the application. Before perspiration begins, the heart is usually very much excited. The acceleration of the pulse is in direct proportion to the elevation of the temperature of the bath; the higher the temperature, the more rapid the pulse. With dilatation of the cutaneous vessels and beginning perspiration, the pulse is slowed, and blood tension lowered.

This interesting fact respecting the influence of the Turkish bath upon the circulation was well studied by E. Large.*

At a temperature of 150° to 180°, the respiration is purely thoracic, and more than doubled in frequency. The Turkish bath powerfully excites the sudoriparous glands. In his experience with this bath during the last twenty-five years, the author has often seen patients lose two pounds or more in a single bath of an hour's duration.

The amount of fluid which may escape through the skin under favorable conditions is very great, sometimes amounting, as in the case of a workman in hot weather, to as much as one fifth the body weight in twenty-four hours. Excessive activity of the skin is of course attended by an unusual movement of fluids toward the surface of the body. The amount of fluid poured into the alimentary canal is considerably reduced, and the result is constipation, the urine being also rendered scanty at the same time. It is thus evident that vigorous sweating must promote absorption from the alimentary canal. It is due to this fact that the sweating bath is such a powerful means of stimulating nutrition.

A lowering of blood pressure also occurs as the result of the diminished volume of blood. The rapid loss of fluid during profuse perspiration, amounting to three or four pounds per hour, emphasizes sufficiently the necessity for copious drinking in connection with sweating baths of every sort. The usual absence of perspiration during fever, also the absence of the normal odor of the perspiration during the febrile state, as observed by Bouchard, are interesting phenomena which indicate the importance of the skin as a heat-regulating organ, and as an avenue for the escape of toxic matters from the blood. The Turkish bath usually fails to excite perspiration in fever.

Therapeutic Applications.— The Turkish bath may be use- 1241
fully employed in the majority of chronic disorders. It is

* "Recherches Physiologiques sur les Bains de Vapeur Sèche" (Hamman Bains, Turcs).

an error, however, to suppose that the profuse sweating which may be induced by this bath is at all essential to good results in all classes of cases.

The therapeutic indications are essentially the same as those mentioned for the hot-air bath. The same suggestions and precautions are also applicable. It is especially important to investigate, by careful physical examination, the condition of every patient before submitting him to so vigorous a process as the Turkish bath. Like the hot-air bath, the Turkish bath may be used either as a sweating process or as a means of preparing the skin for cold applications of any sort (**1235**).

1242 **Contraindications.**—The Turkish bath should not be employed in cases of skin disease accompanied by eruptions, on account of the excessive congestion of the skin induced, whereby the eruptions are aggravated. The vapor and Russian baths are better in these cases. The Turkish bath must also be avoided in most cases of *organic disease* of the *heart*, in *Bright's disease* of the kidneys, in most *pulmonary affections*, in cases of *arteriosclerosis* in which the disease has reached an advanced stage, in cases in which a previous attack of *apoplexy* has recently occurred, in *diabetes* with emaciation, and in *febrile affections*.

Care must be taken to avoid the overuse of the Turkish bath. It is on the whole a very agreeable procedure, and may easily be employed to excess. Frequent long-continued exposure to the sedative influence of heat is debilitating. This effect of the bath is overcome, however, provided the application is not too prolonged or too frequent, by means of the cold shower or plunge with which the bath is completed.

THE RUSSIAN BATH.

1243 In this bath the patient lies upon a slab in a small room filled with steam, being rubbed at intervals by an attendant so as to promote the early appearance of perspiration. The temperature of the room is usually from 115° to 120°; 140°

is barely endurable, but can not be continued for any great length of time without danger. The length of the bath may be from 10 to 20 minutes. A cold shower bath is sometimes arranged in the apartment, so that the patient can, if he desires, expose himself to the alternate action of heat and cold by stepping under the shower bath for a few moments.

In Finland a Russian bath is produced by pouring water upon heated stones in a room provided for the purpose. This method is essentially the same as that used from the earliest times by the North American Indians.

The Russian bath, like the Turkish, is followed by a shampoo and a cold shower or plunge bath (**1239**). The same precautions should be observed at the conclusion of the bath respecting the cooling of the patient, as elsewhere indicated (**1233**).

Physiological Effects.— The effects of the Russian bath **1244**
are essentially the same as those of the hot-air bath (**1233**); but to the ordinary effects of other hot baths the Russian bath adds one disagreeable feature,— the interference with the respiratory process, because of the saturated condition of the atmosphere of the bath.

The elimination of CO_2 is diminished in the Russian bath, and perspiration is less active than in the Turkish or the hot-air bath at a temperature equally endurable.

One advantage possessed by the Russian bath over the Turkish or hot-air bath is that it is better tolerated by persons suffering from eruptions or cutaneous irritation of any sort.

Perhaps the most important characteristic of the Russian bath is the rapid and considerable rise of body temperature, due to the interference with heat elimination through the skin and lungs, as well as by the heat communicated. The body temperature rises higher and more rapidly in the Russian than in the hot-air or the Turkish bath. As a result, the oxidation of proteid elements is greatly increased, the condition being allied to that of fever. This increased oxidation of nitrogen gives to the Russian as well as the vapor bath

and the sweating pack a special value in the treatment of chronic rheumatism and all forms of uric-acid poisoning and chronic toxemias, in which one of the chief indications is for increased oxidation and destruction of nitrogen-containing wastes and toxins. There is no bath which excels the Russian in this particular, except the electric-light bath, which rapidly heats the body, not by retention of body heat, but by the penetration of the rays of radiant energy into the depths of the tissues and powerfully excites metabolism.

1245 **Therapeutic Applications.** — These are essentially the same as those already mentioned in relation to the hot-air bath and the Turkish bath. The Russian bath is for some persons more agreeable than the Turkish or hot-air bath, because of the effect of the moist air upon the skin. Persons suffering from *acute bronchial catarrh* often experience very great temporary relief in the Russian bath. Its effect is likely to be transient, however; and unless extraordinary precautions are taken, the exposure ordinarily necessary after the bath is likely to result in an aggravation of the cold. The Russian bath whitens the skin by improving its circulation, relieves *rheumatic pain*, and may be advantageously employed in *diabetes* when there is no cardiac complication, in the *chronic toxemia* of *dyspepsia*, and in some *skin disorders* in which Turkish and water baths prove too irritating; it relieves pain in *sciatica*, and is generally useful in the *rheumatic diathesis*.

The Russian bath is not so well adapted to the treatment of cases of *obesity* as is the hot-air or the electric-light bath or the sweating pack. The reason for this is the tendency in obesity to overheating and systemic weakening in consequence of the exhaustion of the nerve centers.

Contraindications. — Extraordinary care must be exercised to avoid overheating the patient in this bath, as heat elimination is almost altogether suspended; and hence the bath must be avoided in *febrile cases*. The bath must also be interdicted in cases of *cardiac weakness*, in most cases of *advanced Bright's disease*, *pulmonary tuberculosis*, and in *arteriosclerosis*.

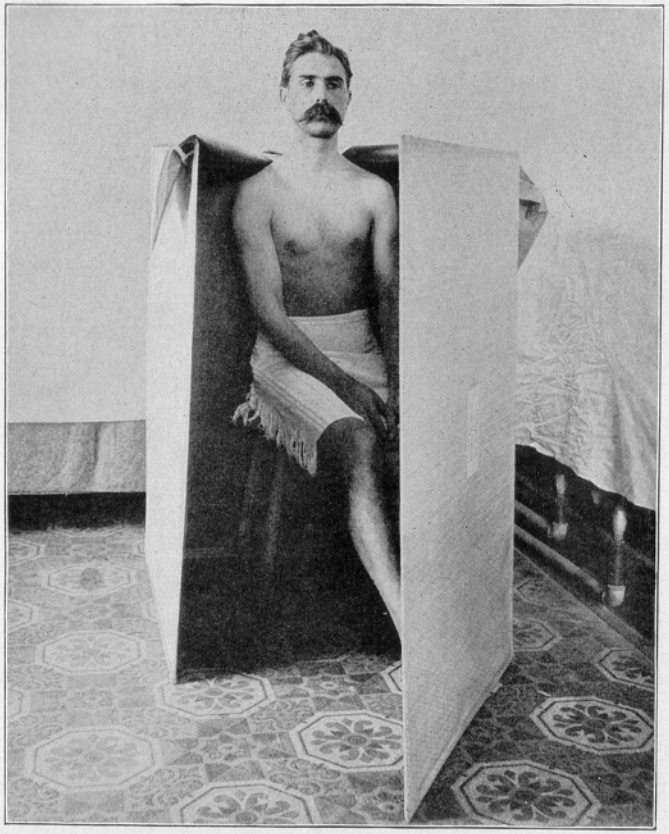


FIG. 132. PORTABLE VAPOR BATH (p. 702).



FIG. 134. HORIZONTAL ELECTRIC-LIGHT BATH (p. 708).

THE VAPOR BATH.

The vapor bath (Fig. 131) resembles the hot-air bath 1246
n the mode of administration. The same sort of cabinet nay be used, and the emergency arrangements suggested for :he hot-air bath are equally useful for the vapor bath (Figs. 127, 128). When the vapor bath is given in bed, however, an oil cloth must be placed under the patient to avoid wetting the mattress.

Among the different methods of giving a vapor bath may be mentioned the following:—

1. Water may be boiled in a flat-bottomed basin over an alcohol lamp or a small gas or kerosene stove. The basin should be wide, and the quantity of water small, so that it may boil quickly and vigorously.

2. A pail of boiling water may be placed in the cabinet beneath the chair on which the patient sits, and into this may be lowered one by one well-heated flat-irons, bricks, stones, or other mineral or metallic masses, a wire being attached to each so that the entrance into the water may be easily controlled. The mass should be gradually let down into the water, so that the steam may not be generated too rapidly.

3. A rubber tube attached to the spout of a teakettle with a tight-fitting cover is a useful method of conveying steam to the cabinet.

4. In the absence of a better arrangement, a vapor bath may be taken in an ordinary bath-tub supplied with hot and cold water, by the aid of the following simple arrangement devised by Winternitz: A board of a size sufficient to support the patient, and perforated with inch holes, is laid in the tub, and raised by proper supports three or four inches from the bottom. By means of a piece of ordinary garden hose three or four feet long, connected with the hot-water faucet, the hot water may be carried to the upper end of the tub beneath this board. By leaving out the plug, the hot water is thus allowed to run in and out of the tub; and as it passes the

whole length of the tub before escaping, it gives off a large quantity of steam, which, passing up through the openings in the board, surrounds the patient with warm vapor. The vapor is retained about the body of the patient by blankets placed over the top of the tub, and tucked around the neck in such a way as to protect the head from the warm vapor. The intensity of the heat may be regulated by controlling the flow of water. The inventor of this ingenious kind of vapor bath informed the author, when on a visit to his establishment at Kaltenleutgeben, near Vienna, that he had been able to administer a good vapor bath with two gallons of hot water.

Nothing could be simpler or cheaper unless it be the method adopted by the New Zealanders, who, as we have been informed by Mr. Maui Pomare, administer a vapor bath by the following unique but effective means: Several stones are laid upon a small heap of wood properly arranged; the wood being lighted, the stones are soon heated very hot. They are then covered with a thick bed of green leaves, upon which the patient lies down. The patient is covered with a blanket, which retains the moist vapor from the steaming leaves, and is thus made to perspire profusely. After the bath he is cooled by plunging into the sea.

An old French author describes a method of administering a vapor bath by placing an empty wine barrel from which one head had been removed over a fire until well heated, then reversing it and putting the patient inside, enveloping both the patient and the barrel in thick coverings to retain the heat and moisture.

The accompanying cut (Fig. 132) shows an extremely convenient portable cabinet which may be employed for either the vapor or the hot-air bath.

In certain cases it is desirable to administer a vapor bath with the patient reclining. This may be accomplished in several ways. A convenient arrangement devised by the author is shown in Fig. 131 (b).

Physiological Effects.— The pulse is greatly quickened, 1247
rising rapidly to 140 or 150 beats per minute. The heart is quickly tired out by the excitation of the hot bath, with the low vascular tension to which it gives rise, because its periods of rest are diminished. Beating at its ordinary rate, the heart has about forty seconds to rest out of each minute; but if its rate of beating is increased 25 to 50 per cent., its periods of rest are diminished proportionately.

The pulse is much more profoundly affected in the vapor than in the hot-air bath. Sweating begins much sooner in the vapor than in the hot-air or Turkish bath, and less quickly than in the electric-light bath. It should be noted that the appearance of moisture upon the surface of the body is not necessarily an evidence of perspiration, as it may be the result of condensation of vapor upon the skin. Frey, in his interesting study of the hot-air and vapor baths,* calls attention to the interesting fact that while the respiration is quickened, the respiratory movements do not increase either in the hot-air or the vapor bath in proportion to the pulse. In the vapor bath, however, respiration is excited to a much greater degree than in the hot-air bath.

The absorption of oxygen is interfered with in the vapor bath for the reason that the respiration is not quickened in proportion to the increase in the pulse-rate. Oxidation is thus interfered with to some extent. When perspiration is induced by exercise, the breathing is quickened in proportion to the heart action, a larger amount of oxygen is taken into the system, and hence sweating resulting from exercise is less exhausting than that produced by the vapor bath or other sweating processes.

The effect of the vapor bath upon the body temperature is very profound, the rectal temperature rising in the course of 20 or 30 minutes sometimes to the extent of three or four degrees. The temperature of both the rectum and the axilla

* "Experimentelle Studien uber die Wirkung der heissen Luft und Dampfbäder," *Archiv für Psychiatrie*, Berlin, 1880, XI, 266–270.

rises much more quickly in the vapor bath than in the Turkish or dry hot-air bath (Exp. 62). The axillary temperature rises more rapidly and to a higher point than the rectal temperature. This is doubtless due (1) to the fact that vapor is a much better conductor of heat; and (2) to the further fact that cooling of the body by evaporation is suspended in the vapor bath as in the Russian bath, the hot immersion bath, and the wet-sheet pack.

In consequence of the elevation of temperature produced by the vapor bath, this procedure becomes a powerful factor in the oxidation of proteids, in common with all other hydriatic procedures which are accompanied by elevation of body temperature.

1248 **Therapeutic Applications.**— The vapor bath is indicated in the same class of cases as those for which the hot-air, Turkish, and Russian baths are recommended. It is especially useful as a means of heating the skin previously to a cold application of some sort (120° for 3 to 5 min.). For this purpose, however, it is inferior to the electric-light bath. Its only specific application is as a heating process in cases in which the skin is so irritable that the hot-air bath, the electric-light bath, and other similar processes are contraindicated. The contact of the moist vapor with the skin produces a soothing effect in these cases, provided an excessively high temperature is not employed. The vapor as well as the Russian bath has a further advantage in that it softens the epidermis, and facilitates the discharge of sebaceous matters and inspissated products from the perspiratory ducts, thus relieving a condition which one writer graphically describes as "constipation of the skin."

The physiological effects produced by the vapor bath, particularly its influence upon blood circulation and tissue activity, indicate it to be a powerful therapeutic procedure. The influence of the bath upon proteid oxidation especially adapts it to the treatment of those cases of retarded nutrition in which it is desirable to stimulate the oxidation of proteid

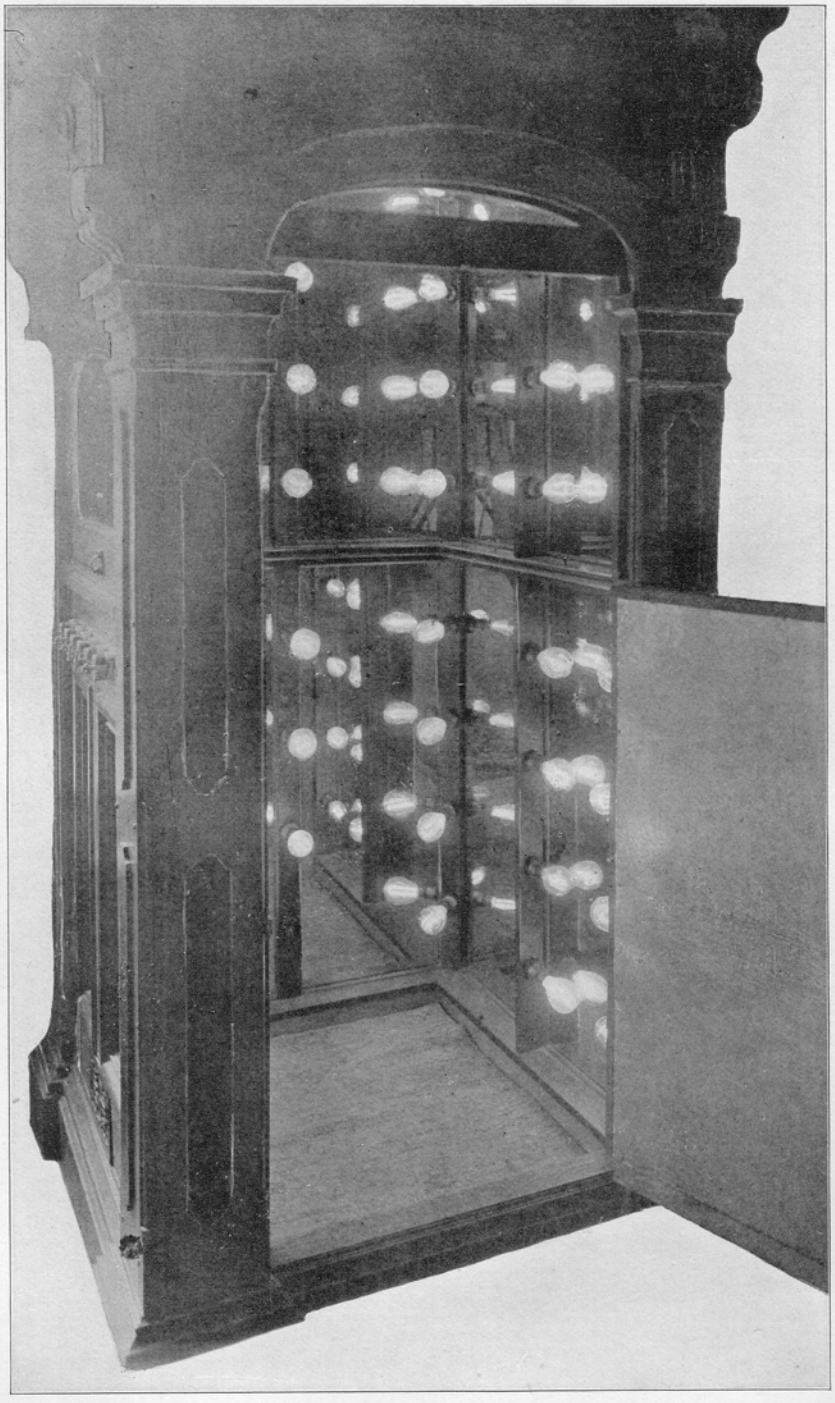


FIG. 133. ELECTRIC-LIGHT BATH (p. 707).

wastes, as in *rheumatism* or *gout*, and that very large class of chronic cases, including a large proportion of *neurasthenics*, in which the *uric acid diathesis* is the fundamental dyscrasia which forms the general background for the varied pathological pictures presented.

The vapor bath is a powerful eliminative measure. When employed for this purpose, its duration should be from 15 to 30 minutes. The prolonged vapor bath is indicated in *chronic rheumatism*, *jaundice*, *tertiary syphilis*, and whenever general spoliative effects are required, as in *obesity* with rheumatism.

The vapor bath is useful in all forms of *chronic toxemia*. It is especially well adapted to this class of cases, being exceeded in value by no procedure excepting the electric-light bath, which by its greater power to heat the tissues, stimulates still more actively the oxidation of the proteid substances of an excrementitious or toxic character, the presence of which gives rise to the exceedingly varied conditions so admirably described by Bouchard in his "Autointoxications."

Neuralgias, especially facial and spinal neuralgias, *sciatica*, *hemicrania*, *peripheral paralyses*, especially when due to syphilis, *paralyses* resulting from the exudates of gout or rheumatism, *functional disorders* of the *spinal cord*, *hysteria*, *hypochondria*, are all favorably influenced, often with remarkable rapidity, by the vapor bath. *Exudates* and *effusions*, whether of inflammatory origin or due to mechanical disturbance of the circulation, are absorbed under the powerful alterative and spoliative influence of the vapor bath; although for this purpose it is perhaps less effective than the hot-air or the electric-light bath. Paralysis resulting from *exudative meningitis* of the spine not infrequently yields rapidly to the influence of the vapor bath. This measure may also be appropriately applied in the treatment of *chronic nephritis* during an acute exacerbation, in *infectious jaundice*, in *acute alcoholic poisoning* in connection with the cold bath, in *tetany*, in *migraine* and *malarial neuralgia* (between at-

tacks), and as a heating procedure in connection with general cold applications, such as the douche, the half bath, and the wet-sheet rub. As a heating procedure (2 to 5 min.), it is very convenient, and is widely used in continental hydriatic establishments, although the electric-light bath is rapidly superseding it.

In the application of the vapor bath, it is important to remember that it is a very powerful measure. It is far more energetic than the hot-air bath, for moist air is a better medium of communicating heat to the body than is dry air.

Contraindications.— The contraindications for the vapor bath are the same as those for the hot-air and the electric-light bath as regards general conditions. The vapor bath is a more vigorous procedure than the hot-air bath, and hence better adapted to the strong and young than to old and feeble persons. Great caution must be employed in its use in advanced cases of cardiac or renal disease, in which it must be, as a rule, strictly prohibited. Exceptions to this rule are noted in the discussion of the hydriatic treatment of these affections.

THE LOCAL VAPOR BATH.

1249 While the chief use of the vapor bath is in general applications, it may be made to render valuable service in various partial applications as well. By suitable arrangements, the application may be confined to an arm, a leg, or any circumscribed portion of the body. When thus used, a much higher temperature may be employed than when the whole cutaneous surface is exposed.

Therapeutic Applications.— The powerful heating effect of the vapor bath renders it highly valuable as a means of relieving pain. It may be applied in nearly all conditions to which the fomentation is applicable. The fomentation itself is in fact little more than a crude form of vapor bath. As compared with the fomentation, the partial vapor bath has the advantage that it avoids mechanical contact with the affected part, and hence is better suited to cases in which there is extreme sensitiveness

of the skin, as in superficial inflammations and cutaneous hyperesthesias. Nearly twenty-five years ago the author learned from a patient who had long been a great sufferer from painful hemorrhoids and *rectal ulcer*, an application of the local vapor bath which is worth mentioning. This patient had made the discovery that by pouring into a pail a gallon or two of boiling water and sitting over it while evacuating the bowels and for a short time afterward, he was able to escape the terrible pain which he otherwise suffered.

By means of the *vapor douche* (**1102**), circumscribed vapor baths may be administered to any portion of the body, and at a temperature much higher than water in any other form can be applied.

THE ELECTRIC-LIGHT BATH.

In 1891 the author's attention was called by a colleague, **1250** Dr. Kate Lindsay, to the convenience of the ordinary incandescent electric lamp wrapped in flannel as a means of applying heat in cases of pain. He had, some years previously, made extensive use of sunlight in the treatment of chronic invalids by a variety of means, especially the sun bath, modified by glass of various colors, and by means of large lenses which concentrated the rays of light upon painful points for the relief of hyperesthesia, particularly in the treatment of so-called spinal irritation. The observation above referred to, showing the electric light to be a convenient means of applying heat for local pain, led him to renew the study of the properties of light, and to begin experiments with various kinds of apparatus designed to make therapeutic applications of the electric light, which resulted in the development of the incandescent electric-light cabinet and various other devices for the general and local application of heat by means of the electric light. The first form of cabinet devised consisted of a compartment about eight feet in height (Fig. 133), upon the inside of which were placed between fifty and sixty incandescent lights, the spaces between the

rows of lights being filled with glass or metal mirrors to multiply the number of lights by reflection. The cabinet is so arranged that the whole body of the patient, sitting upright, can be exposed to the influence of the light, or the head may be excluded, as in the ordinary vapor bath. By means of switches and a proper grouping of the lamps in wiring, the number of lights in use can be instantly and perfectly controlled. As the heat effects of the bath are derived directly from the incandescent films by radiation, and do not at all depend upon the heating of confined air, the fullest provision is made for ventilation. It is not at all necessary that the air should be confined.

In another form of cabinet (Fig. 134), provided with sixty to ninety lamps, the patient lies in a horizontal position, the lights being placed on three sides. A suitable couch, provided with rollers, is pushed entirely within the cabinet, or only so far as to expose such portions of the body as it is desired to bring under the influence of radiant light and heat. By this plan, the influence of the light may be confined to the feet and legs, or any other portion of the body up to the neck. If preferable to do so, the attendant may protect by a sheet and a piece of mackintosh any portion of the body which it may be desirable to exclude from the action of the bath.

By means of other constructions, the effects of the incandescent light are localized for the spine (Fig. 135), the trunk, (Fig. 136), the legs (Fig. 137), and the joints (Fig. 138). These appliances are so quickly and easily managed that they constitute by far the most convenient and effective means of applying heat to the cutaneous surface. By the touch of a button the whole heating power of the apparatus may be brought to bear at once, or may be as quickly terminated. The intensity of the application may be regulated by a rheostat, or by the number and candle-power of the lamps employed.

Method.—There are two general forms of the electric-light bath; viz., the incandescent-light bath and the arc-light

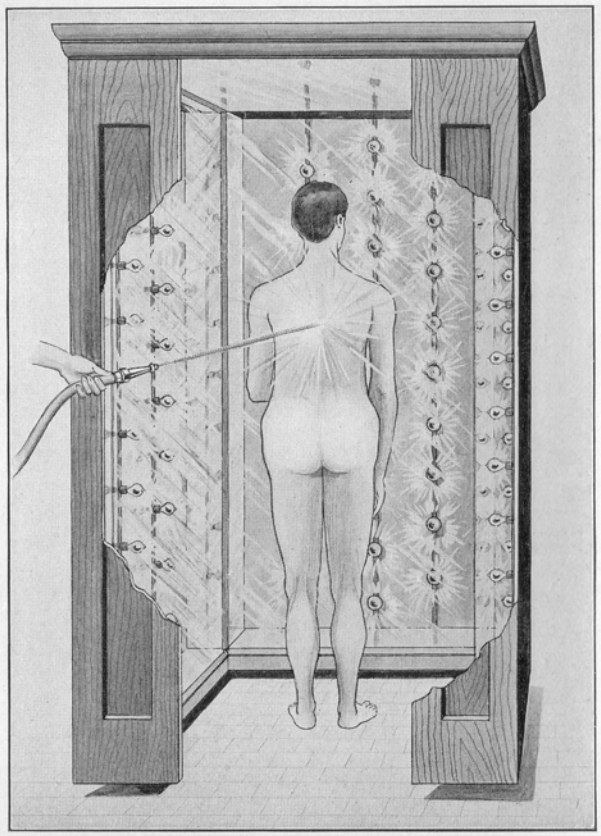


FIG. 139. ELECTRIC-LIGHT BATH AND COLD DOUCHE COMBINED (p. 709).

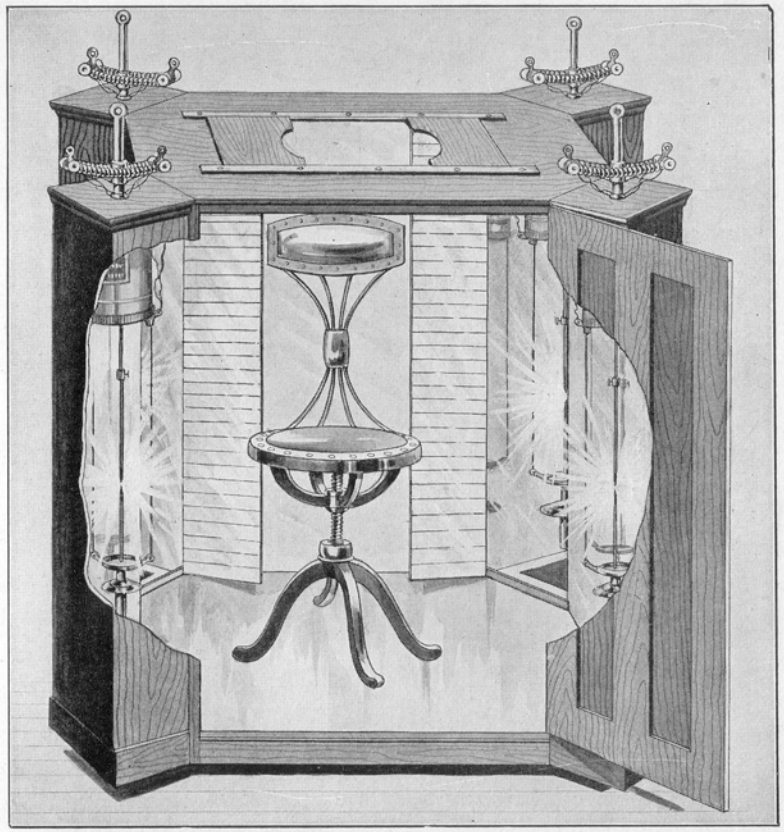


FIG. 140. AUTHOR'S ARC-LIGHT BATH (p. 711).

bath. Unless otherwise indicated, the term "electric-light bath" as used in this work refers to the incandescent electric-light bath, the several forms of which are shown in accompanying cuts. The author has also arranged cabinets in which the arc light and the incandescent light are combined.

The trunk electric-light bath has been found especially valuable in cases of disorders of the liver, kidneys, stomach, and bowels.

Employed in any of its localized forms, the application is usually followed by a cold trunk pack, cold friction, or a cold spray or douche to the surface which has been exposed to the heat.

The incandescent electric-light bath and the calorific or heating bath administered by means of the electric-arc bath may be regarded chiefly as heating procedures, and should be followed by cooling applications in precisely the same manner as the hot-air, Turkish, vapor bath, etc. The incandescent electric-light bath is superior to every other form of heating procedure in the quickness with which the skin may be heated when the object sought is simply a preparation for the cold bath. The time required may be not more than 3 to 5 minutes. When strongly derivative or eliminative effects are required, the application may be continued for 15 to 20 minutes. A longer application is likely to produce exhausting effects through overstimulation of the nervous system and excessive elevation of temperature.

For general revulsive effects, the author has devised a new form of bath, which combines the shower and douche with the electric-light bath. The cabinet is made in such form that the patient stands in an upright position (Fig. 139). After the skin has become thoroughly warmed by the heat from the lamps, a cold shower or horizontal jet douche of the desired temperature is applied, the lamps being protected from the cold water by an internal lining of plate glass. The revulsion thus produced is of the most powerful character, and may be repeated as many times as required. By repeat-

ing the cold application for 10 seconds at intervals of half a minute, this bath may be made very highly exciting and also tonic.

The sweating electric-light bath is usually followed by a shampoo and a cold douche, the finishing treatment being essentially the same as that for the Turkish and the Russian baths.

In cases in which the purpose is simply to excite the circulation of the skin, the daily shampoo is not required, as the heating process will be terminated when active perspiration begins. Feeble patients and persons not accustomed to cold water may be cooled by means of the wet-hand or wet-towel rub, by the cool friction mitt, or by affusion.

In the radiant-heat, or incandescent electric-light, bath the body may be subjected to the most intense heat desired without confining the patient, and without overheating the atmosphere surrounding him. This is due to the well-known fact that rays of heat pass through such transparent media as the air without heating them. This accounts for the intense cold experienced by balloonists and those who ascend high mountains, even in the tropics. As the woodchopper in the logging-camp roasts his back before a big log fire on a cold winter's evening, while the frost is taking sharp nips at his nose on the other side, so the patient in the incandescent electric-light bath, while perspiring freely, may be surrounded by air at the ordinary temperature.

If it is desired to heat the air of the bath, this may be accomplished by simply closing the cabinet, excluding the head. The glass globes of the lamps soon become heated, and in turn heat the air. The heating power of the globes depends upon the degree of vacuum. Winternitz has shown that the more air the bulb contains, the more the glass is heated. It thus appears that the incandescent electric-light bath may be so managed as to combine with the remarkable effects of radiant heat, all the effects of the ordinary hot-air bath, the value of which in promoting evaporation from the

skin and thus encouraging perspiration, is certainly incontestible.

Local applications of the incandescent-light bath may be continued for half an hour or more, if desirable, as in the treatment of chronic inflammation of the knee-joint for resolvent effects, and in obstinate cases of sciatic neuralgia

Local applications to the spine are a most efficient means of exciting the spinal centers, and at the same time producing a powerful derivative effect. This is a most excellent measure in spinal neuralgia, in lumbago, and in reflex spinal pains arising from irritation of the sympathetic ganglia.

Application of the electric light to the joints is a more efficient method in old affections of these parts than any other known, and when combined with the heating compress and massage, accomplishes wonders in a class of cases most of which are generally looked upon as incurable. The heat and actinic rays penetrate the depths of the tissues, vitalizing and energizing the diseased and sluggish parts, and quickening the healing process.

A convenient appliance for a local application of the electric light may be easily improvised from an ordinary incandescent lamp by simply adding a conical tin shade of sufficient size to prevent contact of the lamp with the skin. If the heat is too intense, the skin may be protected by one or more thicknesses of white flannel cloth.

The Arc-Light Bath.—Experiments have shown that in **1251** the incandescent light bath only five per cent. of the electrical energy employed is thrown off as luminous rays; hence the great heating power of this bath.

In the arc light bath (Fig. 140), as stated elsewhere (**599**) in this work, we have other important factors. The electric arc light has been shown to contain actinic rays in even larger proportion than does the sunlight. In the arc-light cabinet which the author has had constructed, devices are introduced whereby the calorific, the actinic, or the combined rays of the electric arc may be brought to bear upon the patient. This

cabinet consists of a quadrangular construction which permits the exclusion of the head of the patient. In each corner of the cabinet is placed a powerful arc light, so arranged that it may be moved up and down at will, thus bringing its rays to bear at any level. At each side of the opening through which the rays of each lamp are admitted, hangs a hinged door, one of red glass, the other of blue glass, so arranged that either screen may at will be brought before the lamp, thus excluding from the cabinet all rays except those which are desired. By means of a strong air current circulating through each lamp compartment, the accumulation of heat is prevented when desirable. The air of the cabinet is also constantly changed so that the patient may be subjected exclusively to the action of the radiant heat of the electric arc.

The author's experience with this form of bath is less extensive than with the incandescent form, but it has been sufficiently long to establish a reasonably fixed method for its employment. The calorific effects of the bath are secured by filtering the rays through red glass as described elsewhere (**596**), this being used when heating effects alone are desired. On the whole, the author's experience has shown the arc light to be less serviceable for this purpose than the incandescent light, as the light is less evenly distributed, and the method of obtaining heat much less economical. By means of the blue-glass screen the actinic rays are employed, with the exclusion of a large share of the luminous and calorific rays. The heating effects obtained with blue glass are very slight, but marked nervous and other vital phenomena may be elicited by a sufficiently long exposure, the experimental proof of which has been given elsewhere in this work (**599**).

The electric arc-light bath is only to a moderate extent a heating procedure, but the heat is sufficient to warm the skin thoroughly, so that tonic applications such as the cold douche may be employed directly after this bath.

[252 **Physiological Effects.**— In experiments conducted by the author, assisted by his colleagues, Drs. Paulson and Rand,

and Professor Gomberg of the University of Michigan, who superintended the chemical work, several very useful and interesting facts respecting the physiological effects of the electric-light bath have been demonstrated. It was ascertained, for example, that this bath is without doubt the most efficient and satisfactory of all modes of producing perspiration, as it stimulates the perspiratory glands and other structures of the skin in the most powerful manner. It causes the perspiration to appear in a remarkably short space of time, thus avoiding the exposure of the body to the exhausting effect of prolonged heat, as profuse perspiration generally appears in the electric-light bath in 3 to 5 minutes, even when the temperature of the air surrounding the patient is not above 85° F., while the dry pack not infrequently fails to produce vigorous activity of the skin within less than an hour and a half or two hours, a still longer time being sometimes required.

A fact which must be kept in mind in the employment of this powerful means of calorification, however, is that the body temperature, as indicated in the rectum, may rise to 103° or even higher in a prolonged electric-light bath.

It has also been ascertained that the lungs throw off, while exposed to the incandescent light, a decidedly larger proportion of carbonic acid gas than usual, showing increased oxidation. Hence the bath must not be excessively prolonged.*

The peculiar value of the electric-light bath is due to its efficiency as a source of radiant energy. In the Turkish bath, heat is communicated to the body chiefly by convection from heated air. Air, being a poor conductor, communicates heat to the body very slowly. Absorption of heat is further hindered by the skin, which is an excellent non-conductor, and by the rapid evaporation of moisture upon the skin, whereby it is cooled so rapidly that it is possible for a person to enter and remain for a considerable time in an atmosphere far above the boiling point. The heat of the electric light is in the form

* See paper, "The Incandescent Electric-Light or Radiant-Heat Bath," read before the Electro-Therapeutic Association at its fourth annual meeting, New York, Sept. 25–27, 1894.

of radiant energy. The electrical current of the incandescent electric-light bath develops light rays to the extent of only 5 to 8 per cent., while heat rays are developed to the extent of 92 per cent.*

This energy is not communicated to the body by convection. The skin, as well as the air, is to a large extent transparent to radiant heat, and the same is true of all the living tissues. This is evidenced by the gastrophone of Einhorn and other transilluminators. Through a speculum placed in the vagina with a suitably arranged electric light placed close to the abdomen, the author has seen the interior of the trunk illuminated and made to glow with a bright red light, the red color being due to reflection from the red corpuscles of the blood. Even the bones are translucent to light when in the living state. This is clearly shown by placing the hand between an electric light and the eye, with the fingers in close contact; if the hand is placed near enough to the light, the whole fingers will be seen illuminated, the bones as well as the soft parts. It may thus be said that heat from the electric light penetrates the body just as it would penetrate any other transparent or semi-transparent medium; while the heat of the Turkish, vapor, or Russian bath is communicated to the body by convection, and slowly works its way into the body by heating the successive layers of living tissue which, although, like glass, transparent to radiant energy, also possess to a greater or less degree the nonconducting quality of glass and allied substances.

Dr. Winternitz, professor of nervous diseases in the Royal University at Vienna, after having carefully reviewed the author's observations concerning the electric-light bath, and having himself made an extended study of the bath, states his conclusions in a recent work† as follows:—

"The electric-light bath presents an advantage over every other means of applying heat in the readiness with which the

* Kuhner, *Int. Klin. Rundschau*, Wein, 1894.

† Winternitz, "Fortschritte der Hydrotherapie."

dosage may be regulated as regards time and intensity. The instant the switch controlling the circuit is closed the whole force of the bath or that portion of it in use is brought to bear at once upon the body. The instant the circuit is opened the heat is wholly and absolutely withdrawn. By means of properly adjusted switches whereby the number of lamps in use may be controlled, the amount of heat applied may be exactly regulated.

"Another advantage of the electric-light bath is that it does not interfere with heat elimination. It in fact encourages heat elimination by encouraging free perspiration. Many other forms of hot applications, particularly hot water baths and sweating packs, cause retention of bodily heat. In the electric-light bath, the heat elimination and the excretion of effete matters which accompany vigorous perspiration proceed with increased activity at the same time the rays of radiant heat are penetrating the tissues, elevating the temperature of the blood, and quickening all the vital processes."

"The importance of this property of the electric-light bath is clearly shown by the interesting experiments of Conrad Klar.* This investigator showed by calorimetric experiment that with the body exposed in an atmosphere somewhat below the body temperature, heat elimination was during the first five minutes ten times the normal amount; while during the second five minutes the amount of heat eliminated was half as great. The diminished loss during the second five minutes was doubtless due to contraction of the blood-vessels of the skin. In the electric-light bath the cutaneous vessels are thoroughly relaxed, and this condition is maintained by the action of the rays of light falling upon the skin while the air about the patient is but little above the ordinary atmospheric temperature, a condition which in the highest degree favors heat elimination."

Professor Winternitz continues :—

"The electric-light bath is a new invention by Kellogg,

*Klar, *Wien. Klin. Woch.*, 1895, p. 180.

Battle Creek, Mich., U. S. A. It is undoubtedly true that radiant heat penetrates the tissues much better than conducted heat, and it is very probable also that the inner life of the cell is influenced by the radiant heat, either qualitatively or quantitatively, and to a higher degree. All the effects of the vapor bath can be produced by the electric-light bath. The loss of carbonic acid gas is considerably greater in the electric-light bath than in the vapor bath, and what is especially remarkable, perspiration occurs very quickly and at a very low temperature, and is very profuse. [Indications of perspiration are sometimes noticed at 28° R. (95° F.). The author has observed perspiration at 85° F., and Professor Winternitz stated to him personally (1899) that he had seen moisture appear upon the skin in a single instance at 65° F. The patient was a somewhat excitable neurasthenic, and very susceptible to the stimulus of radiant energy.]

"Ordinarily a much higher temperature is necessary before symptoms of sweating occur in the vapor bath. The time required to produce sweating in the electric-light bath is commonly $3\frac{1}{2}$ minutes, whereas about 5 minutes are required in the vapor bath. Finally the quantity of perspiration is considerably greater in the electric-light bath. That the radiant heat is the main cause of this, and not the heated air, was evident from the observations made by us that the external part of the leg upon which the rays of light directly fell perspired very much more quickly and profusely than the internal part of the leg, which received only reflected rays. After 10 to 30 minutes the body temperature increased to 40° C. (104° F.), the pulse to 160, respiration to 42, — symptoms of the condition resembling fever. We have used the electric-light bath in ways analogous to the use of the vapor bath in a number of cases of sclerosis, rheumatism, and gout, and have been much gratified with the results. We have as yet made no further experiments. Kellogg reports very good results in sclerosis, arthritis, and many disorders of nutrition. Lehmann has been very successful in psoriasis. Since we

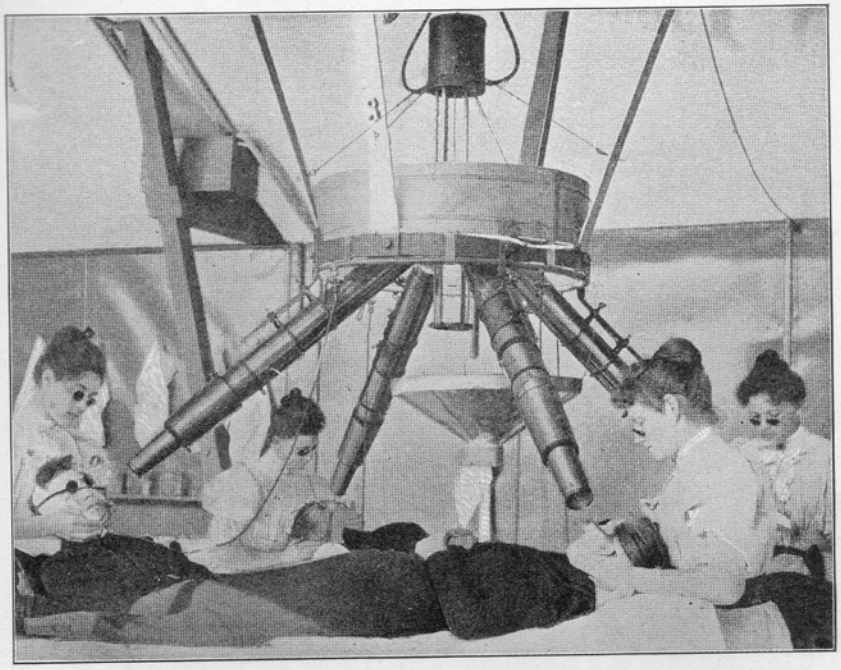


FIG. 141. FINSEN'S APPARATUS FOR PHOTOTHERAPY (p. 721).

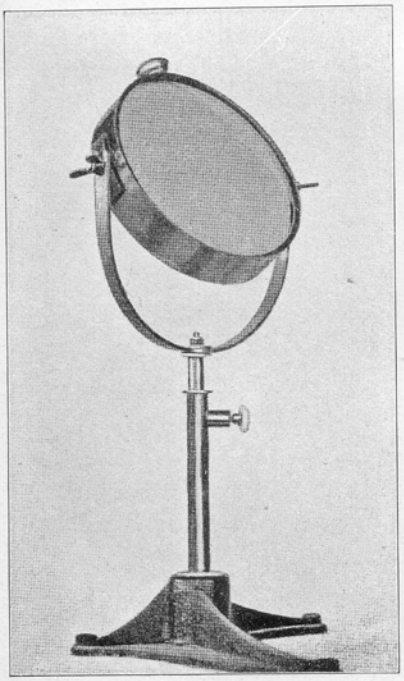


FIG. 142. LENS-BOTTLE FOR FILTERING OUT HEAT RAYS (p. 721).

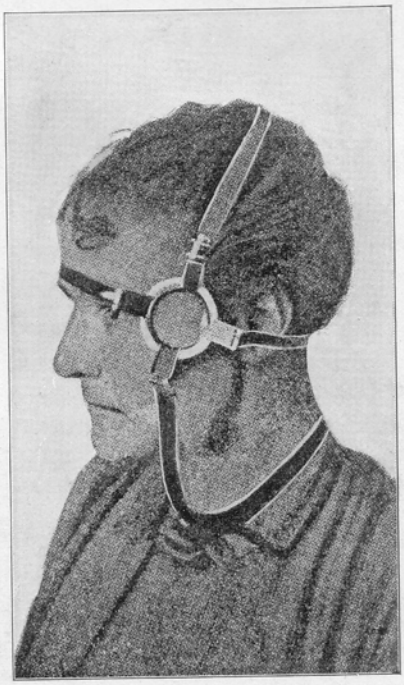


FIG. 143. COOLING COMPRESSOR (p. 721).

have in the electric-light bath a thermal method by which the degree of heat applied can be physiologically and exactly measured, and knowing the powerful influence of light upon the life of the cell and of the whole organism, we believe that this method will hold a prominent place among the forms of thermal applications, and that we shall be enabled by its use to influence a series of maladies more quickly, more effectively, and more satisfactorily than heretofore."

For a fuller discussion of the physiological effects of sunlight and of the electric light, see pages 168 to 180.

Therapeutic Applications.— The electric-light bath has **1253** proved, in the author's hands, of far greater value in the treatment of a large variety of maladies than any other means of applying heat except water, and admits of much more general employment than the ordinary Turkish, Russian, vapor, or hot-air baths. One reason of this is the convenience and rapidity with which the degree of heat may be graduated by turning on or off one or more groups of lamps, the amount of heat being thus rendered absolutely and instantly controllable, since the source of heat relied upon is the incandescent filaments of the lamps rather than a heated atmosphere. The instant the lamp is turned off, the heat which had previously been emitted is withdrawn from operation. If additional heat is required, the desired number of lamps may be turned on, and become instantly operative.

Another reason for the more universal utility of the incandescent-light bath is the fact that when properly applied, its effects are highly tonic in character. A short application of the bath at full force for a time just sufficient to induce powerful stimulation of the skin without provoking perspiration is a most effective means of cutaneous stimulation. The tonic effects of such an application may be still further intensified by instantly following the bath with a cold spray or other cold application, thus producing a revulsive effect of the most agreeable and effective character. The excessive heating of the skin prepares the way for the cold application,

without at the same time so overheating and relaxing the blood-vessels as to render recovery of the tone of the cutaneous tissues so tardy as to involve the risk of exhausting the patient too greatly or exposing him to the liability of taking cold. In the experiments referred to, the amount of perspiration produced in the electric-light bath was found to be double that produced in the Turkish bath. The body temperature is also raised much more rapidly in the electric-light bath than in any other form of bath, because the rays of radiant energy pass through the skin and reach the interior of the body at once.

The electric-light bath is especially valuable in *cardiac disease* and in *diabetes*, in which prolonged sweating measures can not usually be employed without more or less risk. The penetrating nature of the heat of the electric-light bath stimulates oxidation of the residual tissues, and thus hastens the disappearance of redundant fat in *obesity*. In *dropsy*, associated with either cardiac or Bright's disease, in the *toxemia* of *chronic dyspepsia*, and in all conditions for which general and local applications of heat are applicable, the electric-light bath stands pre-eminent.

Chronic malarial cachexia, *syphilis*, *diabetes*, *obesity*, *neuritis*, *neuralgia*, *acute nephritis*, *migraine*, *neurasthenia*, *tetany*, *habit chorea*, and *hysteria* yield good results to the thermic impressions of the electric ray.

In *rheumatic* and *anemic* patients, and in all cases when the heat-making capacity is small, the electric-light bath serves an exceedingly useful purpose in preparing the skin for cold applications by storing up in it supplies of heat. And it serves a useful purpose in this way, not only in preparing the patient for tonic applications of water, but as a means of producing most excellent revulsive effects. For pure revulsive effects, only the circulatory reaction is desired, it being, in fact, necessary to suppress thermic reaction altogether. Hence the duration of cold applications which follow hot applications should be such as exactly to neutralize the heat

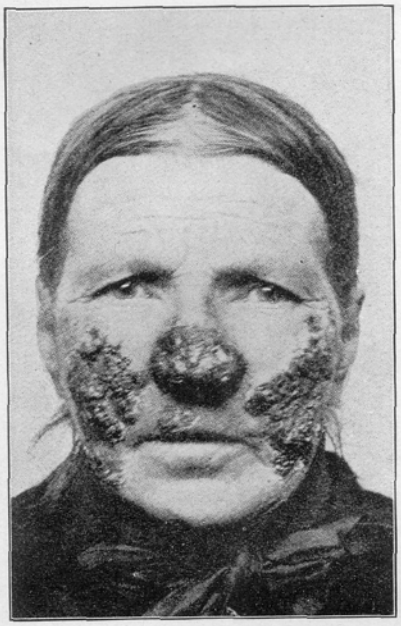


FIG. 144. A CASE OF LUPUS BEFORE TREATMENT (p. 721). (Finsen)



FIG. 145. A CASE OF LUPUS AFTER TREATMENT (p. 721). (Finsen)



FIG. 146. SUN BATH (p. 722).

which has been absorbed by the skin in the previous hot application. The electric-light bath having the power to store up quickly a large amount of heat in the skin, it is consequently of special service in applications of this kind, which are the most effective means of relieving internal congestion, as well as the most powerful of all external agents for the relief of pain.

The electric-light bath is superior to all others in the treatment of *chronic rheumatism* and all maladies dependent upon the *uric acid diathesis*, owing to its ability to elevate body temperature while at the same time producing vigorous cutaneous activity. The elevated temperature stimulates the oxidation of proteid wastes, and augments vital combustion, while the increased skin activity carries off the waste products prepared for elimination.

Recent physiological experiments have shown that the elevated temperature in febrile conditions is one of the methods by which nature combats the causes of disease, or neutralizes some of the morbid conditions resulting from disease. The physiological effects of the electric-light bath may exercise in many cases a strongly curative influence by the elevation of the body temperature, thereby enabling it to produce antitoxins, or to render effective the curative efforts instituted by the *vis medicatrix naturæ* of the body.

As a *prophylactic*, this bath also possesses a high value, especially for persons who live a sedentary life, as teachers, doctors, lawyers, preachers, judges, and professional men generally, and to a still greater degree for the majority of women, as it is the best substitute for muscular activity in the open air.

The hygienic value of the sweating bath is certainly scarcely yet appreciated by the majority of civilized men and women. This can not be said of the Finns, however; for in Finland every house has connected with it a bath-house with conveniences for producing vigorous perspiration. Indeed, the author, while on a recent visit to Copenhagen, was told

by an intelligent Finnish gentleman that it is the custom in his country for a young man anticipating matrimony to build as a foundation for his future home, first of all, a sweat-house. A vast multitude of city dwellers in civilized countries are suffering tortures from disease in various forms, and dying prematurely, because of the neglect of that important hygienic provision in the injunction of the Almighty to Adam, "By the sweat of thy brow shalt thou eat thy bread." Indeed, the neglect to sweat is one of the most prolific causes of disease in the conditions of civilized life. A modern writer has very sagaciously suggested that the chief difference between the savage and the civilized man is in the way he sweats. The savage sweats his brow in earning his bread, and taxes his brain but little; the civilized man earns his bread by the sweat of his brain, but seldom sweats his brow.

The electric-light bath, while not a complete substitute for the sweating produced by exercise, certainly comes nearer to being so than any other heating process; and when followed by some vigorous cold application, as the cold bath, possesses a hygienic value which can not be overestimated.

A local application of the electric light for 15 or 20 minutes, followed by an application of an ice compress or ice friction for 5 to 8 seconds, is almost a panacea for the pain of *sciatica* and for similar painful affections in which there is no inflammatory action.

The electric-light bath has been found superior to all other means for applying heat to circumscribed areas of the surface; and by the use of a number of simple appliances it is far more convenient in its application than the fomentation, hot bags, or any similar appliance (Figs. 135–138).

M. Below, who has for some time employed the electric-light bath constructed after the author's plan, reported in a paper read before the medical society of Berlin in 1898, a considerable number of cases in which the bath had been successfully used in the treatment of rheumatism, syphilis, and various other morbid conditions.

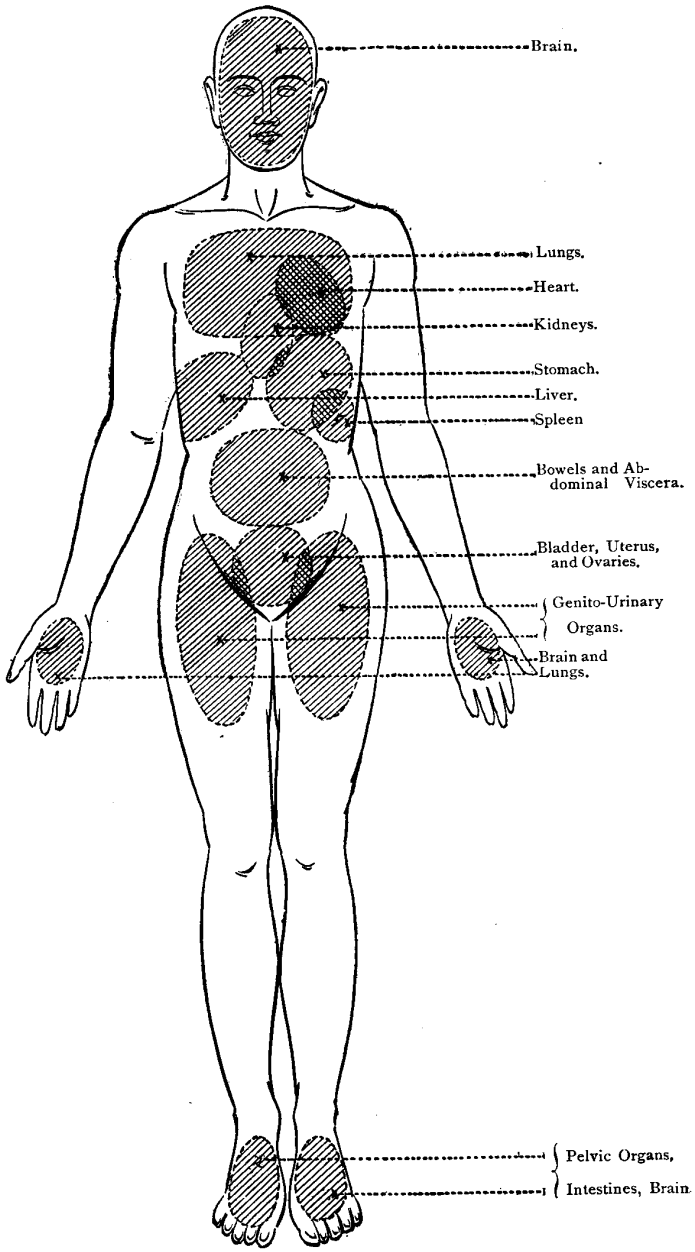


FIG. 147. CUTANEOUS AREAS REFLEXLY ASSOCIATED WITH INTERNAL PARTS (pp. 117–120).

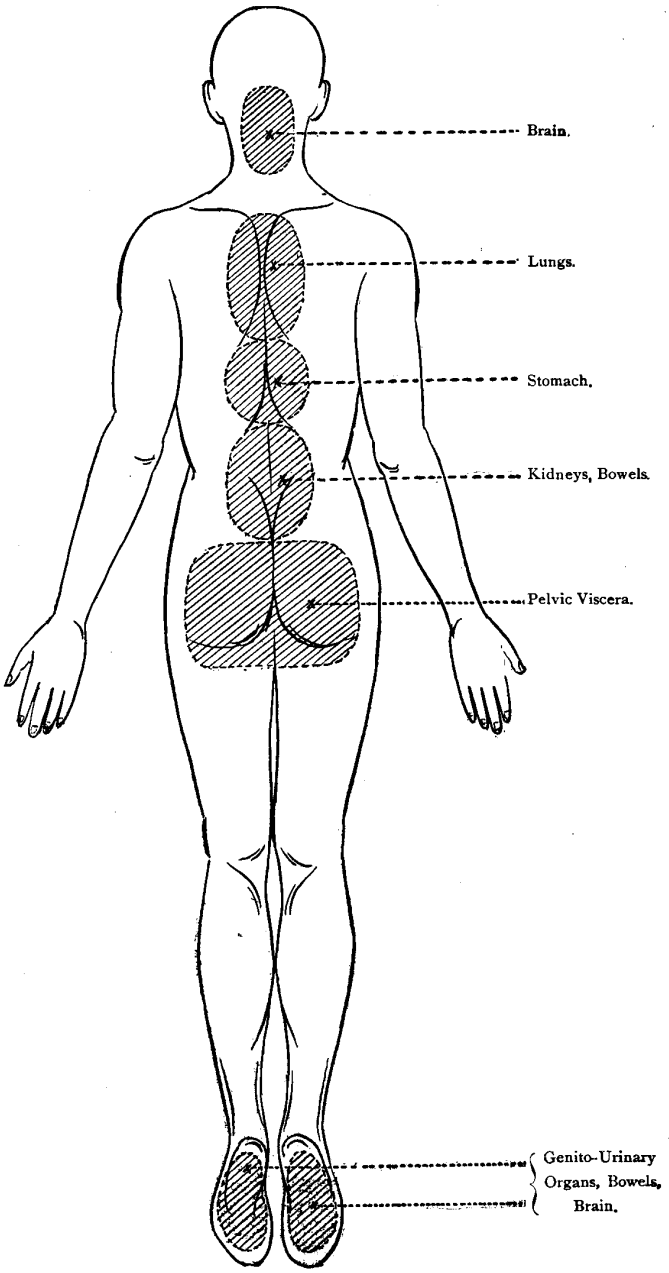


FIG. 148. CUTANEOUS AREAS REFLEXLY ASSOCIATED WITH INTERNAL PARTS (pp.117–120).

That the *electric arc light* acts powerfully upon the nervous system has been clearly proved by the experiments of Maklakow, Arloing, Paul Bert, and others. As yet, it is true, we are not fully acquainted with the exact measure of this influence; neither do we know precisely to what extent it may be utilized therapeutically; but knowing the fact, and having at hand the appliances necessary for exact observation, we are on the road to therapeutic discoveries which may prove to be not only interesting but of immense advantage to the human race.

That it is a true nerve tonic can not be doubted. It is daily in use in the treatment-rooms of the Battle Creek Sanitarium, and in the great hydriatic institution of Dr. Winternitz, at Kaltenleutgeben, near Vienna, and produces most excellent results, especially in the treatment of neurasthenics suffering from chronic toxemia.

Finsen, of Copenhagen, has shown that the actinic ray of the electric arc is capable of destroying the bacillus of tuberculosis in the skin under suitable conditions, and has utilized it in the successful treatment of hundreds of cases of lupus. On the occasion of a visit to the "Light Institute" at Copenhagen, an institution under the supervision of Professor Finsen, the author saw demonstrated most clearly the powerful therapeutic value of the actinic ray of the electric arc in the treatment of this disease (Figs. 141, 142, 143). There were numerous cases nearly cured, photographs of which, taken when they entered the institution, showed that the disease had already attained an advanced stage, while the history showed that these cases had proved wholly intractable to other methods of treatment. This is well shown by the accompanying illustrations (Figs. 144, 145). At the time of the author's visit, there were one hundred and twenty-five persons under treatment in the institute. A large number of these were personally seen, and the progress which had been made under the treatment was remarkable. The author is awaiting the opportunity to make a trial of this same

method in the treatment of leprosy, believing that it may be found of value in dealing with this most obstinate malady, at least in the tubercular form of the disease.

THE SUN BATH, OR INSOLATION (Fig. 146).

1254 Sunlight is one of the most powerful of all hygienic and curative agents. As a hygienic measure it is of inestimable value in the destruction of dangerous microbes, the most of which are unable to resist the action of the direct rays of the sun for more than a few minutes. Sunlight is thus the most important of all disinfecting and sterilizing agencies. The value of sunlight in the maintenance of health is well shown in the dwarfed development or rapid deterioration of plants deprived of its stimulating influence. In caves, mines, and other places from which the light is excluded, plants, with the exception of the fungi, do not grow, or if they do, very quickly die, never attaining maturity. Animals also are dwarfed and sickly under these conditions.

It was long ago noticed that in hospitals a larger percentage of recoveries occurred on the sunny side than on the shady side of the ward. At least a part of the well-known good effects obtainable from an outdoor life or from systematic exercise out of doors must be attributed directly to the influence of the sun's rays.

In taking a sun bath, either the whole or a part of the body may be exposed to the direct influence of the solar rays, or some protection may be afforded by a covering of white cheese-cloth. The bath may be best taken in a room properly constructed for the purpose. The room should face the south (in the Northern hemisphere), and the windows should be sloping. The patient should lie on a cot placed before a window, the head being protected from the direct rays of the sun. The length of the exposure will depend upon the intensity of the sun's rays and the effects sought. If the light is very intense, or the patient very feeble, the duration of the bath should not be more than five minutes, if the

whole body is exposed; while in less sensitive patients, or those accustomed to the sun bath, it may be continued from twenty minutes to half or three quarters of an hour.

Physiological Effects.— The sun's rays not only influence the skin, but pass through the skin into the body, exciting and stimulating every cell and tissue. The surface circulation is greatly accelerated, free perspiration occurs, the heart's action is increased, and the activity of all the vital functions is promoted. In many cases the patient experiences very pronounced sensations of languor or drowsiness during the bath, and not infrequently falls asleep. The effects of the sun bath are practically identical with those of the electric-light bath, which has been previously described.

The investigations of Finsen, of Copenhagen, Bert, and Maklakow, referred to elsewhere (**597** to **599**), have greatly broadened our knowledge regarding the physiological effects and therapeutic properties of light. Sunlight may be properly regarded as not only a source of radiant energy in the form of heat, but as a powerful tonic through its actinic rays. Its calorific, or heating, rays may be isolated by placing a red-glass screen between the sun and the patient, so that the actinic rays are filtered out. For tonic effects, the calorific rays may be separated by employing a blue-glass screen in like manner.

Therapeutic Applications.— The sun bath is useful in all **1255** cases of *mal-nutrition*, *anemia*, *inactivity* of the *skin*, *chronic dyspepsia*, most cases of *neurasthenia*, *indigestion*, *chlorosis*, *rheumatism*, *diabetes*, and *obesity*. The only class of cases in which the bath is positively contraindicated is that in which the patient has recently suffered from heat stroke, and is especially susceptible to the action of the direct rays of the sun.

The ancients made great use of the sun bath in the treatment of the sick. According to Plutarch, Diogenes, the renowned Athenian cynic, was in his old age accustomed to lie in the sunshine for the purpose of recruiting his energies,

a custom which, according to Pliny, was common among old men in Greece. It is stated that Diogenes valued his sun bath so highly that when called upon by Alexander, who offered to render him any service in his power, he replied, "Only stand a little out of my sunshine."

According to Pliny, the sun bath was also in very common use among the Romans. Both the older and the younger Pliny were accustomed to spend an hour in exposure to the sun daily after dinner. Hippocrates prescribed the sun bath for chills. A noted French physician once said to some people who had brought their children to him for treatment: "Take these children to the country; feed them as well as you can; but above all, roast them — roast them in the sun."

Suggestions and Precautions.— It must be remembered that some people are so susceptible to the sun's rays that untoward effects resembling, or identical with, heat stroke, are very readily produced. On this account it is well to keep the patient under careful supervision during the bath, especially the first applications. If the sun's rays are very intense, a sheet should be thrown over the patient at the first application, to avoid the possibility of extreme effects. In all cases, the exposure of the head must be avoided. The actinic rays powerfully influence the brain. The author observed, as a common custom in Egypt, the protection of the head by a huge red shawl wound about it.

LOCAL OR PARTIAL HYDRIATIC MEASURES.

1256 A very great variety of local or partial hydriatic applications are in use, each experienced practitioner of hydrotherapy employing some measures which he has especially devised or modified to meet his own views or convenience, or in the adaptation of his resources to his needs. Thus, in the description of local or localized measures, the author will not attempt even to mention all possible applications, but only the leading and typical forms and their principal modifications. Several new measures, the outgrowth of the authors'

personal experience, are presented, but only such as have borne the test of actual use and have proved their efficiency.

In a strict sense, all hydriatic applications are local or partial in character, since the most general measures, as a rain douche, an immersion or a vapor bath, act directly only upon the skin, thus immediately influencing only a small portion of the blood-vessels and nerves of the body. As fully shown elsewhere, however, an application to the entire cutaneous surface, though partial in an anatomical sense, becomes general through reflex action and reaction.

These general applications are often of service for securing purely local effects, as in the use of the hot bath in acute nephritis, which relieves the renal congestion by congesting the skin; the neutral bath to quiet the central nervous system; the wet-sheet rub to relieve cerebral congestion.

On the other hand, local or partial applications, while generally employed for purely local or localized effects, either at the seat of application or at some remote part by revulsive or derivative influence, likewise produce in many instances more or less decided general effects, as may be noted in the tonic influence of the running cold foot bath, the general sedative effects of prolonged cold applications to the head, the restorative and energizing effects of a cold douche to the spine, the excitant effects of very hot or very cold applications to almost any portion of the surface, even though the area be very limited.

The localized effects of partial applications depend upon a few well-established principles. These have been elsewhere briefly stated, but may be here recapitulated and extended: —

1. Reflex Relations.— Every portion of the cutaneous sur- 1257
face is in special reflex relation with some internal organ or vascular area. The most important of these reflex relationships are the following (Figs. 147, 148):—

(1) The skin of the scalp, face, and back of the neck is in reflex relation with the brain. The circulation of the scalp is also immediately connected with the brain through

the medium of the skull, the vessels of which anastomose with those of the scalp and those of the brain.

(2) The skin of the back is reflexly related to the centers of the spinal cord. This is also true of the entire skin surface of the trunk and limbs.

(3) The skin covering the neck is reflexly, through the spinal cord, related to the pharynx and the larynx.

(4) The upper dorsal region, the skin of the chest in front and behind, and the inner surface of the thighs, have special vasomotor reflex relation with the lungs.

(5) That portion of the chest wall overlying the heart (the precordia) is especially associated with the heart,— a fact often of priceless service.

(6) The skin covering the lower portion of the right chest is reflexly related to the liver.

(7) The skin surface of the lower left chest is associated with the spleen.

(8) The skin covering the lumbar region is reflexly associated with the uterus, ovaries, bladder, rectum, kidneys, and intestines.

(9) The skin covering the lower part of the sternum is especially associated with the kidneys.

(10) The dorsal spine is associated with the stomach, a fact which may often be made of great service in the suppression of nervous vomiting.

(11) The skin of the epigastrium has special relations with the stomach.

(12) The whole surface of the abdomen, and especially the umbilical region, is reflexly related to the intestines.

(13) The lower abdomen is associated with the uterus, bladder, colon, and rectum.

(14) The feet, and to a considerable extent the whole lower extremities, are associated with the brain, lungs, bladder, uterus, ovaries, and bowels.

(15) The skin covering the shoulders and upper portion of the back and the arms and hands is an area which is closely associated with both the cerebral and the pulmo-

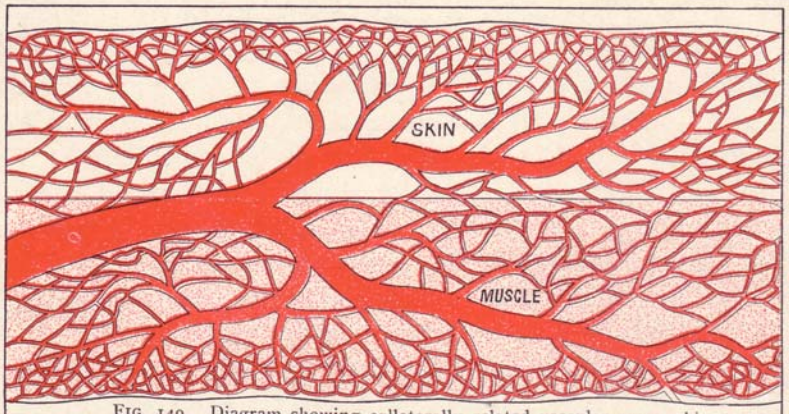


FIG. 149. Diagram showing collaterally related vascular areas, skin overlying muscle (p. 731).

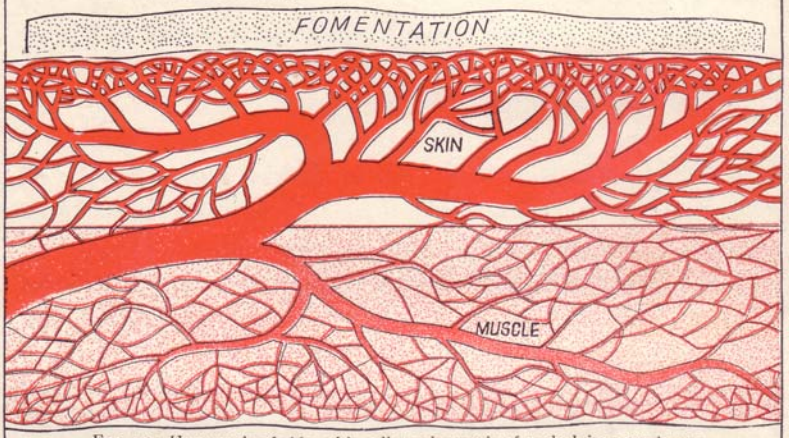


FIG 150. Hyperemia of skin with collateral anemia of underlying muscle produced by a hot application (p. 731).

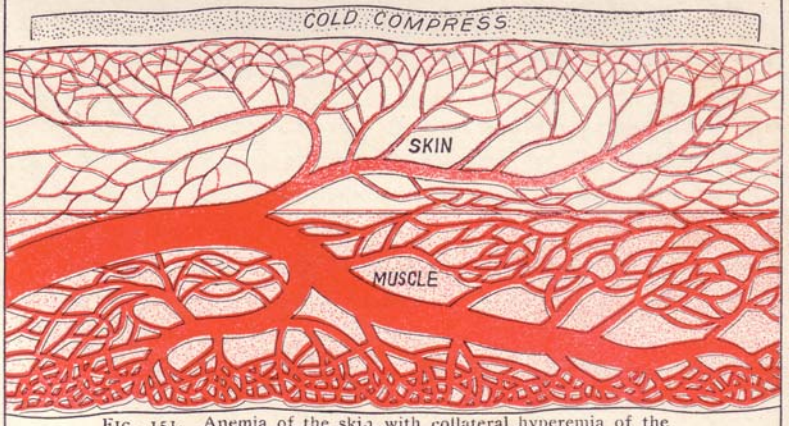


FIG. 151. Anemia of the skin with collateral hyperemia of the underlying muscle produced by a cold application (p. 731).

nary circulations, and may be employed in producing most useful therapeutic effects both by the reflex influence of cold applications and by the derivative effects induced by hot applications.

2. Internal Reaction.— The changes induced in internal 1258
parts by applications to the surface, especially by cold applications, may be not improperly termed *internal reaction.* (For full discussion of the phenomena of reaction, see paragraphs **429–481.**) These changes it is desirable sometimes to suppress or diminish, in other cases to encourage.

In general, it may be said that the more intense the external application, the more pronounced will be the internal reaction. The reaction of cold differs diametrically from the reaction following a hot application. The reaction following cold increases all kinds of vital work — heart and vessel work, brain and nerve work, gland work, respiratory work, tissue building, oxidation, poison destruction, poison elimination, heat production. Heat is followed by decrease of vital work.

It is often desirable to lessen the internal reaction to cold. This may be done in several ways, as follows: —

(1) By applying water of a *higher temperature*, thus lessening the external reaction.

(2) By means of the *Scotch douche* or other analogous measures. The greater the extremes of heat and cold, the greater the internal reaction. By raising the temperature of the cold application and lowering that of the hot application, thus lessening the difference between the two extremes, the intensity of the internal reaction may be diminished.

In the use of the alternate douche (**1044**), the greater the number of alternations, the greater the excitation induced.

Internal reaction may be diminished when alternate applications are employed, by *graduation* of the alternations, — increasing the difference between the extremes of heat and cold with each successive alternation, either by increasing the temperature of the hot application or lowering that of the cold application, or by changing both simultaneously.

(3) The *graduated bath*, either immersion or douche, lessens internal reaction and especially thermic reaction by the avoidance of an abrupt change of temperature. The zero of the temperature sense is gradually lowered by beginning the bath at a temperature near that of the body (98° to 100° F.), and gradually cooling to 90° during a period of from 30 to 60 seconds. The sensory impression made is thus greatly attenuated.

(4) By applying *before* the local application a general cold bath of some sort, the external and internal reactions may be generalized, and thus the local effect will be attenuated. The general application may be either a general douche or some form of nonpercutient application, as a wet-sheet pack (**1179**), a wet-sheet rub (**1216**), an affusion (**1103**), or general friction, either moist or dry.

(5) We may *precede* the local application by the general Scotch douche, the intensity of which may be graduated in any one of the several ways elsewhere pointed out (pp. 457, 459–461).

(6) We may *follow* the local application with a general douche or other cold application whereby general external and internal reaction may be produced.

1259 **3. Reflex Action.**— A cold application to the surface causes at first a brief contraction of the vessels in the internally related viscus as well as in the skin. This contraction is normally followed by reaction in both the skin and the internal parts. For the production of reflex effects the douche is the most powerful measure (**1070** to **1103**), but various other means may be employed, as the following: —

(1) Local cold affusion.

(2) Hot and cold affusion.

(3) Cold foot bath for 10 to 20 seconds, the water very cold and not more than one fourth of an inch deep.

(4) Alternate foot bath.

(5) Cold sponging.

(6) Cold compress.

(7) Ice rubbing.

(8) Fomentation followed by ice rubbing.

(9) Fomentation followed by an ice compress for a few seconds.

(10) Hot sponge bath followed by ice-water sponging.

(11) Vapor douche followed by cold affusion, ice rub, or ice compress.

The reflex effects resulting from localized hydriatic applications differ in both intensity and quality, according to the duration and temperature of the application.

4. Fluxion.— By the term *fluxion* is meant the movement **1260** of blood. There are four modifications of blood movement to be considered: —

(1) *Increasing the rate of movement* of blood through an organ.

(2) *Diminishing the rate of movement* of blood through a part.

(3) *Increasing the volume* of blood in a part containing too little blood (anemia).

(4) *Diminishing the volume* of blood in a part containing too much blood (congestion, or hyperemia).

In the preceding paragraphs the rationale of increased rate of blood movement resulting from reflex hydriatic applications (**1257**) has been explained, as has also the production of passive congestion for derivative effects (**1261**) It remains to consider more fully the rationale of the production of changes in the volume of blood by hydriatic means not acting reflexly.

When a cold application is made to the whole surface of the body, all the internal organs are thereby congested— after the first momentary contraction of their vessels has passed away — by the mechanical displacement of blood from the skin inward, or *retrostasis*. During the first instant after the general cold application, while the internal vessels are contracted, the surplus blood, chased out of the systemic circulation, finds temporary refuge, so to speak, in the veins and

the portal reservoir, from which, in the later moments, it is distributed among the internal organs. When the cold application is partial, however, this general retrostasis of blood does not occur except to a very limited extent, a very different readjustment of the blood distribution taking place. For example, if cold is applied to the lower part of the body, the blood-vessels, both external and internal, contract, and the blood is driven out of the lower extremities, pelvis, and lower abdomen. At the same time, the vessels of the head, chest, and arms are dilated, and the volume of blood in these parts is increased. The reverse is equally true. The umbilicus is the dividing line in this compensatory action. If cold is applied to one foot or hand, the effect is not, however, as might be supposed, to increase the volume of blood in the other hand or foot, but to decrease it, as shown by Brown-Sequard, through reflex action. A cold compress or a percussion douche over the spine does not produce general internal congestion to any marked degree, but causes contraction of the spinal vessels, which by reaction is followed by active congestion if the application is short and intense, and so produces a powerful tonic effect through exciting the spinal centers.

By means of hot applications, effects the opposite to those following cold are produced. The dilatation of the vessels of the legs following hot applications to these parts produces congestion of the vessels of the lower part of the body and anemia of the upper parts.

By the application of this principle, it is possible to combat either anemia or congestion of the brain, lungs, uterus, or other important vital parts. It should be said, however, that the principle is more often and more conveniently applicable to congestions and anemias of the upper parts of the body than to similar conditions of the lower parts, for the reason that intense congestion or anemia of the brain and lungs can not be induced with the same degree of safety with which we may congest the legs or lessen the blood supply of these parts.

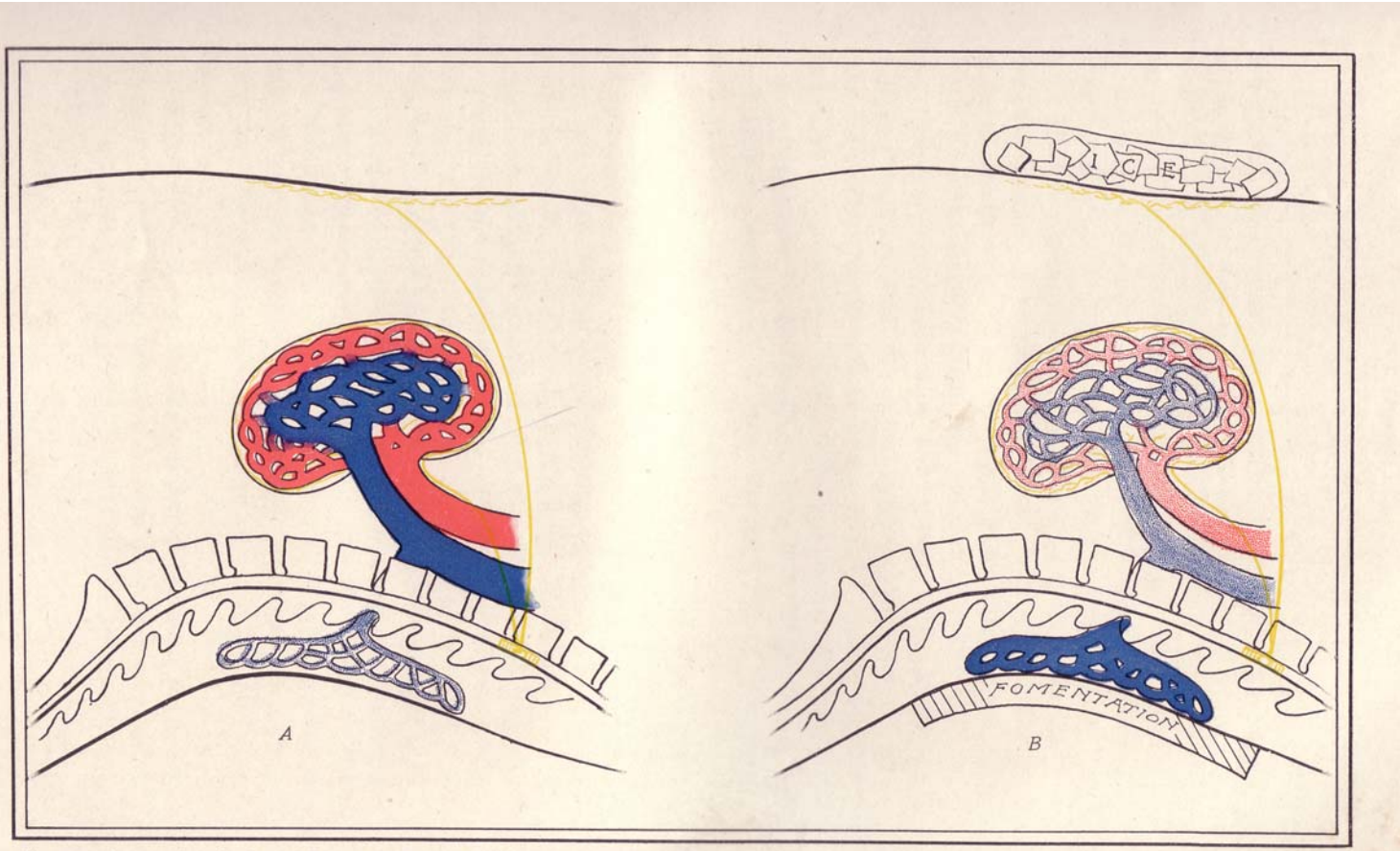


FIG 152. Co-operation of reflex and fluxion effects (*1361*). *A*. Renal congestion. *B*. Ice-bag to lower sternum with fomentation to loins.—Congestion relieved (p. 732).

Collateral Anemia and Hyperemia.— Where all the parts concerned are supplied by a common arterial trunk, reciprocal changes in the volume of blood occur between the superficial and the deeper parts. This relation exists between any muscle, joint, or bone and the overlying cutaneous area. It also exists between the overlying skin and the following organs : The brain, the spinal cord, the eyes, the ears, the serous lining of the pleural and peritoneal cavities, the lungs, the kidneys, the uterus and ovaries in woman, the testicles and prostate in man. This relation between the skin and the uterus, ovaries, kidneys, bladder, and lungs is less intimate than between the muscles and joints; but clinical results as well as anatomical considerations indicate that such a relation really does exist, though more remote, and it is even possible to trace a very distinct and direct anatomical connection between the blood-vessels of the liver, stomach, intestines, spleen, and pancreas, and the contiguous superficial parts (**1270** to **1276**). **1261**

If, in illustration of this principle, we apply a cold compress over a fleshy part, as the front of the thigh, the result will be the production of pronounced anemia of the skin and a corresponding hyperemia of the underlying quadriceps extensor femoris muscle. If, on the other hand, a hot compress or fomentation be applied instead, the result will be the diversion of blood to the skin and the production of anemia of the muscle (Figs. 149, 150, 151).

It is by the application of this principle that we are able to combat inflammation, congestion, and pain in muscles and other deep parts which are directly connected with the skin through a common blood supply. By diverting blood into the skin by means of a fomentation or other hot application, the congested or inflamed muscle, nerve, or joint may be relieved.

In not a few instances, the collaterally related parts are not contiguous. The relation of the blood-vessels rather than the simple contiguity of the parts should be considered.

Many examples of this might be given. The cutaneous vessels of the arms are collaterally related with the brain circulation through the vertebral branches of the subclavian; with the lungs through the superior intercostals; the legs and hips with the head by diverting blood into the abdominal aorta and its branches; the legs with the pelvic viscera by diverting blood into the external branch of the iliac.

The most powerful effects possible are obtained by measures which combine the principle of induced hyperemia of collaterally related parts with that of reflex stimulation of the controlling vasomotor centers. Fortunately, the cutaneous areas which may be utilized for these respective purposes are often distinct, so that there is no anatomical obstacle in the way of their simultaneous employment. These relations are indicated in Figs. 152–155. Examples: The fomentation to the back of the chest with the cold compress to the front; a hot foot bath combined with a cold hypogastric compress.

Venous or passive hyperemia may likewise be induced as a means of draining collateral vascular areas. The means to be employed are the fomentation at a moderately high temperature (104° to 120°), and the protected heating compress applied without change until the desired effect has been obtained. Venous congestion is produced in connection with the arterial hyperemia resulting from a hot application. It may also be induced simultaneously with arterial hyperemia, by operating upon distinct areas (**1291**).

The portal system constitutes a most important arrangement for modifying the volume of blood in the systemic system. It is capable of holding all the blood in the body, and having no valves, there is easy fluxion in and out through the four gateways by which it communicates with the systemic veins (**1277**).

By means of induced collateral *arterial hyperemia* the arteries of a part are drained, the blood supply is lessened, and tension lowered. By induced *venous hyperemia* the veins of the part interested are drained, and the movement of

blood through the part is accelerated by lessening resistance. An inflamed part does not need less blood, but less tension, and especially the rapid removal of toxins, CO_2, and disabled leucocytes, and an abundant and constant supply of fresh and pure serum, oxygen, and active leucocytes.

In active visceral congestion, as in the first stage of an inflammation, collateral arterial hyperemia is especially indicated. In passive congestion, collateral venous hyperemia is especially useful, but the best effects will be obtained by the simultaneous establishment of both conditions (**1291**).

Induced venous hyperemia may render most valuable service in many cases by association with cold compresses applied to another cutaneous area which is reflexly associated with the actively congested internal organ under consideration.

Cutaneous Areas which may be Utilized for Derivative Effects.— The anatomical arrangements whereby derivative effects in favor of various internal parts may be produced by hydriatic measures are scarcely less elaborate and interesting than those by which reflex effects upon both blood and nerve supply are secured. The following are only a few of the more important and clearly established collateral relationships whereby useful derivative effects in favor of important vital organs may be induced through the application of heat (**1286**) or combined heat and cold (**1290**), the skin surfaces named indicating the areas to which the application is to be made, and the blood-vessels the channels through which the fluxion takes place (heat produces hyperemia of the skin, and collateral anemia of the deep structures which are vascularly related thereto, while cold applications to the same surfaces induce anemia of the skin and hyperemia of the deep-lying parts) (Figs. 150, 151):— 1262

The Brain.— The scalp, through the direct vascular connection between the cutaneous vessels and the vessels of the dura mater; the skin of the face, by diverting the blood into the cutaneous branches of the external carotid. This method is rarely practical, however, as the bones of the skull and

face are so good conductors that the brain is quickly heated by a hot application, and thus the desired derivative effect is lost. The most practical method of lessening the blood supply of the brain is by means of alternate compresses or the reflex influence of cold applications. Hot applications must be brief.

Short hot applications to the back of the neck may divert blood from the cerebral branches of the vertebral arteries into the cervical, influencing especially the cerebellum.

Hot applications to the hands and arms may diminish cerebral congestion by diverting blood from the vertebral arteries, which are branches of the subclavian. If made very hot, favorable reflex effects will also be produced during the first moments of the application.

Warm applications about the neck, even warm wrappings, congest the brain by inducing dilatation of the carotid and vertebral arteries (cold produces the opposite effect [**307**]. Prolonged warm applications to the back of the neck congest the brain, as the vertebral arteries give off few cutaneous branches, so that their dilatation by prolonged warmth results in an increased supply of blood to the brain.

The direct connections between the venous sinuses of the brain and the cutaneous veins of the scalp afford opportunity for the relief of passive congestion of the brain by dilating the cutaneous veins, and thus enlarging the channels leading to the heart. The anatomical arrangements whereby the blood entering the cranium may be conveyed back to the heart through the cutaneous veins of the head are numerous and highly interesting. According to Woolsey,* the following relations exist: -

"(*a*) The *longitudinal sinus* communicates with the temporal veins through one or both parietal foramina when present, and, in the child, with the veins of the nose through the foramen cecum.

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* "Text-book of Anatomy by American Authors." Gerrish.

"(*b*) The *lateral sinus* is connected with the occipital (or posterior auricular) vein through the mastoid foramen (the largest and most constant emissary), and sometimes with the vertebral vein through the posterior condylar foramen.

"(*c*) The *cavernous sinus* communicates with the pterygoid plexus through the foramen of Vesalius and the foramen ovale, as well as through the inferior ophthalmic vein; with the pharyngeal plexus through the foramen lacerum medium; and with the internal jugular vein by the carotid plexus through the carotid canal.

"(*d*) The *occipital sinus* communicates with the vertebral and extraspinal veins through the anterior condylar foramen.

"(*e*) A small vein occasionally passes to the *torcular* through a foramen in the occipital bone near the external occipital protuberance."

By hot or alternate hot and cold applications to the areas above indicated, any one of the principal sinuses of the brain may be drained into the veins of the adjacent skin. For example: —

1. To influence the *longitudinal sinus*, applications should be made to the parietal region, that is, the sides of the head.

2. The *lateral sinus* may be drained by applications to the back part of the head, especially the areas just behind the ears.

3. The *cavernous sinus* may be drained by applications over the ear, face, and side of the neck.

4. Blood may be diverted from the *occipital sinus* by applications to the back of the neck.

Applications made to the back of the neck influence especially the cerebellum, dilating the vertebral and the posterior jugular veins.

Applications to the side of the head and neck drain the brain through the internal jugular.

The Spine.—The skin of the back may be used to drain **1263**

the spinal cord, through the dorsal branches of the aortic intercostals, which nourish the cord.

The dorsi-spinal veins, the superficial veins of the back, form a plexus which connects with the vertebral veins of the neck, with the intercostal in the dorsal region, the lumbar and sacral veins lower down. The dense plexuses formed by these veins in the skin and especially about the spinous processes, form a capacious reservoir into which the blood may be diverted from the venous plexuses which occupy the spinal canal (meningo-rachidian) with which they are connected by anastomosing branches passing through the intervertebral foramina and joining the vertebral, intercostal, lumbar, and sacral veins.

The veins of the spinal cord itself join the vertebral veins at the base of the skull. Applications intended to influence the blood supply of the vertebræ or structures connected with them should be applied the whole length of the spinal column. Applications directed toward the envelopes of the spinal cord should extend from the base of the brain to about the middle of the lumbar region. Applications intended to influence the spinal cord itself may cover the entire spinal area, but care must be taken to give particular attention to the extreme upper portion, including the lower and back part of the scalp.

264 *The Eyeball.*— The skin of the eyelids and forehead drain the eyeball, by dilating the supra-orbital branch of the ophthalmic, a branch of the internal carotid.

265 *The Middle Ear.*— The whole side of the head and face, diverting blood from the internal carotid and internal maxillary. If the hot compress extends below the jaw, the common carotid will be dilated. An ice-bag below the jaw with the fomentation increases its effect by contracting the carotid.

266 *The Internal Ear.*— Receiving its blood supply from the vertebral artery, a branch of the subclavian, the internal ear is not influenced by heat over the ear, but may be relieved when congested by warm applications to the arms and cold

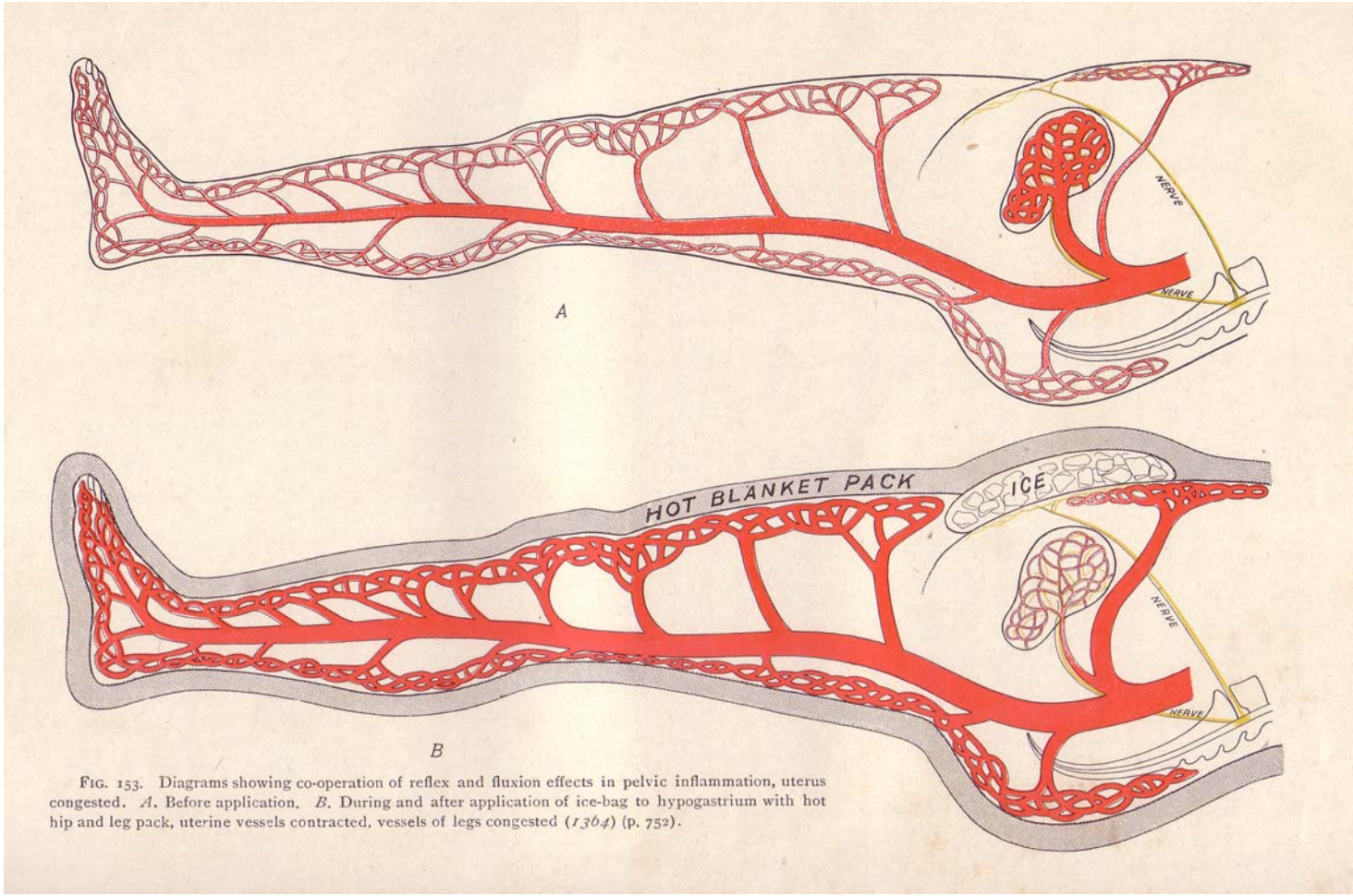


FIG. 153. Diagrams showing co-operation of reflex and fluxion effects in pelvic inflammation, uterus congested. *A*. Before application. *B*. During and after application of ice-bag to hypogastrium with hot hip and leg pack, uterine vessels contracted, vessels of legs congested (*1364*) (p. 752).

applications to the head and the back of the neck, thus diverting the blood into the arms from the vertebral arteries while at the same time contracting the vertebral arteries by a proximal cold compress or an ice-bag to the back of the neck.

The Nasal Cavity.— The face and sides of the head, **1267** diverting the blood from the internal carotid and the internal maxillary.

The Pharynx.— The whole face, diverting blood from the **1268** internal maxillary and the ascending pharyngeal.

The Larynx.— The skin of the neck overlying the larynx, **1269** and the arms, diverting the blood from the internal branches of the carotid and the subclavian into their external branches (the superior and inferior thyroids). The arms and back, and the sides of the upper chest may also be utilized. Chilling of the arms and shoulders should be avoided.

The Lungs.— The aim is to influence the bronchial arter- **1270** ies, the nutrient vessels of the lungs. The collaterally related cutaneous surfaces are: —

1. The anterior chest wall from the clavicle to the umbilicus, influencing especially the pleura (also the pericardium) through the cutaneous branches of the internal mammary.

2. The pleura of the posterior chest wall, through the cutaneous branches of the aortic intercostals.

3. The arms, through the diversion of blood from the superior intercostal, a branch of the subclavian, influencing especially the pleura of the upper part of the chest. Induced hyperemia of the arms also relieves congestion of the pleura of the anterior wall of the chest by diverting blood from the internal mammary, a branch of the subclavian.

4. A direct relation exists between the bronchial arteries and the skin of the right chest, through the fact that the right bronchial arteries arise from the aortic intercostals. The relation between the left bronchial arteries and the skin circulation is less direct; hence the importance of making applications to the whole chest in the hydriatic treatment of pneumonia, though one lung only may be affected. It is

especially important that the application should be made to the back of the chest.

It is interesting to recall the fact of the connection of the bronchial arteries with the pulmonary capillary plexus and veins, whereby arterial blood passing through the lungs may return at once to the left heart without entering the systemic venous system, and without visiting the right side of the heart, forming thus a sort of second pulmonary circuit, very small, but possibly very useful in many conditions for carrying on oxygenation of the blood independently of the pulmonary circulation proper.

5. Through the free anastomosis of the tracheal branches of the inferior thyroid and the bronchial arteries, the nutrient vessels of the lungs may be influenced by applications made to the front part of the neck. Cold applications made to this region will tend strongly to concentrate the blood in the lungs. By warm or alternate warm and cold applications the blood may be diverted from the lungs by facilitating the movement of blood through the collateral circulations, and passive congestion may be relieved.

6. The veins which return the blood from the nutritive arteries (bronchial) of the lungs empty on the right side into the azygos vein; on the left side either into the superior intercostal or the azygos vein. The intercostal veins are thus on both sides so connected with the bronchial veins that when dilated by hot or alternate applications the blood stream through the lungs may be accelerated, thus relieving passive congestion, a condition which constantly exists in pneumonia after the first stage, and in cardiac disease accompanied by dyspnea due to deficient compensation. Applications to be efficacious for this purpose must cover the whole thoracic cage, and especially the back and sides, as the intercostal vessels with which the bronchial arteries are associated are chiefly distributed to these portions of the chest. An appreciation of these anatomical relations is sufficient to impress the necessity for maintaining active circulation of the skin in pneu-

monia, and allowing opportunity for complete reaction to take place at short intervals when cold applications are made. If continuous cold applications are made to the front of the chest, care must be taken to maintain warmth, and to prevent collateral pulmonary congestion by applying heat behind.

The Kidneys.— The loins, through the renal branches of the lumbar arteries. 1271

The Bladder, the Uterus and Adnexa, and the Prostate. — The sacrum, buttocks, perineum, external genitals, inner surface of thighs, groins, suprapubic region, through the sacral, gluteal, obturator, sciatic, inferior hemorrhoidal, superficial perineal, deep circumflex iliac, and deep epigastric arteries, derived from the internal iliac. 1272

The Rectum.— The anal region and the perineum, through the inferior hemorrhoidal, superficial perineal, and other branches of the internal pudic. 1273

The Stomach.— The arterial circulation of the stomach may be influenced through the free anastomosis of the gastric artery with the esophageal arteries, which in turn anastomose with the inferior thyroid, a branch of the subclavian. An arterial connection also exists between the vessels of the stomach and of the internal mammary, through the phrenic artery. The venous circulation of the stomach is connected with the skin through anastomosis of the gastric with the esophageal veins, which empty into the right azygos vein. The last-named vein also receives the intercostal veins, especially those draining the skin covering the sides and back of the chest. Applications intended to influence the arterial circulation of the stomach should be of such size as to cover the lower third of the sternum, the cartilages of the lower ribs, and the space between these structures and the umbilicus. When it is desired to influence the venous circulation, as in chronic gastritis, cardiac insufficiency, and hepatic cirrhosis, the applications are made to the back and sides of the chest. 1274

The Liver and Spleen.— The arterial circulation of the 1275

liver and spleen may be influenced by the same measures described in relation to the stomach. The vessels of these organs are connected with the cutaneous circulation through the anastomosis of the phrenic arteries (right and left) with the internal mammary and the intercostals. Passive congestion of these organs is seldom of serious importance except when arising from disturbance of the portal circulation. Applications to relieve general portal congestion (**1277**) will relieve hepatic and splenic congestion, since such causes as tend to concentrate the blood in the portal circulation will influence in like manner the liver and spleen, together with the other abdominal viscera.

1276 *The Intestines.*— The intestines, especially the duodenum and the colon, have no vascular connection with the surface except through the renal circulation. Hot applications to the lumbar region by lowering the pressure in the lumbar veins may divert a portion of the blood from the left renal vein with which the veins from the duodenum and the transverse colon communicate. Similar applications over the front and lower portions of the chest exercise a like influence through the connection of the phrenic veins with the left renal vein on the one hand and the internal mammary on the other. Alternate applications may relieve the venous circulation of the duodenum and the colon through diversion of blood from the renal vein into the veins which accompany the branches of the renal artery distributed to the suprarenal capsule, the capsule of the kidney, and the overlying muscles.

1277 *The Portal Circulation.*— The portal veins contain no valves. This makes it possible for this appendage of the venous system to render the most valuable service as a blood reservoir, the capacity of which may be very easily and quickly varied, thus constituting a regulating or balancing mechanism whereby the delicate structures of the body are saved from injuries which they might otherwise suffer from sudden or excessive increase or diminution of the blood pressure. There is maintained a constant balance between the

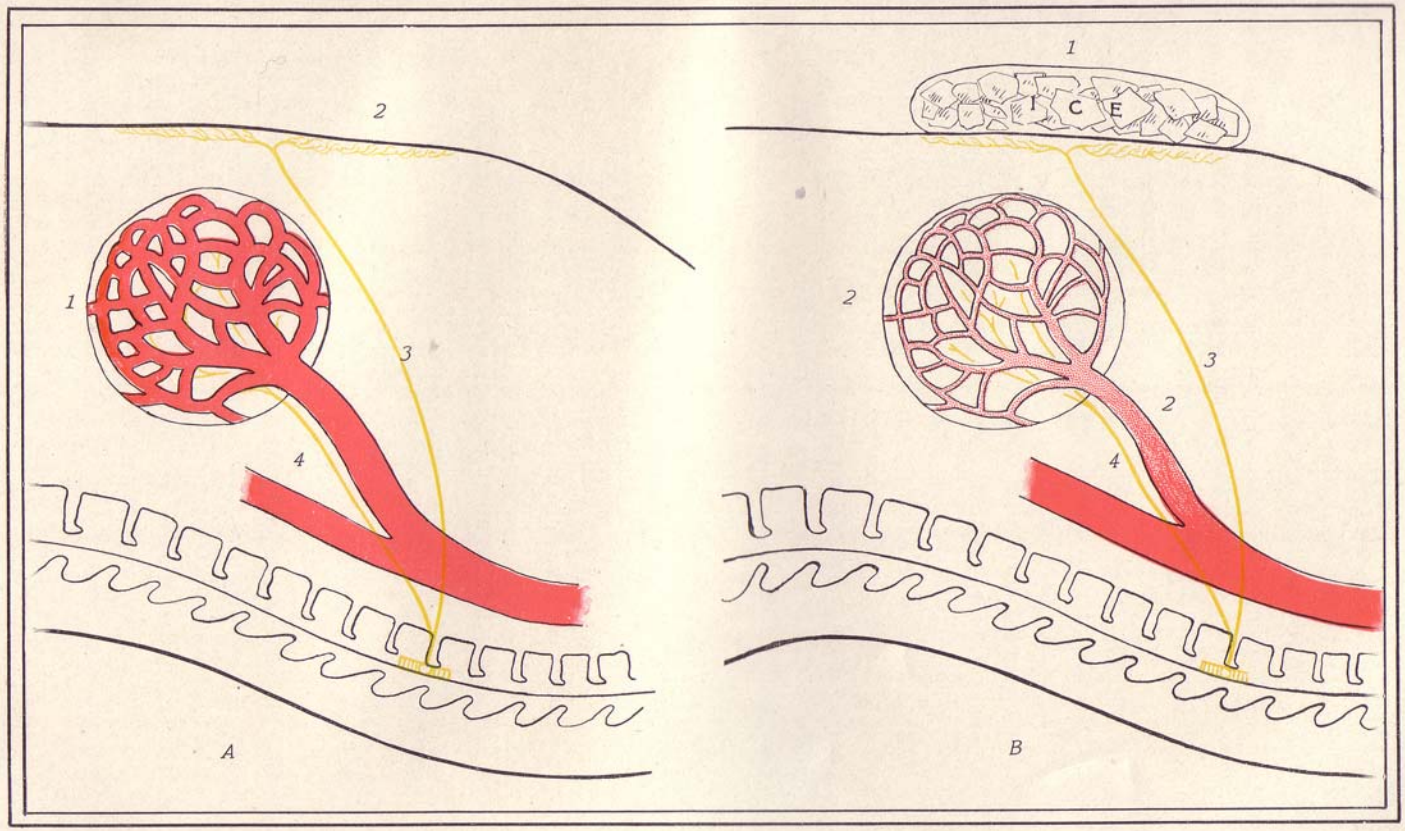


FIG. 154 *A*. Diagrammatic illustration of gastric congestion. 1. Arteries greatly dilated. 2. Cutaneous area reflexly related with the stomach. 3. Nerve trunk connecting this area with the spinal center connected with the stomach. 4. Sympathetic and vasomotor nerves which transmit to the stomach the sensory impulses received from the skin (p. 732).

FIG. 154 *B*. Diagrammatic illustration of the effect of cold applied to the cutaneous area reflexly connected with the stomach in case of gastric congestion or inflammation (*1319*). 1. Ice-bag. 2. Arteries contracted under the reflex influence of the cold application. 3. Nerve trunks by which the thermic impression made by the ice-bag is transmitted to the spine. 4. Vasomotor and sympathetic nerves which convey the impression to the gastric vessels securing their contraction and relieving congestion (p. 732).

intra-abdominal pressure and the general blood pressure. Even the volume of gases in the intestines and the tension of the abdominal muscles influence the blood pressure. The great splanchnic nerve is, through its control of the portal circulation, one of the most important factors in the blood-pressure-controlling mechanism of the body; it especially influences the cerebral circulation.

The study of the relations of the portal system to the 1278
general venous system and to the blood distribution of the skin, is exceedingly interesting, and of high practical value. The blood gathered up by the portal vein from the stomach, intestines, spleen, pancreas, and gall-bladder, in the main finds its way back into the general venous system only after it has passed through a second capillary network in the liver, from which it is gathered up, and conveyed to the ascending vena cava by the hepatic veins. There are, however, other channels well known to anatomists, of great practical value to the hydriatic practitioner. These are, as pointed out by Todd and Bowman * many years ago, as follows :—

1. The *hemorrhoidal plexus*, which communicates with the mesenteric veins on the one hand and the internal iliac on the other, thus furnishing an outlet for the blood of the portal circulation at its most dependent part,—an important safeguard against the development of diseased conditions of the hemorrhoidal veins.

2. *The esophageal veins*, which connect the gastric veins and the vena azygos minor.

3. A direct connection between the *left renal vein* and the veins of the duodenum and the colon.

4. A direct connection between the *phrenic vein* and the portal system at the surface of the liver (Kiernan).

According to Treves, the eminent English anatomist, the visceral vessels which anastomose with the parietal or cutaneous and muscular vessels are derived from the hepatic, renal, and suprarenal arteries, and also the vessels supplying the pancreas, cæcum, ascending and descending colon, and the duodenum. The connecting superficial vessels are derived

from the phrenic, lumbar, ilio-lumbar, lower intercostal, epigastric, and circumflex iliac trunks. Schiff also has demonstrated an anastomosis between the portal veins and the epigastric veins at the umbilicus.

"In a case detailed by Professor Chiene (Journ. Anat. Phys., vol. 3) the cœliac axis and mesenteric vessels were plugged, but blood in sufficient amount to supply the viscera had reached the branches of these arteries through their parietal communications. The anastomosis gives an anatomical demonstration of the value of local blood-lettings and of counter-irritants in inflammatory affections of certain of the viscera, and also a scientific basis to the ancient practice of poulticing the loin and the iliac region in nephritis and in inflammation about the cæcum." (Surgical Applied Anatomy, Page 371.)

These interesting anatomical relations, when understood by the hydriatic physician, place at his disposal most powerful means of influencing the portal circulation. By warm or hot applications to the rectum the veins composing the hemorrhoidal plexus may be dilated, thus relieving any abnormal pressure in the portal circulation. By hot applications (5 to 15 min.) to the anal region, a hot pelvic pack or a hot sitz bath, followed by a short cold application (30 to 60 secs.), strong fluxion of the portal circulation may be produced, and passive congestion may be thus relieved.

Chronic portal congestion is best combated by the prolonged cool sitz (**1508**) and the wet girdle (**1347**). The temperature of the sitz should be 80° to 70°, the duration 15 to 30 minutes. The girdle should be protected by flannel only, and should be renewed every four hours, or just before it becomes dry, so that a tonic effect may be constantly maintained. These prolonged cold applications cause contraction of the external and internal branches of the iliac arteries, thus lessening the supply of blood to the iliac veins, and so lowering the pressure on the systemic side of the hemorrhoidal plexus, and increasing the outflow of blood from the portal veins. It is

thus that the cool sitz affords relief in hemorrhoids, in catarrh of the rectum and colon, and in dysentery and diarrhea.

Cold applications either to the rectum itself or to the skin will temporarily produce the opposite effect; namely, interference with the movement of blood from the portal circulation into the systemic veins through the hemorrhoidal plexus. But if the application is short in duration, the reaction following may produce a result similar to that produced by warm or hot applications.

The effect of a prolonged hot application to the abdominal surface is quite different from that of a short application. The tone of the mesenteric vessels is constantly governed and modified by the reflexes sent in from the skin covering the abdomen. Cold causes contraction of the muscles of the intestinal walls as well as of the arteries, veins, and lymphatics, and even of the abdominal muscles; while heat produces the opposite effect. It is for this reason that we apply heat in colic and cold in tympanitis, acute inflammation, and hyperpepsia or hyperchlorhydria. A short hot application momentarily dilates the mesenteric vessels, but when it is removed, the subsequent cooling of the skin restores the normal tone. Thus passive portal congestion is relieved by short hot applications (5 to 10 min.), followed by cold (1 or 2 min.), through the energetic fluxion induced. For marked therapeutic effects the application must be renewed at intervals of two or three hours. The compresses may be alternated several times in succession at each application. When the application is prolonged, the mesenteric vessels lose their tone, and fill up with blood from the systemic circulation. It is thus that the prolonged (20 to 60 min.) warm sitz or the continuous heating abdominal compress or the wet girdle produces not only hyperemia of the skin, but also filling of the portal vessels. When this effect is desired, the compress or girdle must be protected by an impervious covering so as to secure the maximum amount of heating effect. When flannel alone is employed, the wet compress gradually dries by

evaporation, through which means a cooling effect is produced just sufficient to maintain the tone of the mesenteric vessels, thus producing intense hyperemia of the skin with accelerated movement of blood, but without overfilling the portal veins.

The means by which the portal circulation may be influenced through the communicating vessels, have already been described. The hot trunk pack (15 to 20 min.), the sweating pack, the hot abdominal compress, the wet girdle covered with flannel only, the short hot sitz, and the Scotch douche to the spine and abdomen are the most effective means of draining the portal circulation through the cutaneous veins. A short cold application should always follow the hot application, to restore the tone of the visceral vessels.

1280 *The Upper Half of the Body.*— Induced hyperemia of the legs diverts blood from the brain, chest, and pelvis, and by induced hyperemia of the arms, shoulders, and chest, congestion of the pelvic viscera may be lessened.

The Rationale of Localized Measures.— In the following paragraphs (**1260** to **1291**) the practical application of the foregoing principles is illustrated by means of the compress.

1281 (1) Internal reaction, with dilatation of visceral vessels, occurs almost instantly after a *short cold* application, for the reason that the cause of the reflex vascular spasm (the cold application) being removed, the heat of the surrounding tissues (100° to 106°) quickly relaxes the parts. The rhythmical activity of the vessels of the part and the amplitude of their contractions are increased through the stimulation of the controlling ganglia. As a result, the supply of blood is increased, and with this arrive fresh and enlarged supplies of oxygen, leucocytes, and nutrient material. There is also a more thorough removal of CO_2 and other waste products, and hence an increase in the normal vital activities of the part, a higher grade of life, better tissue formation, and in time a restorative reconstruction in case the tissues of the organ concerned are in a morbid or diseased condition.

1282 (2) The effect of a *prolonged cold* application is to cause

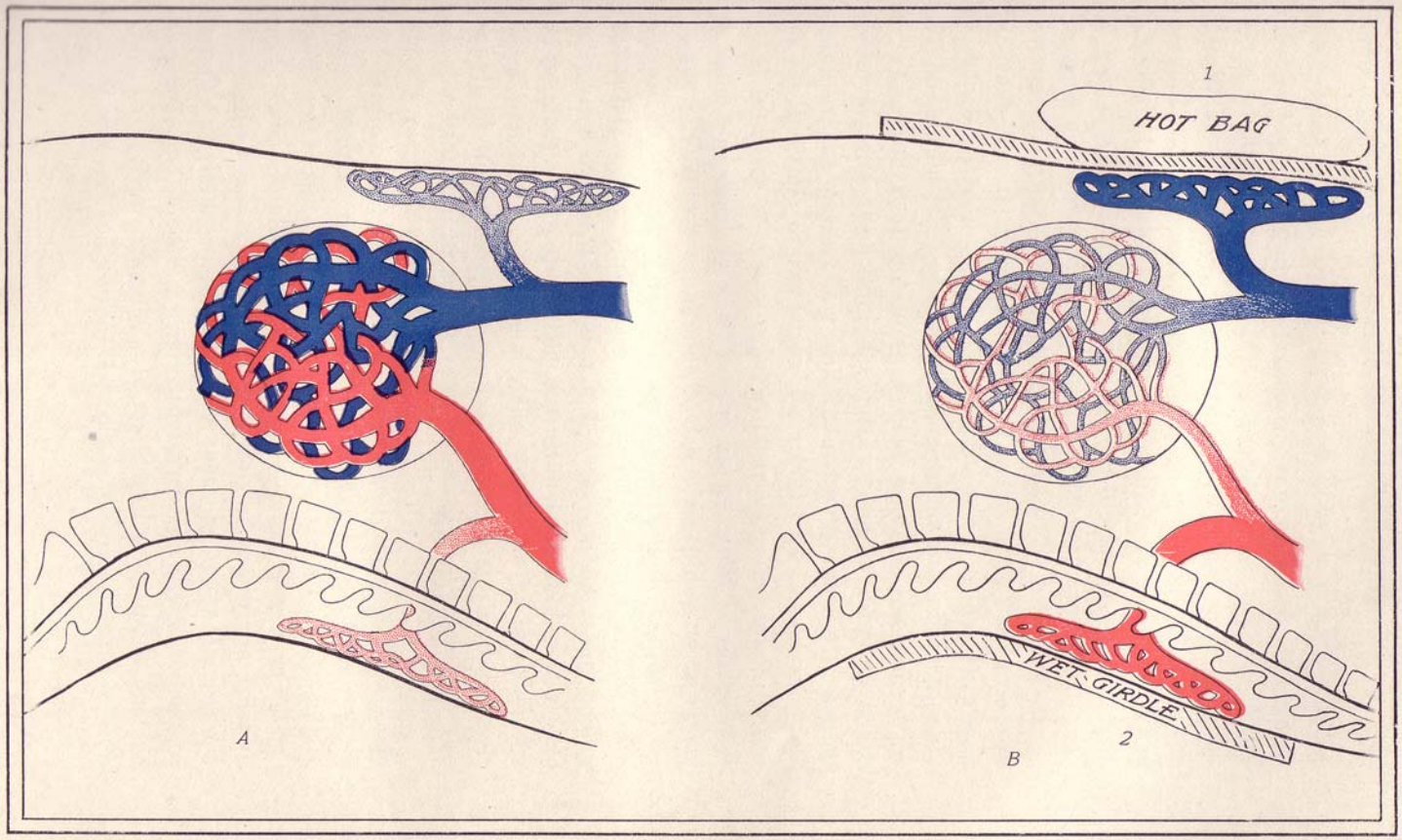


FIG. 155 *A*. Diagram representing visceral congestion (p. 732).

FIG. 155 *B*. Diagrammatic illustration of the effect of the hot and cold trunk pack (*1367*) in relieving visceral congestion. 1. The hot bag diverts blood from the stomach to the cutaneous veins by dilating the latter, while the wet girdle (2) at first causes constriction of the small arteries, later by reaction dilating both the arteries and the veins, thus relieving the visceral congestion (p. 732).

continuous contraction of the vessels of the internally related part so long as cutaneous sensibility is maintained; but when the application is so intense or prolonged as to destroy the sensibility of the skin, the reflex action ceases, and stimulation of the vasomotor centers no longer exists; hence, the vessels of the related internal vascular area relax. Thus a cold application, if too prolonged or too intense, may defeat its own purpose, producing an effect the very opposite to that intended. This interesting fact seems to be little known, or at least little regarded, if one may judge from the loose way in which instructions are given for the use of cold applications to the skin for relief of internal congestions and inflammations.

The reflex stimulation of cold may be maintained by removing the application for 3 to 5 minutes every 20 to 30 minutes, the parts being well rubbed with warm, dry flannel in the interim, or heat may be applied for 2 or 3 minutes.

The effect of a prolonged cold application, made in the manner suggested, is to lessen the blood supply of an internal viscus. This may sometimes be desirable, but is certainly far less often needed than is generally supposed. Injury does not result so much from the excess of blood in a part as from stagnation of blood. The blood is the chief healing agency in the body. It can not be too often reiterated — *it is the blood that heals.* Hence the aim should be to increase the supply of fresh blood to a part by encouraging the movement of blood through it, rather than to lessen the volume or the activity of the blood current.

While a cold application causes contraction of the vessels of the related viscus, the contraction of the cutaneous vessels may tend to fill the vessels of the part, if there exists collateral relation of the cutaneous and visceral vessels involved. The actual effect produced will depend upon the relative activity of the two forces. Care must be taken to arrange the compress in such a way as to avoid antagonistic effects of this sort. For example: In making cold applications to relieve cerebral congestion, the cold application should include

the neck, so as to cause contraction of the main supplying trunks, thus preventing the collateral hyperemia of the brain, which may be induced by cold applications to the face alone.

In certain cases the effect of cold applications may be to increase internal congestion to such a degree as to make this the dominant effect, thus constituting a contraindication. A good illustration of this is seen in the case of the eye. A cold compress contracts the supraorbital artery, thus increasing the blood supply of the eyeball to which a collateral branch is distributed. For this reason the fomentation rather than the cold compress is indicated in inflammation of the eyeball. But the application must not be so prolonged as to heat the eyeball itself, thus dilating its vessels. In most cases inflammation of the lids is better relieved by short, very hot applications than by prolonged cold compresses. If cold compresses are used, they should be very small, not larger than the eye socket, and care should be taken that they do not extend above the brow.

1283 (3) The *proximal* cold compress controls local blood supply by contracting the supplying arterial trunk. This procedure is of special value in the treatment of congestion of the head, a cold compress, an ice-collar, or an ice-bag being applied to the neck. An ice-bag to the back of the neck contracts the vertebral arteries; cold applied to the sides or front contracts the carotids. The proximal compress is of greatest value when associated with heat applied derivatively, as in the treatment of cerebral congestion or inflammation, or inflammation of the pharynx, nasal cavity, or middle or internal ear (**1327**).

1284 (4) If the cold application is permitted to accumulate heat sufficiently to allow partial reaction to occur, being renewed only at intervals of 10 to 40 minutes, or when it has become warm, a still different effect is produced. At the first application of the cold, the blood-vessels are made to contract, thus forcing out of the diseased organ the accumulated and

poison-laden blood. The lymph vessels share in the contraction, and likewise the muscular elements of the capsule and other structures. Thus the organ is well squeezed, so to speak, as one might compress a wet sponge in the hand. The germ-laden leucocytes are sent on their way to the spleen or other parts for repair or destruction, while a new supply of these most valiant and important body defenders is later brought into the part. As the compress warms up, internal as well as external reaction takes place, the vessels dilate, their rhythmical pumping is stimulated, and thus the introduction of a fresh and vital supply of blood is effected. By this means, leucocytosis is encouraged, and the supply of fresh leucocytes is constantly renewed, just as a wise general continually brings against the enemy fresh relays of soldiers, retiring those who are worn out by the combat, in order to maintain a vigorous fight.

From the foregoing it will be seen that the *frequently renewed heating compress* has characteristic properties which commend it for use in specific inflammations of deeply seated parts, as in pneumonia, typhoid fever, hepatitis, gastritis, pelvic and other internal inflammations.

It may be further remarked in relation to this form of partial application, that *by permitting sufficient reaction to maintain an active cutaneous circulation, an excellent derivative effect is produced*, the value of which is often overlooked.

(5) By *alternate hot and cold* applications to a limited 1285
cutaneous area, a most active fluxion of blood through an associated internal part may be produced; and this effect may be many times repeated, by reason of the constant renewal of the sensibility of the skin surface by hot applications, thus maintaining a high degree of reflex activity. The frequent change from heat to cold (every 15 secs.) powerfully excites the nerve centers in charge of the parts, and thus the nerve supply; hence, this form of application is contraindicated by pain or acute inflammation.

Each application of cold causes instant contraction of

the associated visceral vessels; each application of heat instantly restores the normal temperature of the skin, and terminates the reflex effect of the cold. Thus the organ is alternately emptied and filled, much as a sponge may be squeezed and filled, and this may be accomplished almost as rapidly as the compresses can be applied, and may be continued indefinitely,—a veritable pumping process by which blood may be passed through any internal organ, a genuine vasomotor gymnastics, applicable to a multitude of acute and chronic conditions.

On the other hand, an application so capable of exciting both vascular and nervous activity is especially adapted to cases of passive congestion, chronic exudates, and atonic and indolent states, such as malarial enlargement of the liver and spleen, rheumatic joints, serous and fibrinous exudates in the chest, muscles, or joints.

1286 (6) *Very hot* applications produce internal vascular effects somewhat similar to those of cold applications; but the contraction is briefer in duration, and occurs only when the application is sufficiently hot to cause pain, and to induce contraction of the cutaneous vessels. The contraction of the cutaneous vessels quickly gives way to dilatation, especially of the veins, because of the direct influence of the heat upon the sympathetic ganglia of the small vessels; but the stimulation of the vasomotor centers continues as long as the temperature of the application is sufficiently high to excite pain, and thus the influence upon the reflexly related parts may be much more prolonged. It must be remembered, moreover, that the application of heat to large surfaces, or over the heart, has the effect to excite the action of the heart, which is usually undesirable. The arterial trunks are also dilated, an effect often desirable and indicated, but which must sometimes be avoided. Hot applications for purely local effects should be not larger than necessary, and the duration must be carefully regulated.

1287 (7) A *warm* or *neutral* compress is soothing in its effects.

This fact is due to the shutting off from the internal related viscus of all external stimuli. It is by these stimuli, chiefly thermic in character, that the vascular tone and functional activity of internal parts is maintained. These vital conditions are, at least in very great measure, dependent upon the fusillade of sensory impressions constantly playing upon the spinal and cerebral centers. When these impressions become too intense, or the nerve centers abnormally sensitive, the phenomena of irritation appear — pain, spasm, hyperesthesia, etc. Neutral applications protect the skin against external irritants. This explains the soothing effect of the poultice. It must be remembered, however, that a warm compress, when applied across an arterial trunk, has the effect to dilate the vessel, and thus to increase the volume of blood flowing into the parts supplied by it. Hence the fulness in the head and the discomfort resulting from too warm clothing of the neck.

(8) *Moderately hot* applications generally produce con- **1288**
gestion of the associated vascular areas. It is in this way that a warm hip or foot bath encourages the menstrual flow, and the heating abdominal compress fills the portal circulation with blood, and thus relieves the brain. The fomentation (**1328**) and the heating compress (**1344**) are the most important partial measures for accumulating or concentrating blood in parts in which such an effect is desirable either to combat a local anemia or to produce a derivative effect in favor of some remote or associated part, though many other procedures are of great service in special cases.

(9) By means of the *prolonged heating compress* it is pos- **1289**
sible permanently to increase the volume of blood in a part, thus lessening the volume of blood in some collaterally related area. For example, the prolonged heating abdominal compress not only distends the cutaneous vessels, but also the portal circulation, thus drawing away from the brain or lungs a considerable amount of blood, and relieving an existing congestion, either active or passive. (*a*) When the effect desired is increased volume of blood in a given part, for the

purpose of producing anemia in some proximate or remote part, the wet towel should be protected not only by flannel, but also by rubber cloth or other impervious material. The purpose is to retain as much heat as possible, so as to secure the fullest dilatation of the cutaneous vessels. (*b*) When it is desired to increase the movement of blood in a reflexly related part, while at the same time combating stagnation or passive congestion, a compress covered only with flannel should be employed, so that by the limited but constant evaporation taking place, there may be maintained an *active* congestion of the skin and related parts, with derivative effect, and at the same time a vigorous fluxion in the reflexly related viscus, and a stimulation or energizing of the nerve supply of the part, and of all those vital activities whereby disease processes are opposed and the integrity of the body conserved.

1290 (10) *The hot and cold compress* (**1356**) produces remarkable effects by combining derivative and reflex effects. For example, (*a*) a fomentation to the upper back diverts blood from the bronchial vessels, while cold simultaneously applied to the front of the chest contracts the same vessels by reflex influence, thus intensifying the effect (**1270**); (*b*) Cold over the sternum with a fomentation over the lumbar region relieves congestion of the kidneys in the same way, by diverting blood into the cutaneous branches of the lumbar arteries while contracting the renal vessels (**1271**); (*c*) The pelvic circulation is controlled by a cold bag over the hypogastrium in conjunction with a hot pelvic pack (**1272**); (*d*) To relieve congestion of the liver, stomach, spleen, or pancreas, the application may be reversed, the heat being applied to the anterior surface and the cold application behind; or if pain is not present, the compress may be applied to the whole trunk, thus acting derivatively upon the whole portal system, while an ice-bag is placed over the stomach to contract the gastric vessels, and thus combat congestion, which is likely to be the cause of the pain; or for distension of the stomach

with gas, a frequent accompaniment of hyperpepsia or hyperchlorhydria, which depends upon the escape of gas from the blood rather than upon fermentation (**1275**); (*e*) The intestines are most strongly influenced by the cold compress to the umbilical region combined with the fomentation over the lumbar region.

(11) The *hot and cold* pack (**1365**) consists in a hot bag or **1291** coil combined with a heating compress or partial pack. The action differs from that of the hot and cold compress in that the principal action is a remarkable derivative effect through drainage of the arteries of the affected part by the passive hyperemia induced by the heating compress, while at the same time blood is diverted from the veins by the dilatation of the collaterally related vessels by means of the hot bag.

The hot and cold pack very strongly influences both the arteries and the veins. It is, perhaps, our most powerful derivative procedure, its effects being almost wholly derivative in character, while the hot and cold compress concerns chiefly the arteries, which it influences both reflexly and derivatively.

Special Indications and Precautions Respecting Localized **1292** **Applications.**— Great care must always be employed in the application of douches or affusions to the head. (1) A short cold application excites the brain, and may be used in melancholia and cerebral anemia, and in sunstroke with pallor. The prolonged cold douche to the head is one of the most powerful of all depressing agencies. Unless very short, the depression may be too great; hence the cold affusion is better.

(2) Hot and warm as well as cold applications to the head must be managed with great care, and should be at first employed in a tentative manner, carefully noting effects.

(3) A cold or very hot douche to the back of the neck stimulates the respiratory centers. If too cold or too prolonged, suffocation or arrest of the heart may result. The very hot or very cold compress, alternate compresses, or

sponging are milder measures which produce similar effects, and are in general to be preferred.

(4) A short tepid douche to the head or a tepid affusion will allay excitement. It may be usefully employed in insomnia, maniacal excitement, and cerebral irritation. The temperature should be from 80° to 92° for 3 to 5 minutes; a slightly higher temperature causes congestion. Affusion is to be preferred to the douche. In the application of water to the head, percussion should always be avoided.

(5) Hot affusions to the head are useful in syncope and collapse, and in cases of migraine with low arterial tension, but should be employed with great precaution. In cases of cerebral anemia, alternate applications may be employed instead of the short cold douche, or hot or cold compresses may be applied. In syncope, especially when the condition is prolonged, hot or alternate hot and cold compresses or affusions should be applied to the head and face.

(6) Long cold applications to the head are usually exceedingly depressing, but may be used in fever, in cerebral congestion, and in sunstroke with congestion of the skin.

(7) The affusion, the ice-compress, and the evaporating compress are usually more convenient for application to the head than the douche, and safer, because less likely to be overdone.

(8) Hot applications must not be indefinitely continued. By degrees the beneficial effect often disappears. The vessels of the deeper-lying parts fill up from the anastomosing vessels and from heating of the deeper parts of the vessels, and consequent dilatation of the vessels, so that the advantage at first gained is after a time lost, and thus the derivative or revulsive influence of the heat in dilating the surface vessels is effaced. To renew the effect, however, it is only necessary to make a short cold application, withdrawing the heat for the purpose. The cold application must be very intense (40° to 60°), and the duration must be brief (10 to 60 secs.), just long enough to contract the sur-

face vessels, sending the blood on into the veins, and thus making room for another diversion of blood from the deep parts through the application of heat. The cold application also serves a most useful purpose in causing reflex contraction of the vessels of the deeper parts, thus aiding in the production of the desired anemia, which is increased and maintained by the succeeding hot application.

(9) As a corollary from the above principles, it appears that, in general, partial cold applications should rarely be absolutely continuous, but should either be allowed to accumulate heat sufficiently to permit slight reaction, or should be interrupted by a short hot application at intervals, or by brisk rubbing of the skin. Continuous cold is indicated only in cases of superficial inflammation at the very onset of the morbid process, and then must not be so intense as to suspend tissue activity, which condition is indicated by numbness of the parts when induced by cold.

(10) Hot applications likewise, when long applied, must be interrupted at intervals of 15 to 30 minutes by a very short cold application.

THE COLD FOOT BATH (Fig. 156).

The *cold* foot bath (45° to 55°, 1 to 5 min.) though less 1293
useful than the hot foot bath, is of great service in producing reflex, revulsive, and other effects. The sole of the foot is one of the most important vasomotor areas in the body, having very direct connection with the nerve centers which control the circulation of the pelvic and abdominal viscera.

The brain circulation may also be influenced by stimulation of the rich vasomotor nerve supply of the plantar region, a fact of practical interest in cases of cerebral congestion.

Method.—The water at proper temperature should be placed in a small tub adapted to the purpose, to a depth of three or four inches. The feet, previously warmed, are immersed in the tub for 1 to 5 minutes. Friction should be applied to

the feet continuously during the bath, either by the hands of the attendant or by the patient's rubbing one foot against the other in alternation.

Physiological Effects.—Among the most interesting effects of the cold foot bath are the vasomotor and other reflex effects set up in the pelvic viscera, causing contraction of the vessels and muscles of the uterus (in women) and the organs connected with it. The blood-vessels of the brain, the stomach, the liver, the bladder, and the intestines, are made to contract at the same time. Intestinal peristalsis and contraction of the bladder are also excited. To obtain the most pronounced effects, the temperature must be very low (45° to 50°). The duration will vary with the effect desired.

1294 **Therapeutic Applications.**—The revulsive effects of the cold foot bath are very decided, and continue for a long time —much longer than those obtained from a hot foot bath or similar applications. As a derivative and revulsive application, the *short* cold foot bath is useful in *cerebral congestion* and *uterine hemorrhage*. For these purposes, however, the application must be very short (20 to 60 secs.), as it is the primary effect alone that is desirable. In cases in which the feet are constantly cold, and in persistent sweating of the feet, the rubbing cold foot bath is a most useful measure, making the feet glow with circulatory reaction (50° to 60°, 1 to 3 min.). It must be repeated daily.

The prolonged cool foot bath (60° to 70°) may sometimes be employed as an antiphlogistic measure in cases of injury to the feet, such as *sprains*, *strains*, *inflamed bunions*, and similar conditions. The feet must be well warmed before the application is made, by walking, running, rubbing, or by heat.

Contraindications.—The cold foot bath must generally be avoided in cases of *cystitis*, *pelvic cellulitis*, *salpingitis*, and in all forms of pelvic and abdominal congestion and inflammation, as *peritonitis*, *prostatitis*, *proctitis*, and in *hepatic*, *uterine*, *renal*, and *intestinal congestions*. In these cases the very hot foot or leg bath should be employed (115° to 125°).

THE SHALLOW FOOT BATH.

1295 The shallow foot bath is a variety of the cold foot bath in which the amount of water employed is small, barely sufficient to cover the toes. After being held in the bath for one-half minute, one foot is taken out and rubbed for half a minute and returned, then the other is treated in like manner, this being continued until the whole surface is well reddened with strong circulatory reaction. Lastly the feet are wiped dry and thoroughly rubbed with the dry hand. The soles are vigorously percussed. The water should be very cold, or at a temperature of 45° to 55°. The shallow foot bath gives rise to powerful reflex effects upon the pelvic viscera, causing contraction of the vessels, and thus relieving uterine congestion. The intestines and even the brain are also influenced.

Therapeutic Applications.—The shallow foot bath produces powerful reaction effects to the feet, and is thus of great service in chronic cases of *cold* and *sweating feet.* Its applications are the same as those of the ordinary cold foot bath, only differing in being somewhat more intense.

THE RUNNING OR FLOWING FOOT BATH.

1296 This bath is a modification of the shallow foot bath, in which, through the constant change of water by means of suitable arrangements, the initial temperature is maintained. Water from a natural source, at as low a temperature as can be obtained, is commonly employed. The outlet should be so placed that the water can not accumulate to a depth greater than one-half inch. Circulatory reaction is promoted by the movement of the water in contact with the feet, and constant alternate rubbing of the feet one upon the other. The purpose of the flow of water is to maintain a uniform and low temperature, while at the same time reaction is promoted by the incomplete submergence of the feet and constant friction. The sole of one foot is rubbed against the dorsum of the other for 10 to 15 seconds, then the feet

are reversed; and thus each foot is treated. The bath is prolonged until the toes are reddened by reaction.

The running foot bath may be conveniently taken in the full bath tub, by allowing cold water to run with the outlet partially or fully open.

Therapeutic Applications.— This bath is indicated in all cases in which the ordinary cold foot bath may be used (**1294**), and is more effective. It is a powerful derivative measure, and a highly valuable remedy in cases of *habitually cold feet* from vasomotor spasm of the extremities. The remedial effect in these cases is obtained not alone by means of the very decided hyperemia induced in the vessels of the feet and legs, but by reflex influence upon the sympathetic centers, especially the lumbar ganglia. Incidentally, *cerebral congestion* is relieved both by reflex spasm of the meningeal vessels during the bath, and by the diversion of blood to the lower extremities through the reaction following.

This bath is of special value in the management of *neurasthenics* suffering from cold extremities and cerebral congestion, producing an excellent general tonic effect.

In cases of *insomnia* due to cold feet, it is well to precede the application by a hot foot bath (110° to 115°, 2 to 5 min.).

When the hands as well as the feet are cold, a rubbing cold hand bath may be taken at the same time with the foot bath, rubbing the hands together in very cold water.

Contraindications.— The flowing foot bath should be avoided in *catarrh* of the *bladder*, *irritable rectum* and *bladder*, and other forms of *pelvic inflammation*. It is also contraindicated in *ovarian neuralgia*, *neuralgia* of the *bladder*, *sciatica*, and *rheumatic affections* of the *toes* and *ankles*.

THE HOT FOOT BATH.

1297 The requisites are a suitable receptacle for the feet, and a supply of very hot water, with cold water for tempering.

Method.— The temperature required for positive effects is 104° to 122°. The bath should begin at a temperature

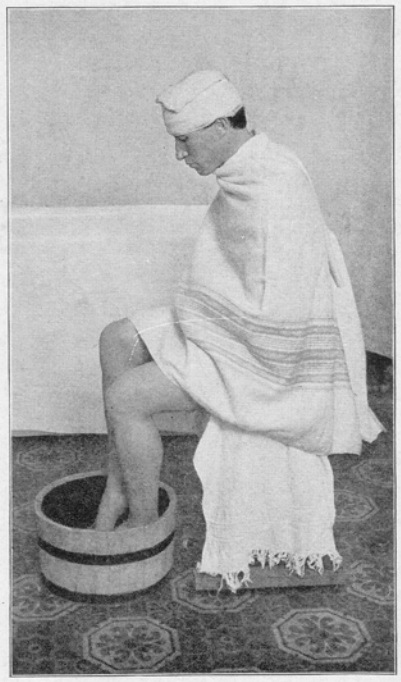


FIG. 156. COLD FOOT BATH (p. 753).

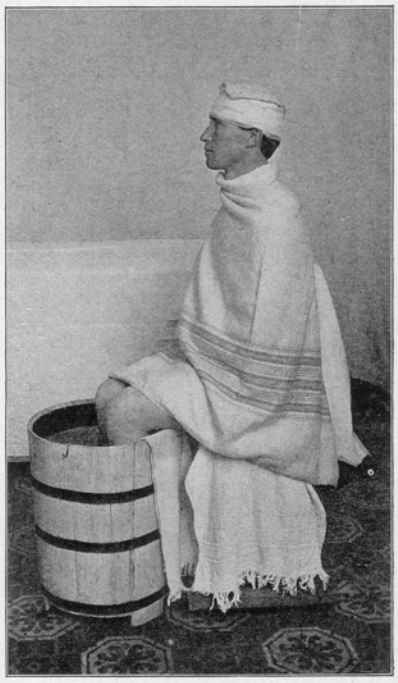


FIG. 157. LEG BATH (p. 758).

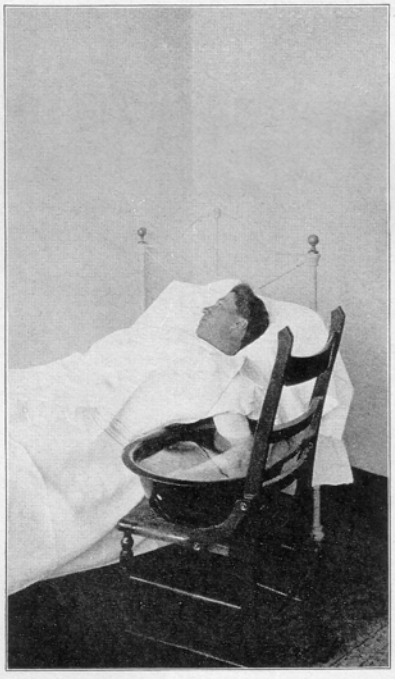


FIG. 158. ARM BATH (p. 759).

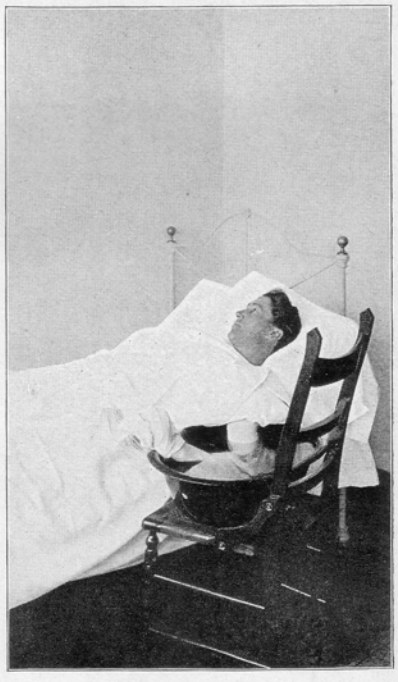


FIG. 159. ELBOW BATH (p. 759).

of 102° to 104°, and should be gradually increased until by the end of two or three minutes a maximum temperature of 115° to 122° is reached. The duration may be from 5 minutes to half an hour. The feet should be completely immersed in the water; the effect may be intensified by increasing the depth of the water.

After the very hot foot bath, the feet should receive a dash of cold water,—affusion, jet, or spray,—to produce the true revulsive effect by suddenly cooling the skin and encouraging tonic circulatory reaction.

Physiological Effects.— Bergesio has shown that the hot foot bath produces in a diminutive way precisely the same effects as the general hot bath. At first the pulse is slowed and the brain congested, but after three or four minutes the pulse rate is increased, and the brain becomes anemic, this condition persisting for some time after the bath is terminated. Shokovsky showed that the foot bath at 108° to 115° for 20 minutes caused elevation of the temperature in the external auditory canal amounting to one degree Fahrenheit. The rectal temperature at the same time *fell to the same extent.* Arterial tension was increased 8 mm.*

Therapeutic Applications.— This bath is more commonly used, perhaps, than any other, as a derivative measure. At a temperature of 103° to 110° the hot foot bath is an exceedingly useful means of balancing the circulation, by the dilatation of the blood-vessels of the legs relieving congestion of the brain and other organs in the upper half of the body.

Very hot (115° to 125°) as well as cold applications to the feet stimulate the involuntary muscles of the uterus, intestines, bladder, and other pelvic and abdominal viscera. Heat may be used at first in cases in which cold is not well tolerated. The dilatation of the blood-vessels produced in the feet by this application extends to the upper parts of the limbs, and even to the vessels of the pelvic viscera. This is shown by the vigorous pulsation of the femoral artery after

* Wratsch, *Lyon Médical*, 1883, page 541.

a hot foot bath. By vaginal examination it may be readily noted that the pulsation of the pelvic vessels is greatly increased in vigor, indicating a heightened vascular activity. By this means the uterus and ovaries receive an increased supply of blood, which renders the foot bath a useful measure for restoring the function of menstruation when suspended.

The very hot foot bath is exceedingly useful in cases of *sprain* of the ankle joint. *Anesthesia* of the plantar region and *neuralgia* of the foot and gout are relieved by the very hot foot bath. The application should be made two or three times a day, and continued for 20 to 30 minutes each time.

The hot foot bath is also of very great service as a means of relieving or preventing a cold resulting from accidental chilling of the feet, if applied soon after exposure.

The prolonged warm or hot foot bath (98° to 106°) dilates the vessels of the feet, and produces collateral anemia of the pelvic viscera. A short, very hot foot bath (110° to 120°, 5 min.) produces the same effect. The hot foot bath (104° to 110°) accompanies the cold sitz.

THE ALTERNATE FOOT BATH.

1298 In the employment of the alternate foot bath, the feet are placed in hot water for 2 or 3 minutes, then in cold water for 20 seconds to 1 minute. They are then returned to the hot water for 2 minutes, then replaced in the cold water, this operation being repeated a number of times. The alternate foot bath is a more highly excitant measure than the cold foot bath. It is especially useful in *chilblains*, in *local asphyxia*, in habitual *coldness* of the feet, and for *sweating* feet.

THE LEG BATH.

1299 This bath (Fig. 157) is essentially the same as the foot bath, with the exception that a deeper tub is used, with a larger amount of water. Any desired temperature may be employed.

The leg bath is a powerful derivative measure, and may be used in cases which do not readily yield to the employment of the foot bath. It is especially serviceable in the treatment of *insomnia*, *pulmonary congestion*, *dysmenorrhea*, *suppression* of *menstruation*, *hyperpepsia*, *ovarian congestion*, and *pelvic pain* from other causes. In all the above-mentioned conditions the warm or very hot leg bath is employed. Low temperatures are rarely called for with this procedure.

The contraindications for the cold leg bath are the same as for the cold foot bath.

THE ARM BATH.

Immersion of the arm in water (Fig. 158) is frequently **1300** a useful measure, especially in surgical cases. In cases of *felons*, *sprains*, and various other injuries to hands and arms, antiphlogistic effects may be obtained in this way. *Chronic ulcers* and some forms of *chronic skin disease*, and especially *burns* of the arms, may be successfully treated by prolonged immersion. The temperature in cases in which deeply seated inflammatory conditions are present should be 92° to 97°, or neutral. A cold bath under such conditions will be followed by reaction with increase of congestion and pain. A long hot bath will cause local elevation of temperature and increased fulness of vessels, and will likewise increase the local pain and intensify the morbid process. A *neutral* temperature, preferably as near 92° as possible, especially if prolonged for several hours, lessens pain, lowers local temperature, diminishes congestion, and thus favors resolution. A short hot arm bath relieves pain by producing hyperemia of the skin and collateral anemia of deep inflamed parts. Superficial pains or inflammations require neutral applications.

The Elbow Bath (Fig. 159) is a modification of the arm **1301** bath which is best suited to the treatment of inflammatory affections of the hand. Immersion of the elbow in cold water lowers the temperature of the hand more efficiently than does cold immersion of the hand itself. This interest-

ing fact, first discovered by Priessnitz, is dependent upon the principle that an application of cold across the trunk of an artery contracts the artery and all its distal branches (Exp. 63). The same results may be obtained by a cold compress about the arm.

THE HAND BATH.

1302 Immersion of the hands in very cold water exercises a powerful influence — much greater than might be expected — upon the cerebral and pulmonary vessels. Vasilieff showed (1885) that immersion of the hands in cold water for a sufficient length of time is capable of slowing the pulse and the respiration, lowering the temperature in the external auditory canal, lessening the pressure in the cerebral arteries, and narrowing the veins of the retina. The hot hand bath produces opposite phenomena. These observations explain the effect of the cold hand bath in controlling epistaxis. Holding a block of ice in the hand is an excellent means of checking nosebleed, and in the author's hands has proved of service in pulmonary hemorrhage, checking the bleeding very quickly even when other measures seemed to be unsuccessful.

Brown-Sequard and others demonstrated long ago the powerful reflex influence of immersion of the hands in hot or cold water, observing that the immersion of one hand in cold water caused a lowering of temperature in the other hand, while placing one hand in hot water produced an elevation of temperature in the other hand.*

THE PARTIAL CONTINUOUS BATH.

1303 This bath, first introduced by Langenbeck,† consists in the continuous immersion of a limb in water at a neutral temperature. Langenbeck resorted to its use as a method of treating surgical wounds, and reported many hundreds of cases dressed by this method. The results claimed

* *Archives de Physiologie*, v. 3, pp. 497–502.

† *Deutsche Klinik*, 1855, No. 39, pp. 409–419.

by him were as follows: (1) Lessening of pain from the wound; (2) lessening of fever; (3) lessened secretion or suppuration; (4) accelerated healing process. Many leading German and French surgeons adopted this method of dealing with surgical wounds; and had it not been for the wonderful discovery of Lister, the partial immersion bath might have remained for a long time the most successful method of dressing surgical wounds. Figures 160 and 161 show the ingenious devices of Langenbeck for the practical and convenient employment of this bath. Duplicates of these were used by Dr. Frank Hamilton in his practice in Bellevue Hospital. Dr. Hamilton certainly deserves credit for his earnest advocacy of the immersion treatment of wounds at a time when amputation was the almost inevitable result in cases of badly contused injuries of the limbs. While the author was a student under Dr. Hamilton in Bellevue Hospital in 1874, numerous grave cases were successfully treated by this method in the hospital wards.

The author had the pleasure of listening to a heated discussion upon the utility of the method, which occurred at the Academy of Medicine in the winter of 1874–75, Dr. Hamilton defending the immersion treatment, while Dr. James Wood and others as vigorously denounced what they chose to denominate the "maceration method." The antiseptic treatment of wounds and injuries has since rendered this method of comparatively little value, but circumstances still occasionally arise in which it may be utilized to advantage, as in the treatment of senile gangrene, severe burns, painful or lacerated wounds, and in the absence of antiseptic dressings.

THE SITZ BATH.

The sitz bath (Fig. 162) is one of the oldest and most **1304** serviceable of hydriatic procedures.

Method.— The tub may be of metal, porcelain, or wood. It is usually of such form and size that the patient may be comfortably seated in it by leaving the feet outside and

flexing the limbs, the feet being placed in a separate and smaller tub during the application. The flexion of the limbs in a sitz bath is, however, to some degree objectionable, as it interferes somewhat with the circulation; and on this account the author is much inclined to exchange the sitz bath for the half-bath (**1174**) in dealing with a large class of cases. The temperature of the sitz bath may be cold, cool, neutral, tepid, hot, or very hot. There are also the rubbing sitz, the flowing sitz, and the revulsive sitz.

The sitz bath may be made to serve the purpose of a general bath by rubbing the body during the bath with the hands or with a towel wet in water of the same temperature.

THE COLD SITZ BATH.

1305 In this procedure, either still or running water may be employed, according to the effect desired.

The temperature of the cold sitz bath is 55° to 65°. A lower temperature is seldom required. The time should be 1 to 15 minutes. The duration of the cool or the tepid sitz may be considerably longer (70° to 80°, 10 to 15 min., with rubbing; 88° to 92°, one-half hour to several hours).

In a cold sitz bath the patient should always be rubbed sufficiently to prevent chilling, and care should be taken that the feet are kept warm, either by the hot foot bath or by hot bags, or flannels wrung out of hot water and placed about the feet and legs. The limbs should be so adjusted that there will be no pressure upon the popliteal space, as this will interrupt the circulation in the feet, and interfere with the results of the bath. If necessary, the foot bath may be elevated a little, or the edge of the sitz bath may be covered with a thickly folded flannel to prevent compression of the vessels.

In the *flowing sitz* bath, cold water is admitted to the tub at such a rate that the temperature may be maintained at the initial point, the surplus water being allowed to flow out through an opening properly placed.

The bath may be administered two or three times a day with advantage in some cases, but the practice of using the

bath five or six times a day, which prevails at some hydropathic establishments, is not to be recommended.

Physiological Effects.—In the sitz bath an impression is **1306** made upon the cutaneous areas which are reflexly connected with the viscera of the pelvis and also those of the lower part of the abdomen; namely, the lumbar region, the hypogastric region, the outer and inner surfaces of the thighs, the perineum, and the external genitals. The physiological effects depend, as in other baths, upon the temperature, the duration, and sometimes the mechanical effects combined with the thermic impressions.

The cold sitz bath produces a profound effect upon all the bodily functions. The general effects are those which pertain to the application of cold water, such as lessened activity of the skin, goose-flesh, contraction of the cutaneous vessels, slowing of the pulse, increased arterial tension, lowering of the temperature of the parts immersed, and if the bath is short, a powerful reaction in the parts brought in contact with the water and reflexly related parts.

A short cold sitz (30 secs. to 2 min.) produces active dilatation of the vessels of the lower abdomen, increasing the movement of blood through these parts. The thermic reaction produced, heightens the nutritive processes in the parts concerned, and excites contraction of the muscular structures of the viscera, thus influencing the bladder, pelvic organs, and the structures involved in the acts of defecation and urination, together with the various musculo-ligamentous structures which support the abdominal and pelvic viscera. During the first moments of the bath, the cold sitz produces increased activity of the heart and a temporary rise of the blood pressure.

Therapeutic Applications.—Short applications (70° to **1307** 50°, 5 to 8 min.) produce tonic effects. Prolonged applications may be sedative. The bath is most frequently employed for fluxion effects upon the pelvic viscera. The cool sitz bath is derivative when continued for 15 to 20 minutes, or long

enough to cause very decided dilatation of the surface vessels. The special advantage of the bath depends upon the persistence of this dilatation, which fixes a large quantity of blood in the skin. Contraction of the internal vessels produced at the same time by the irritation of cold, aids in establishing a condition of relative anemia in the internal parts.

The cold sitz may be advantageously applied in cases of *jaundice* after the hot enema or in alternation with the sweating process. It stimulates the outflow of bile by strongly increasing the tension of the portal circulation.

The cold sitz bath is an excellent derivative measure for patients who are moderately vigorous, and who suffer from *congestion* of the *brain*, or from *hepatic* or *splenic congestions* or *chronic enlargement* from *malarial poisoning*, or other chronic conditions of like character. This measure is especially useful in atonic and paretic conditions of the genito-urinary organs, and in the *nocturnal urinary incontinence* of young children. In *chronic uterine affections* accompanied by a relaxed condition of the vessels, ligaments, and muscles, this measure is invaluable (70° to 80°, 10 to 15 min.). It is equally valuable in *chronic congestion* of the *prostate*, *gleet*, in the atonic forms of *seminal weakness*, and in *constipation* and *atony* of the *bladder* in both sexes.

Contraindications.— The cold sitz must not be prescribed in cases of acute inflammation of the pelvic or abdominal viscera, in painful affections of the bladder or genital organs, in sciatica, nor in cases of acute pulmonary congestion.

THE PROLONGED COLD SITZ BATH.

1308 The sitz bath at 60° to 70° for 15 to 40 minutes causes prolonged contraction of the vessels of the pelvic and abdominal viscera, thus making it a most effectual measure in combating chronic congestions or so-called chronic inflammations. A hot foot bath must be given simultaneously.

In many cases a temperature of 75° to 80° (usually about 75°) is preferable to a lower temperature, especially for

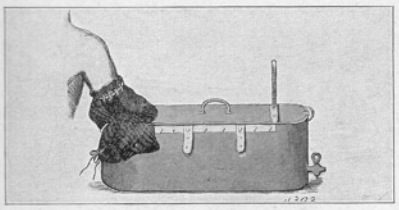


FIG. 160. PARTIAL CONTINUOUS BATH (p. 761). (Langenbeck)

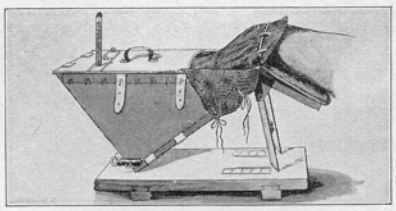


FIG. 161. PARTIAL CONTINUOUS BATH (p. 761). (Langenbeck)

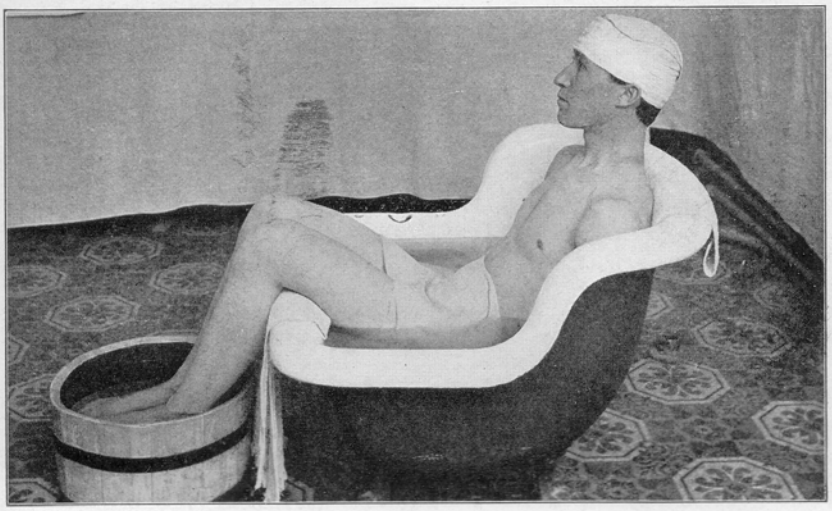


FIG. 162. SITZ BATH (p. 762).

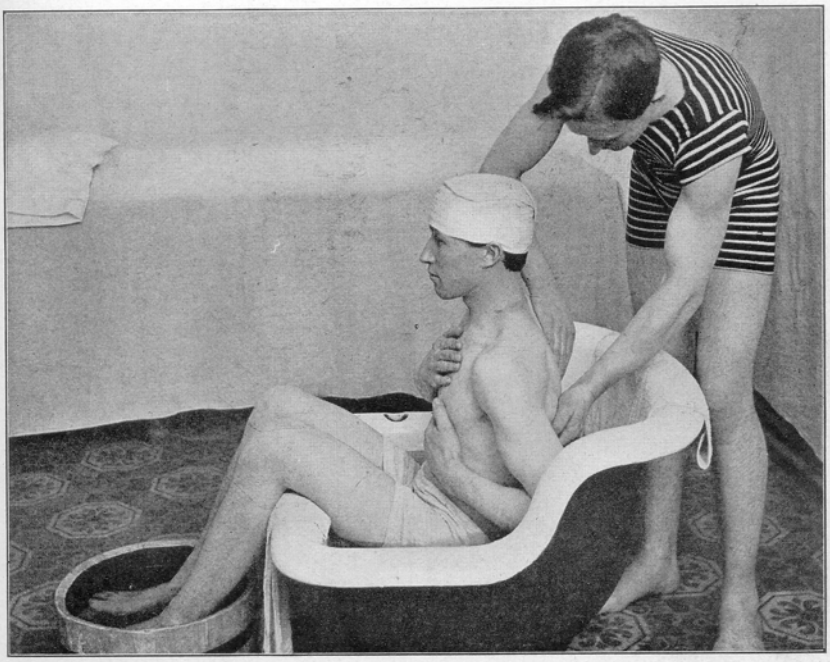


FIG. 163. COLD RUBBING SITZ (p. 763).

patients who have not been accustomed to cold water, and in whom a lower temperature produces pain or other unfavorable excitation, due to the intense internal reaction. The bath may be continued in cases of passive pelvic congestion for 30 to 40 minutes with excellent effects. In some cases it is desirable to begin the bath at a temperature of 85° to 90°, lowering it, after the first few minutes, to 75°. The duration of the bath should ordinarily be 15 to 20 minutes. For chronic congestion, a bath at 65° to 75° affords most satisfactory results. The cold must always be accompanied by the hot foot bath (104° to 110°).

Physiological Effects.— The prolonged cold sitz causes very pronounced effects upon the pelvic circulation. The contraction of the cutaneous branches of the internal iliac tends to produce hyperemia of the pelvic viscera, while the reflex effect is to contract the pelvic vessels. If the parts are rubbed so as to maintain strong surface circulation, the balance of effect will be to decongest the pelvic viscera. Without friction, the internal parts will be congested. This may be obviated by the simultaneous hot foot bath, which drains the iliac vessels through the femoral artery, while the reflex from the skin contracts the visceral vessels, affording a most beautiful example of the advantage of simultaneous hot and cold applications. The temperature of the foot bath should not exceed 110°. A higher temperature may dilate the pelvic vessels.

Therapeutic Applications.— The prolonged cool sitz affords excellent results in *chronic menorrhagia* when not due to vegetations of the endometrium. It should be used in connection with other measures of treatment. A Russian observer finds the prolonged cold sitz following the hot vaginal douche the most effective means of relieving *pelvic congestion.* Winternitz recommends the prolonged cold sitz after the wet-sheet rub as the most effective of all measures for the relief of *chronic diarrhea.* Both these observations the author is able to confirm by many clinical examples.

The cold sitz bath is also indicated in *hemorrhage of the bladder, intestines, uterus, urethra,* and *rectum,* in *hemorrhoids, chronic inflammation of the prostate, chronic metritis, circum-uterine inflammation,* and in most chronic inflammations of the pelvic viscera when pain is not a prominent symptom. The hot foot bath should be administered simultaneously. The pelvic vessels are thus drained of blood while they are at the same time reflexly contracted.

The *revulsive* sitz is a very short cold sitz, simply a dip into cold water for a few seconds, following a very hot sitz (115° to 120°), of 3 to 8 minutes' duration. It is a most powerful sedative measure in painful affections of the pelvic viscera. It may be very advantageously employed in cases of *ovarian* or *uterine neuralgia, enteralgia,* and in *painful affections* of the *bladder, rectum,* and *prostate.*

The cold sitz, accompanied by rubbing of the whole surface with cold water, is a powerful means of stimulating cerebral activity. Winternitz has shown by plethysmographic observations that the cold sitz increases the volume of the arm. This is accomplished through the contraction of the mesenteric vessels, which, with the spleen, constitute a sort of flexible reservoir into which the blood may escape from other portions of the body, and from which, by various means, it may be driven back again into the general circulation. The cold enema and the cold abdominal douche are the only other measures capable of acting in so direct a manner as the cold sitz upon this great reservoir of the blood. An eminent London preacher, Mr. Joseph Parker, has a small bath-room fitted up in the rear of his pulpit, in which he habitually takes a cold sitz just before appearing before his audience. He testifies that the effect of this application upon his cerebral activities is most remarkable, and asserts that if he can have his cold sitz bath, he feels able to command any audience that can be gathered before him.

Contraindications.— On account of the considerable increase of blood pressure at the beginning of the bath, the cold

sitz is always contraindicated in cases in which suddenly increased arterial pressure is likely to prove detrimental. On this account it must be avoided in most affections of the heart. It is also contraindicated in all acute inflammations involving the viscera of the abdomen or pelvis, as in *cystitis*, *prostatitis*, *metritis*, *ovaritis*, *enteritis*, *colitis*, *appendicitis*, *peritonitis*, *salpingitis*, and so-called *cellulitis;* in affections of the bladder, uterus, and intestines attended by *muscular spasm;* in *vaginismus;* in *enteralgia*, *lumbo-abdominal neuralgia*, *neuralgia* of the *ovaries*, *bladder*, *testicles;* in *coccygodynia* and *sciatica;* and in most *painful affections* of the *genito-urinary organs*. The cold bath in any form must be avoided in *spermatorrhea* accompanied by hyperesthesia of the prostatic urethra, or frequent losses; the cold sitz is especially harmful. In many cases in which the cold bath is contraindicated, a sitz bath at 85°, gradually cooled to 75°, may, however, be employed with benefit. The length of the bath when employed in this manner should be 15 to 20 minutes.

THE COLD RUBBING SITZ BATH (Fig. 163).

1309 The patient's head having been properly cooled and protected by a wet towel, he steps into the hot foot bath, and then seats himself in the sitz bath. The attendant at once begins a vigorous rubbing of the hips, back, and thighs. The rubbing should continue during the entire bath, the patient rubbing the abdomen and thighs while the attendant rubs his back and sides (duration 3 to 4 min., temperature 65° to 55°). Friction mitts may be employed to facilitate reaction in persons very susceptible to cold and who do not react well. At the end of the bath it is well to administer the Scotch douche to the hips and legs. When this is not available, a douche at a temperature ten degrees below that of the bath may be applied over the hips and feet (20 secs.).

Physiological Effects.— The effect of this bath is to produce decided thermic and mechanical impressions upon the

reflex areas associated with the viscera of the pelvis and lower abdomen. A most powerful and lasting circulatory reaction is produced in the surface vessels, which depletes the circulation of the associated internal areas by collateral influence, producing a strong revulsive effect.

Therapeutic Applications.—The cold rubbing sitz is a powerfully tonic measure, influencing especially the genito-urinary organs, and is applicable to all atonic conditions. It is one of the best of all measures for the relief of *constipation*, and of *atony* of the *bladder* accompanied by incontinence or retention of the urine, when pain and active inflammation are not present. It is an excellent procedure in cases of *subinvolution* of the *uterus* and *adnexa* in women, and *enteroptosis* in both sexes, especially when the abdominal muscles are greatly relaxed; in *nocturnal enuresis* of children; in *impotence* in men, *sterility* in women; and in cases of *uterine* and *ovarian displacement*, in conjuction with other appropriate measures of treatment.

This measure may be used with advantage in certain cases of *insomnia*, being repeated two or three times during the night if necessary. Usually two or three hours of good sleep will be obtained after each application. It is also valuable in *constipation* with *apepsia* or *hypopepsia*, and in *dilatation* of the *stomach* and *colon*. It may be employed in *delayed labor*, cold water being poured upon the spine while the patient is in the bath.

In certain cases in which the rubbing sitz is indicated, so great intolerance to cold water exists that the patient must be very carefully trained for some time before a vigorous application can be made; in such cases the bath may be given at 80° to 85°, being lowered one or two degrees daily until a really effective cold bath may be administered. When the higher temperatures are employed, the duration of the bath may be prolonged with advantage to 6 or 8 minutes.

1310 **Contraindications.**— This bath is not admissible in cases of *acute inflammation* and *congestion*, and in *painful* or *spas-*

modic affections of the *pelvic* and *abdominal viscera*, as *neuralgia* of the *ovaries* or *testicles*, *tenesmus* of the *bladder* or *rectum*, and *vaginismus*. It may be added, however, that the cold rubbing sitz is of high value in cases of *ovarian neuralgia* and other painful non-inflammatory affections of the pelvis, if made of short duration (one-half minute to a minute), and preceded by a hot pelvic pack or a hot sitz bath for 10 or 15 minutes. When employed in this way, it serves to fix in the skin, so to speak, the blood which has been brought to it by the preceding hot application, and thus intensifies and prolongs the analgesic effect.

THE VERY HOT SITZ BATH.

Temperature, 106° to 120°; duration, 3 to 10 minutes. **1311** It is well to begin with a temperature of 100°, rapidly adding hot water until the maximum temperature is reached. A hot foot bath is taken with it (110° to 120°).

Physiological Effects.— The general effects are essentially the same as those of the hot immersion bath (**1126**). The cutaneous branches of the external iliac are widely dilated, diverting blood from the internal viscera. The hot foot bath, by dilating the branches of the external iliac, still further drains the portal circulation. At temperatures above 110°, especially if the bath is continued beyond three or four minutes, the effect is to excite the pelvic circulation, and to concentrate the blood in this portion of the body.

Therapeutic Applications.— The hot sitz is of great service in restoring the menstrual function when suspended as the result of general chill or other cause. The shallow, very hot sitz is an excellent measure in relieving the pain of inflamed *hemorrhoids*. It is likewise of great value in *vaginismus*, *spasm* of the neck of the bladder, *anal tenesmus*, in *uterine colic*, in *nephritic colic*, in *sciatica*, *lumbo-abdominal neuralgia*, *neuralgia* of the *ovaries*, *testicles*, and *bladder*, and in all painful affections of a non-inflammatory character, involving the viscera of the pelvis and lower abdomen. The hot sitz

bath is a most powerful analgesic measure. For the best effects, it should be followed by a short cold application.

In cases in which this bath is employed for the relief of acute visceral congestion, great care must be exercised to cool the surface of the body gradually, so as to restore the tone of the vessels without producing a general and sudden contraction of the surface vessels, whereby the good effects of the bath may be immediately destroyed (affusion or spray, 80°, 5 min.; or 40°, 5 to 10 secs.). The slightest chilly sensation following the bath will be accompanied by a return of the unpleasant symptoms which have been removed by the application.

1311½ A most useful form of the sitz bath is what the author has termed the *revulsive sitz*. The bath begins at 100° F., the temperature being rapidly raised to 115° or 120°. The patient remains in the bath 3 to 8 minutes, the head being carefully protected by a cold compress upon the head or about the neck. As the patient rises from the bath, a pailful of cold water is dashed upon the hips, so as to produce a tonic reaction, and fix in the skin the blood with which it has been well filled by the hot bath. There is no better analgesic measure than this for the various *neuralgias* and *hyperesthesias* of the genito-urinary organs to which women, and occasionally also men, suffer most persistently, and often without any substantial relief.

THE NEUTRAL SITZ BATH.

1312 The character of this bath is essentially the same as that of the neutral full bath. It is simply a circumscribed neutral bath. The temperature is 92° to 97°; the duration may be from 15 minutes to an hour or two.

Physiological Effects.— The effects are those of a limited neutral bath. No decided thermic or circulatory reaction is produced by it, and as a consequence it exercises a pronounced calmative effect upon the viscera of the pelvis and lower abdomen.

Therapeutic Applications.— The neutral sitz bath is an exceedingly useful means of relieving *nervous irritability* and *congestion* of the *pelvic viscera*. It is of great service in the treatment of *painful* and *inflammatory affections* of the genito-urinary organs in both men and women, in *pruritis* of the vulva and anus, in *strangulated hemorrhoids*, *frequent urination* from irritability of the bladder, *spermatorrhea* arising from excessive irritability of the genito-urinary center, —frequent losses,— *neuralgia* of the *spermatic cord* and *testicles*, and in cases of *enteroptosis* accompanied by extreme hyperesthesia of the lumbar ganglia of the abdominal sympathetic, also in *chronic backache* from rectal and uterine disorders or *enteroptosis*, and *coccygodynia*.

The neutral sitz bath is highly antiphlogistic in character, and may be employed in subacute and even acute inflammatory conditions, such as *acute catarrh* of the *bladder* and *urethra*, and in subacute inflammations of the *uterus*, *ovaries*, and *tubes*. This bath is especially useful as a means of relief in *neuralgia* of the *Fallopian tubes* or of the *testicles*, in *vaginismus*, *pruritis* of the *anus* and *vulva*, *vesical* and *rectal tenesmus*, *hyperesthesia* of the *lumbo-aortic plexus*, and in *hyperesthesias* of the *genito-urinary organs*. It is indicated as a sedative means in *erotomania* in both sexes, in *priapism*, and in cases of *spermatorrhea* accompanied by a marked hyperesthesia of the urethra and ejaculatory ducts, and in all cases of pelvic disease in which cold applications are inadmissible on account of pain or the inflammatory conditions which may be present.

THE COMPRESS.

This is simply the application of water at any temperature 1313
by means of a cloth, a sponge, spongiopyline, or other suitable medium. More than a century ago Benjamin Rush used a compress of clay with excellent results. The ordinary old-fashioned poultice is a compress, but inconvenient and uncleanly. For ordinary purposes, a linen cloth of two to

four thicknesses and of proper size, or cheese-cloth doubled four to eight thicknesses, renders the best service. If the compress is to be greatly prolonged, a rubber bag filled with water at the proper temperature, or a rubber coil through which water at a suitable temperature is continually passed, may be applied over the compress so as to maintain the desired temperature. In addition to the compress, there may be needed a piece of flannel for covering, also in some cases, oilcloth, mackintosh, or rubber cloth, and a Turkish sheet and towel for drying the parts at the conclusion of the treatment.

Compresses may be classified according to their temperature, as: (1) *very cold* (55° or less); (2) *cool* or *cooling* (60 to 70°); (3) *warm* or *neutral* (92° to 98°); (4) *hot* (102° to 110°); (5) *very hot* (110° to 160°); (6) *alternate* (very hot and very cold in alternation); (7) *revulsive* (short cold following prolonged very hot); (8) *hot and cold* (simultaneous); (9) *hot and cold pack;* (10) *heating* or *stimulating* (applied cold, more or less protected, and prolonged until warmed by the body heat); (11) the *proximal compress;* (12) the *irrigating compress.*

These several forms of the compress produce effects so characteristic as to demand particular consideration of each as a special procedure.

THE VERY COLD COMPRESS.

1314 This application may consist of folded cloths saturated with ice-water, and changed every 4 or 5 minutes, or the low temperature may be maintained by bits of ice placed between the folds of the compress. Other methods consist in the use of the ice cap (Fig. 164), the rubber or aluminum *coil* (Fig. 165), or a specially constructed rubber sac (Fig. 166), through which a stream of water at a low temperature is made to flow continuously, a rubber bag filled with broken ice (Fig. 167), or a rubber sack containing a cooling mixture.

When ice or very cold water can not be obtained, as in many tropical countries, a very satisfactory substitute may

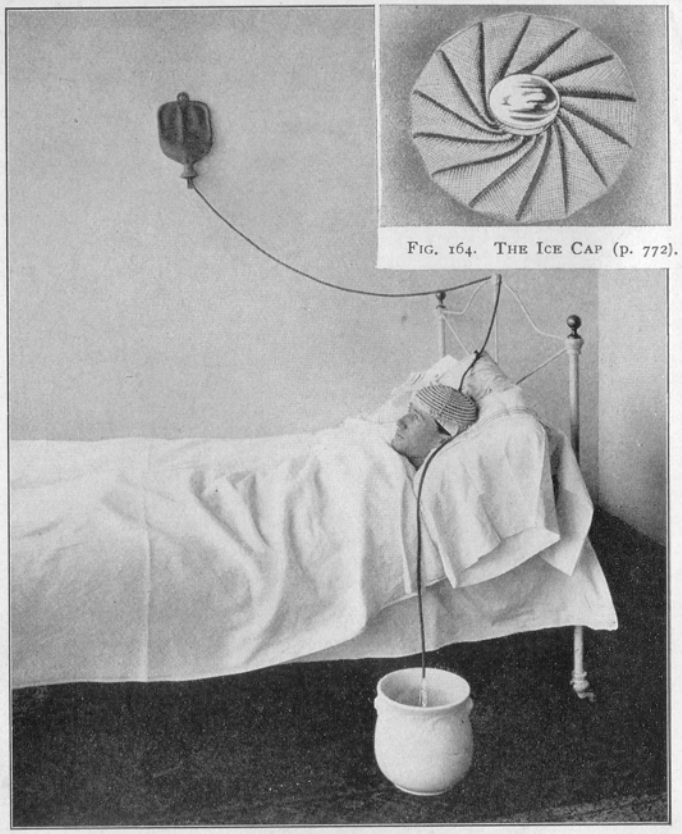


FIG. 164. THE ICE CAP (p. 772).

FIG. 165. ALUMINUM COOLING COIL TO THE HEAD (p. 772).

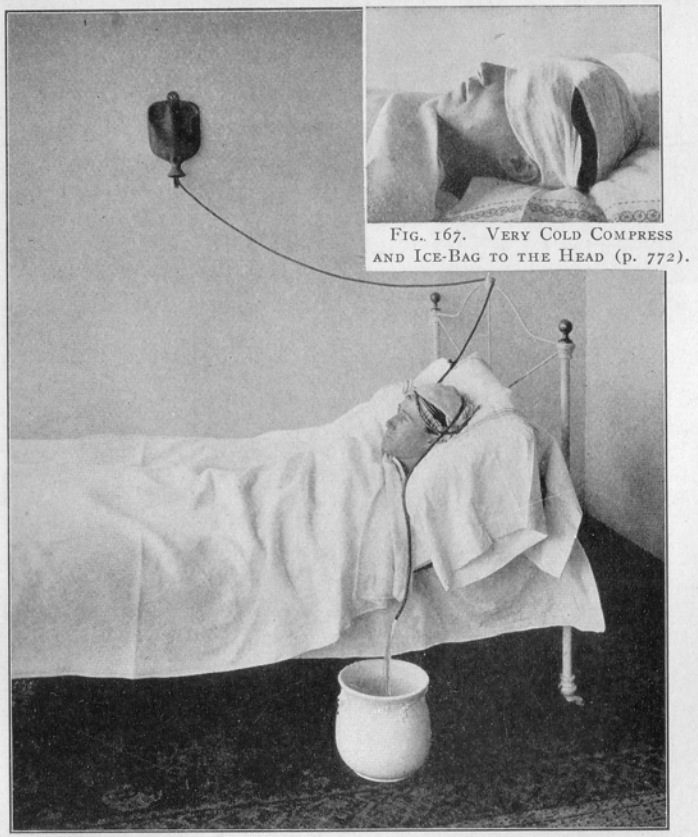


FIG. 167. VERY COLD COMPRESS AND ICE-BAG TO THE HEAD (p. 772).

FIG. 166. IRRIGATING BAG TO THE HEAD (p. 772).

be found in ammonium nitrate. This chemical substance has the property of absorbing an enormous amount of heat in passing from the solid to the liquid state. By adding to a quart of water eight ounces of nitrate of ammonium, a temperature of 41° was secured, the initial temperature of the water being 70°, and the temperature of the room in which the experiment was made being 70° F.

A very intense degree of cold may be obtained by means of carbonic acid gas condensed in the form of snow, known as the "CO_2 compress." For this purpose a flannel bag is used, filled with absorbent cotton. A short pipe leading from the reservoir containing the liquid carbonic acid gas is passed into the middle of the bag, and the liquid gas is then allowed to escape. The rapid evaporation quickly fills the bag with a white snowy mass which has a temperature of —80° F. When the bag is filled, it may be slipped inside a sack made of thin mackintosh.

The cold of the carbonic acid gas compress is exceedingly intense and penetrating. In certain cases the author believes this compress has advantages which are not possessed by any other application or any other mode of utilizing cold. In application, the skin should be protected by flannel placed between it and the bag. This precaution is also necessary in most cases in the use of the ice-bag.

Schultze has shown* by numerous experiments that the deep tissues may be cooled by applications of ice to the cutaneous surface, contrary to the conclusions drawn by some other observers. According to his observations, the temperature of the tissues half a centimeter (one fifth of an inch) below the surface was found to have fallen 18° F.; at a depth of two centimeters (four fifths of an inch), the lowering of temperature was 3.6° F.; and at a depth of seven centimeters, nearly three inches, there was still a lowering of temperature amounting to nearly one-half degree. A ther-

* Joffroy, "These d' Aggregation," Paris, 1878, p. 176.

mometer applied to the internal surface of the chest in a case of thoracentesis showed a diminution of temperature of nearly 7° F. A clinical thermometer placed against the inner surface of the cheek while ice was pressed against the outer surface showed a diminution of more than fourteen degrees in temperature. A thermometer placed in the vagina indicated a fall of nearly one and one-half degrees, as the result of an application to the hypogastrium of a large bladder filled with ice (Exp. 64, 65, 66, 67).

1315 **Physiological Effects.**— These depend upon the length of the application and the part to which it is applied. A *short, very cold* compress has the effect to produce a primary contraction, followed by dilatation of the surface vessels and of the visceral vascular area in reflex relation therewith. By means of such an application, it is possible to influence the circulation in an internal viscus, to awaken vital activity, to relieve passive congestion, to encourage leucocytosis, and to increase vital resistance, as in pneumonia. The ice-water compress produces more powerful cooling effects than ice or the ice-bag, as the skin is more easily wet.

Prolonged very cold applications cause spasm of the surface vessels, together with contraction of the vessels of the reflexly related internal part, and hyperemia of collaterally related vessels.

Continuous very cold applications lower vital action, and may even suspend all vital activity in the parts cooled. The surface becomes blue from excessive absorption of oxygen from the slowed blood stream in the veins. The nerve ends are benumbed, and reflex activity between the surface and the corresponding internal area is interrupted. This effect is sometimes very useful, and may be employed to abolish reflex activity when indicated; but more frequently this effect is undesirable and contraindicated, and must be prevented by frequent removal of the cold compress, and restoration of the parts by warm rubbing or allowing an interval for reaction.

Continuous cold causes contraction of the arteries of the cooled parts; hence the value of the continuous ice-bag or poultice in the proximal compress, as in the ice-collar.

Prolonged cold applications (an ice-bag for 15 to 30 min.) over the heart slow the pulse and raise blood pressure. Continuous cold applications depress the activity of the heart.

Very cold applications made to such extremely vascular parts as the head may lower the temperature of the entire body, when carried to the extent of producing shivering.

Intense cold to the head becomes decidedly painful when prolonged. Continuous cold to the head operates somewhat differently than applications to any other portion of the body. The vascularity of the scalp is so great that the circulation is not suspended even when ice is employed. The bones of the skull are thin; and being, like other bones, good conductors, the continuous cold application to the head is capable of lowering the temperature of the brain, and by depression of the cerebral thermic centers heat production is diminished, and thus general vital activity is lessened.

A short cold application to the head (1 to 5 min.) excites cerebral activity through the reaction which follows. But by rewetting the cold application every three or four minutes, a renewed contraction of the vessels is induced at each contact of the cold water, and thus the vessels are made to contract more vigorously, and the effect of the application is more intense than if continuous, as by an ice-bag or ice-compress.

Intense cold applications, especially when made to the head, become very painful when prolonged. Such a degree of cold is unnecessary to secure the therapeutic effect desired.

Therapeutic Applications.— The *very cold* compress ren- 1316
ders valuable service in many cases, but its usefulness is small compared with that of the cool or cooling compress, which will be mentioned later. It may be usefully employed in the suppression of *local inflammation* in *joints*, *inflamed wounds*, and other conditions in which powerful sedative

effects are required. Applied to the head, it lowers the temperature in *fever*, relieves *delirium* in febrile conditions, may control excitement in *acute mania*, and renders invaluable service in *meningitis*, used in connection with the warm bath.

The ice-bag over the stomach for a half hour before meals is exceedingly useful in *anorexia*. Ice-cold applications are also of service in certain cases of *neuralgia*. Ice compresses may be applied for the relief of *inflamed hemorrhoids*. An ice-bag laid across the trunk of an artery is more effective in reducing the blood supply of the part in which the artery is distributed than an application made directly to the part itself; and an application made to the axilla, the bend of the elbow, the groin, or the bend of the knee, will control inflammation in the distal portion of the limb more effectively than a cold application to a hand or foot. The ice collar or very cold compress about the neck is a powerful means of relieving *cerebral congestion*. An ice compress over the heart lowers the general temperature by cooling the blood, while it energizes the heart. It must be removed for five minutes at intervals of 20 to 30 minutes, so as to allow reaction, thus maintaining the sensibility of the skin upon which its energizing effect upon the heart depends; or the skin may be rubbed or heat applied for one minute every 15 or 20 minutes.

A cold compress to the face and the upper spine causes contraction of the vessels of the nasal mucous membrane, and will thus control nosebleed. This measure is also useful in cases of acute and subacute *nasal catarrh*. Prolonged cold applications to the back of the neck and the face constrict the vessels of the brain, and so relieve *cerebral congestion*.

Cold compresses to the inner portion of the thighs, the perineum, the vagina, and the lumbar region cause contraction of the vessels of the uterus, and are useful in *uterine hemorrhage*, *intestinal* and *vesical hemorrhage*, *bleeding hemorrhoids*, etc. Ice-bags to the spine aid in lowering the general temperature in *fever*.

A cold compress to the thighs, perineum, and hypogastrium in conjunction with a very hot fomentation (10 min.) over the lumbar region, is a valuable means of arresting hemorrhage from the kidney when the bleeding is from small vessels and not due to malignant disease. The cold compress contracts the renal vessels, while the fomentation to the loins diverts blood from the renal circulation into the collateral vessels.

The cephalic, spinal, and cardiac compresses act in special ways in lowering temperature. The head compress lowers the temperature of the blood in the brain, and lessens the activity of the cerebral centers. The cardiac compress lowers the temperature of the blood as it passes through the heart and lungs. The spinal compress causes dilatation of the vessels of the lower extremities, and thus exercises a refrigerative effect, extending over a much larger surface than that to which it is directly applied.

Dieulafoy recommends the application of ice-bags to the whole length of the vertebral column in *ataxic* cases of *typhoid fever*. The author has made use of this measure in many cases of typhoid fever, with excellent results. In some instances, however, the alternate hot and cold spray is more effective. This measure combats the tendency to meningitis and other lesions of the cord. Care must be taken to avoid injuring the vitality of the skin.

The ice compress may be applied directly to a wound as a means of checking *bleeding*, but the compress must be large; instead of covering the wound only, it must extend over the whole part, or the greater portion of it. The circulation of a wounded part must not, however, be restricted to such a degree as to interfere with its nutrition. Hence the cold must be withdrawn as soon as possible. Pure blood is the great healing power in the body, the source of life and energy, in health and disease alike. In case of wounds of the hand or foot, the cold proximal compress may render inestimable service.

Nosebleed may be checked by the application of cloths wrung out of ice-water to the face or to the upper part of the spine.

An ice-bag applied over the stomach or to the spine opposite will often check *vomiting*, and will relieve the excruciating pain of *cancer* of the *stomach* or *chronic ulcer*.

An ice-bag or ice compress renders great service in cases of *inflamed* and *prolapsed hemorrhoids*, and affords marked relief to the pain which accompanies *ulcer* and *cancer* of the *rectum*. The pain of *orchitis* is relieved by the cold compress, the parts being supported meanwhile. It must be remembered, however, that in such cases the parts may be easily damaged by a too intense or prolonged application, the tissues being sometimes so chilled that sloughing occurs. It is only necessary to employ ordinary care and discretion, however, to prevent this. The cold applications should be continued until the parts are no longer sensitive to pressure.

The pain of toothache from *alveolar inflammation* is often more readily relieved by a cold application to the side of the neck just below the jaw, than from a hot application to the cheek. The two applications may be used simultaneously.

Dr. Chapman pointed out many years ago that the ice-bag or intense prolonged cold applications made to the back produce a sedative influence upon the spinal cord, and also upon the vasomotor sympathetic nerve centers. Dr. Chapman's idea was that this effect is to be attributed to the benumbing effect of cold resulting in lessened activity of the centers brought under its influence. According to him, an ice-bag applied to the lower portion of the spine, will dilate the vessels of the lower extremities, and increase the blood supply of the pelvic viscera. While not prepared to support all of Dr. Chapman's claims, the author has noted a number of cases in which the application of the ice-bag to the lower portion of the spine has produced a very marked effect upon the circulation of the lower extremities. A young lady, a bed-ridden invalid, who had for years suffered from cold

feet and legs, noted that her limbs became warm and filled with blood within ten or fifteen minutes after the application of the ice-bag to the lower spine. The patient was first to call attention to this effect of the ice-bag as a curious and interesting circumstance. Many similar cases might be cited. When used for this purpose, the cold application should be continuous and prolonged.

Applications of ice across the neck, just above the sternum, influence the pneumogastric nerve, and will often relieve spasm of the bronchioles in *asthma* within a few minutes. Care must be used to avoid contact of cold water or ice with the chest, and heat may be used to the back of the chest.

The *ice collar* is a valuable measure in the treatment of diphtheria, the application being exchanged at intervals of 15 to 20 minutes for a very hot short fomentation. The effect of this procedure is to diminish the blood supply to the inflamed parts by its influence upon the carotid, the peripheral branches of which are made to contract by the application of cold over their trunks. A beneficial influence is also exerted by the reflex effect of the cold application upon the vessels of the affected region; and thus in two ways the blood supply of the part is diminished, and the inflammatory process controlled to a corresponding extent. In cases in which the inflammatory action is extremely intense, and after the first onset of the disease, the cooling or even the heating compress should be employed instead of the cold compress.

Applications of ice to the mucous membrane of the nose and lips have been shown by Drs. Beer and Forges, of Vienna, to be efficient in restoring respiration in cases of *asphyxia* from opium, chloroform, or other narcotics. The cold application excites the respiratory center.

By a mixture of two parts of finely pounded ice with one part of common salt, a very intense degree of cold may be produced, sufficient to quickly freeze the parts to which the mixture is applied when necessary for surgical purposes.

1317 **Contraindications and Precautions.**—If ice is used, one thickness of flannel should be placed between the ice and the skin.

In cases in which ice must be used for a long time, it is wise to withdraw the application for a few minutes at intervals of half an hour, and to make an application of very hot water from 1 to 3 minutes, as a precaution against too great depression of the vitality of the parts, or the parts may be rubbed until warm and red.

The very cold and the cold or cooling compress must be avoided in all cases in which the collateral hyperemia produced by it may do injury. This collateral effect must always be borne in mind. Examples: *Inflammation* of *muscles* and *joints;* deeply seated *abscesses* vascularly connected with the cutaneous surface; *parietal pleurisy* or *peritonitis; inflammation* of the structures of the *eyeball.*

It must also be remembered that the same reflex impulse which excites the vasoconstrictor nerves, causing vascular spasm in a deeply seated part, likewise excites all the other nerves of the part, and so may intensify pain when present. Hence the cold compress is contraindicated in most cases in which pain is a prominent symptom. The revulsive compress (**1341**) or the fomentation followed by the neutral or heating compress, is to be preferred in these cases.

Sometimes, however, the cold compress may be employed by combining with it a hot application, thus realizing its good effects while antidoting by means of heat its untoward effects. Examples: A hot foot bath with an ice-bag over an inflamed ovary or tube; an ice-bag to the epigastrium in gastritis, with a fomentation to the back; a fomentation to the ear and cheek in otitis media, with an ice-bag over the carotid.

THE COLD OR COOLING COMPRESS.

1318 Hippocrates was familiar with the cooling compress, employing it in the treatment of fevers by having linen cloths dipped in cold water and applied to the hottest parts, while the patient was at the same time given cold water to drink.

The temperature to be employed is 55° to 70°. For sedative effects, the compress may be changed every 5 or 10 minutes. The higher temperature may be employed when thin compresses are used, as the evaporation taking place from the surface will keep the temperature down so that reaction and dilatation of the vessels will not quickly occur, but renewal must be more frequent. The lower temperature named is greatly preferable, because of the decided effects upon the arterial trunks. After the first onset, the cold compress, changed every 20 to 30 minutes, is most useful. For the principles which govern the mode of application of the cold compress, see paragraphs **1256** to **1292**.

The compress should always cover an area larger than the part to be influenced. The recommendation of a leading physician, published in a well-known medical journal, that thin cloths four inches square be laid over the region of the appendix as a means of combating appendicitis, is a veritable travesty of hydrotherapy. The smallest viscera of the trunk requires a compress at least one foot square.

Physiological Effects.— The cooling compress has been **1319** very carefully studied by Winternitz and Baginsky.* It is a powerfully revulsive measure, and one of the most valuable of all means of controlling, through the cutaneous circulation, the circulation of the viscera. When the cold compress is applied to the skin, causing contraction of the surface vessels, with dilatation of the deeper-lying vessels which are supplied by the same artery, the blood-vessels of the reflexly associated viscera are, through reflex influence, maintained in a state of contraction so long as the application is so managed as to avoid reaction, or so great lowering of the skin temperature as to destroy sensation, and thus abolish reflex action. When the skin becomes numb under the influence of a cold compress, the vessels of the associated vascular area dilate

* Baginsky, "Lehrbuch der Kinder Krankheiten," 1896, p. 292.

through loss of the influence of the skin reflexes, while the blood is diverted from the collateral surface vessels into the deep vessels. This is a most undesirable effect, against which the nurse or physician who makes use of cold applications must be constantly on his guard. Neglect of this precaution is responsible for failure to obtain good effects in multitudes of cases.

Sometimes the cold compress produces a tendency to general chilliness. This must be prevented by a simultaneous hot application to some surface where hyperemia of the skin will be advantageous, as to the feet or the back. If the feet are cold, the hot foot bath or hot leg pack is always indicated as an adjunct of the cold compress to the head, abdomen, or pelvis.

A prolonged cold proximal compress, that is, a cold application, as an ice-bag, placed over an arterial trunk, causes contraction of the artery and all its distal branches. A warm or hot application produces the opposite effect. This principle is especially important in relation to compresses applied to the neck, axilla, bend of elbow, groins, or popliteal space.

The effectiveness of the cool or cooling compress depends upon the continued maintenance of a moderately cool temperature, with frequent renewals, whereby continuous stimulation of the vasoconstrictors is maintained.

It must not be forgotten that the action of the cool compress involves more than its direct influence upon the nerve centers. It sets up and maintains a regular play of reflex nervous impulses between the skin and the related internal parts, through the medium of the nerve centers. When the area involved is general, the whole nervous system is excited to a most pronounced degree. This play of nervous activity is a dominant factor in the revulsive effect produced by the cold application. Through it there is produced an increase of vital work in the parts interested,—local metabolism, secretion, excretion, heat production, etc.

The most important effect of the cool compress in many

cases is the fluxion produced by it in deep parts. Fluxion is without doubt one of the most powerful hydriatic resources which we possess. The correct management of this therapeutic force is the most severe test to which an individual's knowledge of hydriatic principles and procedures can be brought (**1260–1291**).

Cool compresses may be employed in such a manner as to influence the circulation and the functions of the liver, spleen, stomach, kidneys, intestines, lungs, brain, pelvic viscera — in fact, all the internal structures of the body.

When used as an antithermic or antipyretic measure, the compress should cover at least one fourth of the skin area (page 316). The size of the compress may be estimated from the weight of the patient by a simple calculation based upon the proportion $180 : W :: 87 : x^{\frac{3}{4}}$, in which W represents the weight of the patient, and x the skin area. Dividing the result by four, the required size of a cooling compress for use in reducing temperature will be: for a person weighing 180 lbs., 5 sq. ft.; 120 lbs., 4 sq. ft.; 60 lbs., $2\frac{1}{2}$ sq. ft.; for a child weighing 30 lbs., $1\frac{1}{2}$ sq. ft., or 12 x 18 inches.

In Dr. Thompson's experiments upon dogs, published in 1892, it was found impossible to lower the rectal temperature by applications to the sacrum or abdomen. In these experiments an incision was made in the abdominal wall, the bulb of a thermometer was introduced, and an ice-cold application made to the surface. The thermometer indicated no change of the temperature of the inner surface of the abdominal wall so long as the animal remained alive, though cold applications to the head produced a very decidedly cooling effect upon the brain. **1320**

The experiments of Schultze give somewhat different results, showing actual reduction of temperature from cold applications to the abdomen (**1314**). Nevertheless, it is doubtless true that the chief effects of the cold abdominal compress in cases of visceral inflammation, unless large enough to cover one fourth of the body surface, are obtained

through its influence upon the circulation and innervation of the diseased structures by reflex action through the vasomotor centers.

The temperature of a deeply seated part is dependent upon its functional activity, and the rate of blood movement through it. The slower the movement of blood, the higher will be the temperature. Hence passive congestion favors local elevation of temperature. The active fluxion of blood through a viscus, which may be induced by the cold or cooling compress, may thus lower the temperature of the most deeply seated organs, and exercise a decided antiphlogistic influence without actually lowering the temperature of the intervening parts.

It is by this reflex influence that we are able to control inflammations in the lungs, spinal cord, stomach, liver, intestines, uterus, ovaries, and other deeply seated organs.

321 **Therapeutic Applications.**— The cool compress may be employed in such a manner as to render invaluable service in all forms of *localized inflammatory processes*, whether superficial or deep. In superficial inflammations the compress produces vasoconstriction, and thus sedative effects are brought about as soon as the application is made. In case of visceral inflammation, the beneficial results obtained are through reflex action, the application being made to the surface which is in reflex relation with the inflamed part (Figs. 168, 169).

The compress is exceedingly useful in *typhoid fever*. It should be covered with flannel only, not with oilcloth, so that there may be little retention of heat, and so as to encourage fluxion in the mesenteric vessels and leucocytosis rather than retention of blood in the portal vessels. The object of the abdominal compress in typhoid is to encourage leucocytosis and vital resistance in the diseased structures, rather than to reduce the temperature.

Care must be taken that the application never be made in such a way as to cause numbness or even lowered sensibility of the skin, as it depends for its effects upon the main-

tenance of reflex activity between the skin and the viscera.

The cold compress is of greatest service in *pneumonia.* It must be applied to the whole front chest and the affected side, and changed as soon as well warmed (**1284**).

The cool compress is highly useful as an application in cases of *cardiac insufficiency*, either in fevers or as the result of disease of the heart. It is applicable in nearly all cases except those in which there is degeneration of the cardiac muscle; in *myocarditis* it is valuable, notwithstanding the affection of the muscle, for the reason that it controls, to such a remarkable degree, inflammatory processes. In cases of *erysipelas*, except when affecting the face or scalp, a cool or cold application is more serviceable than the ice compress as an antiphlogistic application.

In *dermatitis*, the cool compress is exceedingly valuable. In *inflammation of the external portions of the eye*, the cooling compress is more effective than ice-cold applications, but it is effective only when the inflammation is confined to the eyelid itself. When the eyeball is the seat of the inflammatory process, the fomentation or the revulsive compress applied over and above the eye, is the proper measure. The application should be made to the eyelid and cheek only, not extending above the eyebrow (**1262**).

Cold applications for superficial inflammations should be made as long as the parts have a bright red appearance, but a mottled blue appearance of the skin is always an indication for the application of heat, as it shows excessive contraction of the small arteries and slowed movement of blood. Such a case requires the hot compress every two hours (10 min.) with the heating compress between applications.

When renewed every 5 to 8 minutes, the effect of the cooling compress is to maintain contraction of the cutaneous vessels and simultaneous contraction of the vessels of the reflexly associated visceral vascular area. When the compress is left in place long enough for reaction to be established (15 to 30 min.), the effect is somewhat different. The reflexly

associated visceral vessels are dilated, as well as those of the skin. When the application is renewed, the freshly cooled compress causes contraction of the cutaneous vessels and renewed contraction of the visceral vessels. This effect, frequently repeated, serves to maintain a vigorous circulation through the affected organ, and thus combats in the most decided manner the tendency to stagnation or passive hyperemia which is always present in visceral inflammation. This measure is consequently a most efficient means of combating *hypostatic congestion* of the lungs in surgical cases and prolonged helplessness from any cause, in resisting the action of specific bacteria in *typhoid fever*, and also renders most valuable service in the early stages of *pneumonia*. When the febrile activity is very great, the compress may be renewed as often as every 5 to 10 minutes. Later, when the activity of the inflammatory process is somewhat lessened, as shown by the slower heating of the compress, it may be left in place for an hour. The skin must be well rubbed at each renewal. In all deep-seated visceral inflammations, the same principles hold good.

The abdominal compress, frequently renewed, maintains active contraction of the mesenteric vessels. The cooling may be made continuous by ice-bags, but a more moderate temperature is, on the whole, better. This compress should be employed as a routine measure in typhoid fever, and may sometimes become the chief reliance, as in cases of intestinal hemorrhage and other conditions contraindicating the general cold bath. The cold abdominal compress was used successfully in fevers by Le Drau, of France, in 1731.

Often the patient's feelings are a good guide as to whether heat or cold should be applied. The organic intuitions of the body are marvelously correct guides in the application of rational and physiological measures. It is a common thing to hear a patient say, when a correct hydriatric prescription is made, "That will do me good, I am sure." And it does. Nature is a wise teacher and a watchful nurse.

Mays, of Philadelphia, has for several years advocated 1322
the ice-bag to the chest in pneumonia, and the results he reports * are certainly much superior to those obtained by other methods in common use. For more than twenty years the author has employed the cold compress or ice compress in the early stages of pneumonia, exchanging it every three hours for a fomentation, during the early stages of the disease, and applying the cooling compress as soon as the crisis was passed and the period of resolution begun.

The prolonged application of the cold compress to the cutaneous surface produces contraction, not only of the blood-vessels of the skin, but also those of the deeper tissues underlying the area to which the application is made. This effect is reached, however, only after long application. The first effect of an application over a muscle, for example, is to cause collateral hyperemia of the muscle simultaneously with the cutaneous anemia produced.

The cold compress or ice-bag over the heart for half an hour twice a day is of great value in cases of palpitation and cardiac insufficiency. The continuous application of the ice-bag is equally serviceable in cases of cardiac irritability (**1383**). Winternitz very strongly urges the value of this procedure as a substitute for digitalis, to which it is infinitely superior. Its use is indicated by the appearance of dicrotism in typhoid fever or in depression of the heart from shock.

Contraindications.— The precautions and contraindications relating to the cooling compress are the same as have elsewhere been indicated for the very cold or ice compress (**1317**). It needs only to be added that the compress at a temperature of 60° to 70° is generally useful, while a lower temperature is often injurious.

THE COOLING COIL.

A refrigerating method much employed in Germany is the 1323
cooling coil (Fig. 170), consisting of a flat coil of rubber

* Transactions of the Philadelphia County Medical Society, 1895, p. 302.

tubing through which cold water is passed. The coil is placed over a thin wet compress. The author has devised a rubber sack (**1336**) so constructed that its walls can not become too widely separated, and provided with an inlet and outlet on opposite sides. The sack is put in place, and connected by two pieces of rubber tubing with a fountain placed at a proper level and a receiving vessel placed on the floor. By regulating the temperature of the water in the fountain and the rate of the flow, any desired heating or cooling effect may be obtained. When ice-water is used, the same water may be employed continuously, it being only necessary to dip the water back from the lower into the higher vessel as the latter is emptied and the former filled.

Therapeutic Applications.— The cooling coil is especially useful only in those exceptional cases in which continuous cold is desirable, as in *meningeal inflammation*, as a precordial application in *fever* with very high temperature and bounding pulse, and as a proximal application (**1327**) in cases of wounds of the extremities.

THE EVAPORATING COMPRESS (Fig. 171).

1324 This consists of a thin compress or other absorbent material kept moistened with water and cooled by evaporation. In the evaporation of a pound of water about 1,000 heat units are rendered latent; that is, the evaporation of a pound of water absorbs as much heat as would be required to raise 1,000 pounds of water 1° in temperature. The rate at which the water evaporates from a compress of this sort depends upon the heat of the part, the temperature of the surrounding air, and the amount of air brought in contact with it. A compress twelve inches square, covering an area of 144 square inches, may remove from the body under favorable circumstances 150 heat units in an hour; but in order that the evaporating compress may accomplish its work, it must be in direct contact with the skin, must be kept constantly moist, and must not be protected. The moistened hair

Fig. 171. EVAPORATING CEPHALIC COMPRESS (p. 788).

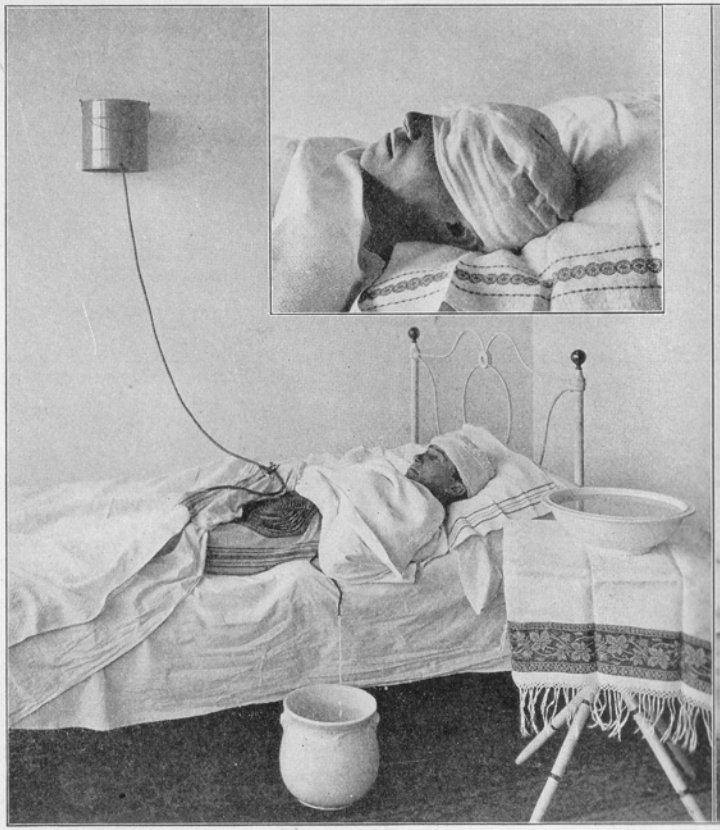


Fig. 170. ALUMINUM COOLING COIL (p. 787).



Fig. 172. IRRIGATING COMPRESS (p. 789).

serves very well the purpose of an evaporating compress to the head, but the hair must be kept wet. A moist compress laid upon the surface of the dry hair is practically without effect in cooling the head.

Therapeutic Applications.— The evaporating compress is **1325** of great value in fevers as a means of cooling the head. Benjamin Rush employed clay poultices as a cooling measure in the latter part of the last century. The evaporating compress is a most excellent means of maintaining a moderate degree of cold in cases of *erythema*, and in various conditions of *irritation* of the *skin* in which an intense inflammatory process is not present, so that more vigorous cooling measures are not indicated. The wet head-cap is a very useful measure in cases of *acute cerebral congestion*, and not infrequently proves a sovereign remedy for the *insomnia* which so often accompanies this condition. The evaporating head compress is contraindicated in rheumatics because of the tendency to cause rheumatic pains of the scalp.

THE IRRIGATING COMPRESS.

In this procedure a compress consisting of several thick- **1326** nesses of cheese-cloth or soft muslin, or a mass of absorbent cotton, having first been saturated with cold water (60°), is laid upon the part to be treated. It is kept moist by an arrangement whereby cool or cold water is made to trickle slowly upon the compress, thus keeping it saturated, and constantly changing the water which it contains, so that as fast as the water in contact with the skin becomes warm, it is displaced by that of a lower temperature. The parts treated should be so disposed as to be inclined somewhat, that the water which enters the compress at the upper end may run away at the lower end. By means of a surgical cushion or oilcloth the water may be collected as it runs away in a vessel at the side of the bed or couch. A convenient arrangement for conducting the cold water from the container to the limb is a simple siphon, as shown in Fig. 172. The tube should

be so constricted by tying a string about it or by other means that the water will flow at just the proper rate to maintain the temperature desired. If a fountain with a stopcock is employed, the flow of water may be regulated by the cock.

The *physiological effects* and the *therapeutic applications* of this procedure are the same as with the ordinary cold compress, the only difference being that by the method of irrigation the temperature of the application may be maintained at a certain point as long as desirable, and thus reaction may be easily suppressed. Irrigation is especially applicable in cases of *wounds*, *burns*, *bruises*, and other injuries in which the dressing can not be readily removed without irritating the injured surface.

Suggestions and Precautions.— It should be remembered that when a very low temperature is employed, the parts may be so devitalized by the long-continued application of cold as to be injured. Consequently a fomentation should be employed for 5 to 10 minutes once in two or three hours, to maintain proper activity of the circulation.

THE PROXIMAL COMPRESS (Fig. 173).

1327 This procedure differs from other compresses in that the application is made, not to the part which it is desired to influence, but at a point near the part and between it and the heart. It is not always convenient to apply a wet cloth to the part to be cooled. This is especially true in the case of wounds, which must be antiseptically treated, it being quite impossible to maintain asepsis with the use of the water dressing in the case of an open wound. This treatment of open wounds won great success half a century ago, before antiseptic treatment was understood, but the present method of dry antisepsis is so much superior, that this method is not to be considered in comparison with it. In many cases, however, great advantage may be gained in the relief of pain and the control of inflammation by the antiphlogistic effects of the cooling compress applied in the manner suggested. The

principle on which this compress rests has a sound experimental basis. The application of cold to the trunk of an artery has been shown to cause contraction of the artery and of its distal branches (Winternitz). The clinical advantage of the application of cold in this way was well understood before the physiological explanation was experimentally discovered. Priessnitz employed the cold elbow bath for the control of inflammatory processes of the hand, and recognized the same principle in the treatment of wounds and inflammations in other parts of the body. The proximal compress may be usefully applied either by means of a cooling compress, frequently changed, at a temperature of 60° to 70°, or by means of the cooling coil or sack, or a bag filled with ice or ice-water, and protected by one or two thicknesses of flannel (Exp. 68).

The following are the most useful applications of the cold proximal compress: —

To the knee and the calf of the leg as an antiphlogistic measure for the foot.

To the whole thigh or an ice-bag to the popliteal space to influence the portion of the leg below the knee.

An ice-bag in the groin to influence the whole leg.

The cold compress around the elbow joint as an antiphlogistic measure to the hand.

An application to the whole upper arm as a measure to influence the forearm.

An ice-bag to the axilla as an antiphlogistic measure for the whole arm.

An ice-bag at the bend of the elbow as a means of lowering the temperature of the hand.

An ice collar about the neck to control congestion of the brain. This is also a most effective measure in laryngeal inflammation, and may be used in meningitis.

THE FOMENTATION (Fig. 174).

This is an application of a hot compress, usually a thick 1328
folded flannel cloth, applied a number of times in succes-

sion at a high temperature. It is essentially a local vapor bath. There is no such thing as a "cold fomentation."

Requisites.— The material for a fomentation may be a piece of an ordinary woolen bed blanket, spongiopiline, a large flat sponge, or a thick woolen cloth of any sort, or, in the absence of anything better, a thick mass of cotton cloth, as cheese-cloth, towels, etc.

The flannel cloth should be large enough so that when folded to four thicknesses, it will well cover the part to which the application is to be made. Fomentations are generally made to cover too small an area. If the affected part involves an area the size of the hand, the fomentation should cover a territory three or four times as large, as the good effect depends much upon the size of the surface to which the application is made. A pain confined to a point not larger than a finger-tip, if acute and persistent, may require for its relief an application covering one or two square feet.

In addition to the flannel used for the fomentation, a much larger dry flannel or blanket and a piece of mackintosh should be at hand to cover the moist cloth, so as to retain the heat. Two or three large towels are also needed. A supply of water at boiling heat should be ready for use. If the fomentation must be given at some distance from the source of supply, a pailful of hot water may be made to retain its heat for some little time by covering and wrapping it well with a woolen blanket or a piece of carpeting.

Method.— The proper application of a fomentation consists of the following steps: (1) Preparation of the patient; (2) wringing the flannel out of hot water; (3) renewal of the application one or more times; (4) finishing treatment. These several steps are executed as follows: —

1. The patient should lie on a bed or couch, with the part to be treated thoroughly exposed. A little vaseline or cacao butter should be first rubbed over the surface to be treated, especially when the treatment is to be given daily. The patient's clothing, and the bed-clothing should be so arranged

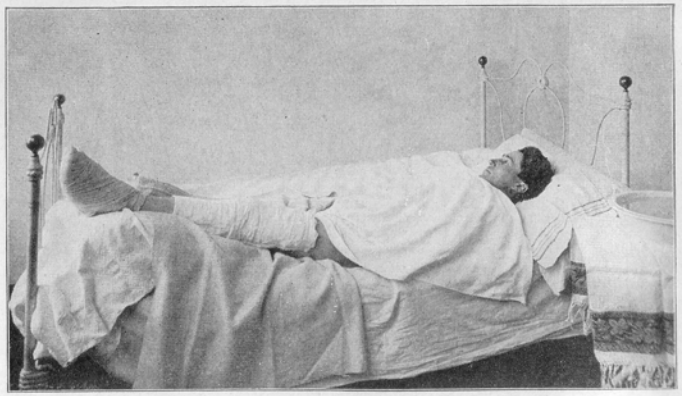


FIG. 173. PROXIMAL COMPRESS (p. 790).

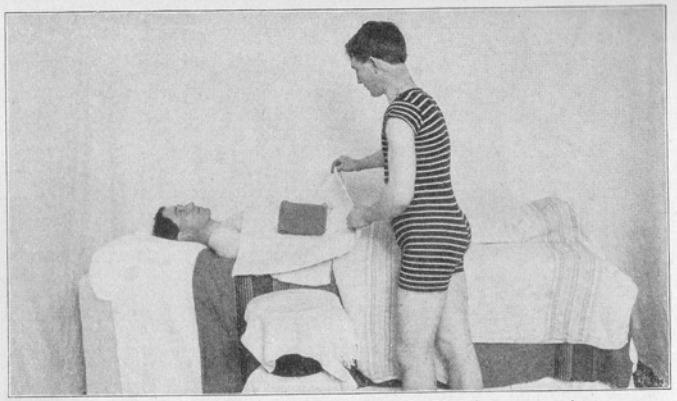


FIG. 174. FOMENTATION TO CHEST (p. 791).



FIG. 175. WRINGING FOMENTATION CLOTH IN A TOWEL (p. 793).



FIG. 176. WRINGING FOMENTATION CLOTH (p. 793).

that it will not be wet, as otherwise he may take cold after the treatment. Care must be taken that the extremities are warm; and if there is cerebral congestion, a cold cephalic compress (**1371**) should first be applied.

2. Unless too large, the fomentation cloth is placed in a strong towel, the towel being folded around it so as to leave the ends free; the attendant then grasps the towel by the ends, dips the whole in the hot water until completely saturated and heated to the temperature of the water, then wrings it over the pail by twisting the ends of the towel and stretching lengthwise (Fig. 175). A convenient method is partially to unfold the cloth, dip one end into the water, and fold together again in such a way that the dry portion will be on the outside. Then, by wringing, the dry part will become saturated by the absorption of water from the wet portion. By using an extra large fomentation cloth, the central portion only may be wet, leaving the ends dry to be grasped by the hands for twisting and wringing (Fig. 176).

The intensity of the application and the length of time the fomentation will retain its heat will depend upon the amount of water left in the cloth, as well as the temperature of the water. When very hot water is used, the cloths must be wrung very dry, otherwise there will be danger of blistering the patient. Another precaution which it is well to observe is to place a dry flannel next the skin, so that the heat of the fomentation may reach the skin gradually. More water may be left in the fomentation and a higher temperature may be employed when the skin is thus protected. When so intense a heat is not needed, but rather a poultice effect is desired, very soft flannel may be used and a considerable amount of water should be left in the cloth, but for this effect the temperature should not be so high as to make the application painful at first contact.

3. Ordinarily, when a mass of flannel of considerable thickness is used, the fomentation will require renewal at the end of about five minutes. When very intense heat

is required, or a thin compress is used, the renewal must be made at more frequent intervals. In other cases, a sufficient amount of warmth may be retained to last for eight to ten minutes. If desirable or convenient, a rubber bag, a bottle filled with hot water, or some other heated object, may be applied between the moist cloth and the dry covering to maintain the heat.

When the fomentation cloth is removed for renewal, the dry wrappings should be quickly replaced and the cloth wrung out of hot water and replaced as quickly as possible, so that the surface will not become chilled by evaporation, and the effect of the fomentation be thus neutralized. An excellent plan, when continuous heat is required, is to have a second cloth wrung out and ready for instant application when renewal is necessary.

4. The duration of the fomentation must depend upon various conditions, most of all upon the patient's own sensations, especially when it is applied for the relief of pain.

The beneficial effects of the fomentation should be still apparent several hours after the application. If the symptoms return after having been relieved, the application may be renewed. Occasionally, continuous application for several hours is necessary, especially in cases in which acute pain is present. So long as the pain or other urgent symptom is relieved by the application, and returns when it is removed, the application may be continued. Every half hour, however, the hot compress should be replaced by a well-wrung cold wet towel for 1 or 2 minutes.

In concluding the treatment, a cold application should always be made. This usually consists of a towel wrung very dry out of cold water — the colder the water, the better. This should be applied quickly over the whole surface which has been reddened by the fomentation, and should be retained in place for 30 to 60 seconds. It should then be removed and the part rubbed slightly, and immediately covered with dry flannel. In cases in which pain is not pres-

ent, no harm could result from a more thorough cooling of the part, but it is only necessary to remove from the skin the heat which has been introduced by the fomentation. By this plan, circulatory reaction is produced and a thorough revulsive effect is secured, without producing thermic reaction, which is undesirable when either pain or acute inflammation is present. In the last class of cases it is often desirable to follow the fomentation by a cooling (**1318**) or heating (**1344**) compress, as in pneumonia, pleurisy, and erysipelas, and sometimes in acute arthritis.

Fomentations may be improvised in a great variety of ways, as the author has often had occasion to learn by personal experience. When stopping at a Western hotel some years ago, he was suddenly aroused in the middle of the night by a loud outcry, and being called to the bedside of the patient, found a young woman suffering from a distressing pain in the head. She was almost beside herself with pain, and writhed in agony as every fresh paroxysm came on. No hot water being obtainable without considerable delay, the following plan was adopted: A towel was folded and wet, then laid upon the bottom of a large dipper placed bottom upward. The inverted dipper was then held over a kerosene lamp, as close as possible to the top of the chimney without producing smoke. In two or three minutes the compress was steaming hot, and by the time the first one was cooled, another was ready for instant application. The patient experienced almost immediate relief, and in ten or fifteen minutes she was sleeping comfortably, and in the morning seemed in usual health.

In an emergency a flannel cloth or a cloth of any sort may be wrung out of cold water and wrapped around a stovepipe or laid upon the top of a stove, or held against its side for a few seconds until heated. To prevent soiling by contact with the stove, the cloth may be placed between the folds of a newspaper; the newspaper, being moistened, will not burn.

1329 **Physiological Effects.**—The fomentation is a powerful excitant measure, stimulating tissue activity, increasing metabolism or tissue change, quickening the circulation and general nutritive processes, and encouraging absorption and repair. The excitation of the sensory, vasomotor, and sympathetic nerves produces highly important functional effects.

Fomentations, like other forms of hot applications, have not only a primary or direct *excitant* effect, but also a secondary *sedative* effect.

When applied at a sufficiently high temperature, the fomentation produces a temporary blanching of the parts from the contraction of the small vessels, which is quickly followed by relaxation or paralysis of the constrictors. When long continued at a high temperature, the vasomotor paralysis produced and the turgidity of the cutaneous structures is very pronounced, and continues for a considerable time, as shown by the dusky redness. The dilatation of the surface vessels produced by the hot application is passive in character, while cold produces active dilatation. The relaxing effect seems to influence the veins somewhat more than the arteries, thus showing the blood stream, which, with the increased rate of hemoglobin reduction (Henocque), accounts for the dusky color produced.

When applied to a cutaneous area reflexly associated with some internal part, the vessels of the latter are through reflex influence relaxed simultaneously with those of the surface. When the fomentation is thus employed to concentrate blood in any internal part, its size should be limited to that of the reflexly associated area; otherwise the derivative effect of the application may counterbalance and nullify its reflex effect.

Very hot applications lessen the sensibility of the cutaneous nerves. When applied to a reflex area, an anodyne effect is produced in deeply seated, painful parts through the thermic nerves.

The parts brought under the influence of the high temperature are, for the time being, excited to increased action.

Very soon after the application is withdrawn, however, an atonic thermic reaction occurs, as the result of which all kinds of vital activity are lowered. An examination of the blood of the part to which the fomentation has been applied for a short time shows a notable diminution in the proportion of the hemoglobin and red cells and an increase of white cells to two or three times the normal. Hot applications encourage migration of the white cells and thus leucocytosis. The actual number of blood cells in the part is, however, greatly increased because of the increased volume.

When the blood-vessels of the skin over a deeply seated part are widely dilated and filled with blood as the result of a hot application, a collateral anemia exists in the vascularly associated areas; that is, deep parts supplied by the same arterial trunk.

The effect upon the deep structures underlying the surface to which the fomentation is applied, and supplied by the same artery, is exactly the opposite of that resulting from a cold application. The dilatation of the cutaneous vessels causes contraction of the vessels in the deeper structures. It is in this way that fomentations relieve pain when applied to the skin overlying a deep part which is the seat of an inflammatory process. This explanation also applies to applications to the abdominal surface for the relief of visceral inflammations, since there is a connection between the venous circulation of the abdomen and that of the cutaneous covering of the abdomen. This fact becomes very apparent in cases of hepatic cirrhosis, by the enormous enlargement of certain cutaneous veins (**1277–1279**).

Through this means, heat becomes a valuable antiphlogistic measure, notwithstanding the fact that inflammatory processes are attended by an increase of heat. It is more than probable that the increase of heat accompanying inflammatory action is not simply an incidental result from the morbid process present, but is one of the methods adopted

by nature for the cure of inflammatory processes or the mitigation of their evil effects. This may explain the wonderful benefit derived from the use of heat in a large number of local inflammatory processes. Recent experiments go to support the idea that elevation of the temperature of an inflamed part may sometimes serve as a valuable aid to the natural processes of defense, stimulating vital activity, and encouraging the development or the efficiency of those subtle elements by which nature renders the tissues inhospitable to the microscopic parasites upon which inflammation almost always depends.

The fomentation is one of the most efficient means of producing dilatation of the surface vessels of a circumscribed part, and thus producing local hyperemia and collateral anemia. Derivative effects are also produced by dilatation of the veins of the part to which the application is made, thus diverting the blood from the veins of some associated part. It is in this way that the portal circulation is relieved, when it is the seat of passive congestion, by large abdominal fomentations or a hot trunk pack.

1330 **Therapeutic Applications.**— Local revulsive, derivative, analgesic, and excitant effects follow the use of the fomentation. The fomentation is always indicated when it is necessary to reduce a swelling, stimulate the absorption of an effusion or an exudate, excite tissue change, increase local blood supply, promote leucocytosis, and awaken functional activity. For these purposes it is best used in alternation with the heating compress. Remote antiphlogistic and hemostatic effects are induced by derivative applications. The abdominal fomentation is indicated when the abdominal muscles are contracted. This remote effect is exceedingly valuable in cases of visceral congestion and inflammation; hence the efficacy of the fomentation in relieving both pain and congestion in *inflammation of the liver, acute* and *chronic gastritis, splenic congestion* and *enlargement, acute* and *chronic intestinal catarrh, peritonitis, ovaritis, metritis,* and *inflammatory*

affections of the muscles and nerves, in all of which cases the application is made directly over the affected part.

The most valuable therapeutic action of the fomentation, to which its remarkable pain-relieving properties are due, is based upon its power to produce prompt and most pronounced revulsion. There is no means by which such certain, immediate, and such intense and efficient, revulsive effects may be produced, as through the dilatation of the cutaneous vessels under the influence of moist heat.

The methods by which hot applications may be best employed for the relief of congestion and inflammation of the brain, the lungs, the liver, and other internal organs, have been pointed out in preceding paragraphs (**1260–1292**).

In case of *acute inflammation* involving the surface structures, the fomentation may be usefully employed for a short period (5 or 10 min.) at intervals of two or three hours, cool applications being employed in the interim. By this means the analgesic and sedative effects of the hot applications are obtained.

Hot applications are perhaps most frequently employed **1331**
for their analgesic, or pain-relieving, effects, for which they certainly afford a most efficient resource. The analgesic effects of heat are obtained chiefly through its revulsive effects, which have been previously explained (**667–678**). For the best results, the application must be made at a very high temperature, the compress being hot enough to cause slight pain when first brought in contact with the skin. Its actual temperature should be from 140° to 160°. There will be little or no danger of burning the patient, provided the compress has been wrung as dry as possible, and the skin has been carefully covered with vaseline, and protected by a single thickness of flannel. When these precautions are observed, the hot water does not come in actual contact with the skin, but only the highly heated air or vapor, the fomentation thus becoming really a local vapor bath.

As an analgesic, the fomentation generally gives magic

relief. The fomentation may be applied in nearly all conditions in which pain is present, whether of functional or organic origin. Its powerful derivative effects often afford temporary relief even in maladies which are incurable. There is no more effective means than the fomentation for the relief of pain from *strain* or *sprain* of joints and muscles, and other injuries in which the skin is unbroken. It may also render very valuable service in the relief of pain and relaxation of tense tissues in cases of *dislocation* and *fracture* of *bones*, thereby greatly facilitating the adjustment of the displaced parts. The author has made it a practice for more than twenty years to administer a fomentation just before applying the dressing in a fresh fracture, unless the patient presented himself immediately after the injury. The effect is greatly to mitigate the patient's suffering, as well as to prevent subsequent swelling, and thus facilitate healing. The fomentation should be applied after the bones have been restored to position; or if the parts are so swollen and sensitive as to make it difficult to manipulate them, fomentations may be applied for 20 to 30 minutes before any attempt is made to readjust the bones to their normal position. Heat relaxes, or rather causes expansion of, the white fibrous tissue of the joint ligaments. By the use of the fomentation in this manner, the administration of an anesthetic may often be avoided.

For the relief of *chronic pains*, the pain from *gall-stones*, *renal calculi*, *hepatic pain*, *infectious jaundice*, and for *neuralgias* and other painful affections of the joints, the fomentation is of immense service, if applied thoroughly. In the painful conditions often present in *hyperpepsia*, a fomentation applied half an hour after meals, or when the pain begins, affords great relief. The applications should be very hot, but not very long continued, as continuous heat over the abdomen after meals is an exciting measure.

1332 A very short fomentation over the heart is useful in *collapse* under *anesthesia*, in *opium poisoning*, and in cases of heart failure due to other causes. The application should be

followed by a cold compress or an ice-bag, which should be left in place for half an hour, when the hot application may be renewed for a few minutes if necessary.

For diseases of the *eyeball*, very hot applications to the eye, avoiding the cheek, but extending over the brow, afford great relief, and greatly facilitate recovery (**1264**).

The fomentation may be applied to the whole head for the relief of *headache* due to *anemia* of the brain, a condition generally found present in neurasthenia, and indicated by a sense of weight or pressure, while the face is pale and the pulse feeble.

The pain of *toothache*, *migraine*, and *earache* is greatly mitigated, if not wholly relieved, by fomentations. Care must be taken to confine the application to the face. If the hot compress extends to the neck below the jaw, the congestion will be increased by dilating the common carotid. It is for this reason that cold applications often relieve a painful affection of the jaw more readily than heat, by causing reflex contraction of the deeper vessels. In such a case still better effects will be obtained by applying the ice-bag or cold compress lower down or below the jaw, so as to contract the large vessels of the neck simultaneously with the fomentation to the face or the side of the head. The very best effects are obtainable by revulsive applications (**673, 1041, 1341**).

In cases of *hyperesthesia* of the solar plexus and the umbilical ganglia of the abdominal sympathetic, the fomentation not only relieves the local distress, but also a great number of reflex symptoms which have their origin in sympathetic nerve disorders, such as *cold hands* and *feet*, *giddiness*, *pain* in the loins, between the *shoulder-blades*, in the *back*, of the *neck*, and various other *reflex neuralgias*, *paresthesias*, and *vasomotor disturbances*.

Farquharson recommends fomentations to the anal region in *incontinence* of urine when of spinal origin, and especially when due to a sort of chorea of the lumbar cord.

Fomentations to the throat are of great value in *inflammatory affections* of the *larynx*, *fauces*, and *tonsils*, through the strong revulsion which they produce, diverting the blood away from the internal parts to the skin. The application should be continued for 15 to 20 minutes; then the cooling compress (**1318**) should be applied for an hour or two, when the fomentation should be renewed. Hot compresses are applicable in *croup*, both true and false, but especially in false croup, in which they always afford relief. In *true croup*, it aids, to some degree at least, in the loosening of the obstructing membrane; and in *false croup*, the fomentation causes relaxation of the contracted air passages by relieving the irritation which gives rise to the disease. After the fomentation, the heating compress should be applied.

The fomentation is exceedingly useful in combination with cool or cold compresses in many cases, as for example, to the throat in *diphtheria* and *tonsillitis*, and to the chest in *pneumonia* and *pleurisy*. The application should be applied for 5 to 10 minutes at a temperature as high as can be borne.

In *ulcerations* and *inflammations* of the *cornea*, in *pannus*, *iritis*, and in affections of the deeper parts of the eyeball, hot applications render great service. The application should not be continued for more than 15 to 20 minutes at a time, however, and should be followed by very short cold applications lasting for 10 to 15 seconds, after which the parts should be covered with warm cotton or flannel to prevent cooling by evaporation, or a neutral compress (96° to 98°) may be applied. The neutral compress must be changed every 10 to 15 minutes to prevent elevation of temperature through accumulation of heat, whereby the stimulating effects of the poultice will be produced; it should also be covered with dry flannel or oil-cloth to prevent cooling by evaporation. The compresses should be applied over the eye and the forehead just above, rather than to the cheek.

Fomentations to the *spine* may be applied in fever as a means of stimulating the spinal centers, especially the sweat

centers, and warming the surface, thus increasing heat elimination.

Fomentations over the *abdomen* relieve the *painful tympanitis* of typhoid fever; and in peritonitis and inflammatory processes of the *pelvis* they not only relieve the pain, but lessen the inflammatory process by bringing the blood to the surface, and contracting the distended vessels of the affected internal part. The atonic reaction which follows hot applications also aids in combating the inflammation.

In the case of *pelvic* and *abdominal inflammations*, a hot hip pack or hot trunk pack is, however, generally much more serviceable than the simple application of a fomentation, since a larger surface is rendered hyperemic, thus diverting more blood from the abdominal or pelvic viscera.

In all forms of *gastric pain* the fomentation is an invaluable remedy. It must cover the area from the fourth rib to the umbilicus, and between the two axillary lines.

The cold compress to the epigastrium in combination with the dorsal fomentation produces most happy effects, acting reflexly to contract the gastric vessels while the fomentation drains them by dilating the intercostal veins (**1362**).

In the early stages of *erysipelas*, and also of *meningitis* of the brain and cord, the fomentation is of great service. It relieves pain in both classes of cases. In *meningitis* it likewise acts as a derivative and an antiphlogistic through the atonic reaction induced. The application of heat should not be continued more than 3 to 5 minutes, and should be followed by a continuous cold application.

Very hot applications (135° to 160°) are exceedingly serv- **1333**
iceable in cases of swollen internal *hemorrhoids* or prolapsed rectum, with large external hemorrhoids. The water should be applied as hot as can possibly be borne, by means of a soft cheese-cloth or sponge. The application should be continued for 15 or 20 minutes, when the hemorrhoids, if internal, should be gently pressed up into the bowel, to avoid strangulation by contraction of the sphincter muscle, and a cold compress

should be applied. If the bowel, or hemorrhoids, can not be reduced, the hot applications should be renewed for 10 to 15 minutes every hour, the cold compress being continued during the intervals.

The fomentation should be employed on the same plan in *orchitis*, *acute inflammation* or *congestion* of the *ovaries*, *uterus*, and *kidneys*, and in *prostatitis*, *proctitis*, and *vaginitis* when accompanied by much pain. In *inflammation* of the *bladder* the cold compress must be omitted, the parts being simply kept warm.

The hot fomentation to the perineum is indicated in *inflammation* of the *prostate*.

Hot applications over the hypogastrium, thighs, and the vulva and perineum are likewise indicated in *inflammations* and other painful affections of the *uterus* and *ovaries*.

Intercostal neuralgia, *pleurodynia*, *lumbago*, *sciatica*, and other pains of similar character may generally be made to vanish as if by magic under the potent influence of the fomentation vigorously applied. *Hemicrania*, being an acute toxemia, in most cases, at least, is more obstinate, but is often greatly relieved.

In *neuralgia* and *acute articular rheumatism*, in which the application of cold as a finishing measure may cause a return of the pain, the parts may be allowed to cool gradually, by leaving the last fomentation cloth in place for 15 or 20 minutes, or until it has become nearly of the temperature of the skin. It should then be removed, the part dried and gently rubbed, then covered with a warm dry soft flannel folded to several thicknesses.

The accompanying cuts (Figs. 149, 150) show at a glance the areas over which hot applications should be made for relief of the most common localized painful affections and for combating congestions in the internal viscera by means of derivative measures. Further details respecting the methods of controlling the visceral circulations have been given elsewhere (**1260–1291**).

In *pneumonia*, *pleurisy*, and *acute bronchitis*, the fomentation is an invaluable remedy. In the acute stage of the disease, fomentations should be employed only for short periods, the cool compress or the ice-bag being applied in the interval, changing every 20 minutes for the fomentation.

In pneumonia, cold or cool compresses should be applied immediately after the removal of the fomentation, which should be renewed at intervals of one, two, or three hours.

In *pulmonary congestion* from any cause, fomentations to the chest often render important service, relieving pain and diverting the blood from internal to external parts, thus lessening the congestion of the diseased lung. In making the application, the region of the heart should be avoided if possible. The application should be made to the whole chest or to the back and sides especially **(1270)**.

A fomentation to the back of the chest accompanied by a cold compress to the front (the hot and cold compress **(1356)**, is perhaps the best of all means of combating passive pulmonary congestion. By means of the fomentation the bronchial vessels are drained into the skin, while the cold compress stimulates contraction of these vessels by reflex action.

In cases of *hemorrhage* of the *lungs* a very hot fomentation may be applied to the upper part of the spine and back of the neck in connection with the cold chest compress. The application should be very short (3 to 5 min.), and should be repeated every 15 minutes.

In the application of heat for derivative effects upon a lung, an ovary, or other viscus, the temperature should be high enough to cause a painful sensation of excessive heat, or as high as possible without actually injuring the skin. Thus the reflex effect of sharp irritation of the cutaneous nerves will be obtained, with contraction of the vessels of the part which it is designed to influence, and the collateral anemia which it is desirable to establish by diversion of blood to the skin, will be aided by excitation of the vasomotor centers.

Very hot fomentations should be applied in the early stage of *boils*, not only for the relief of pain, but to stimulate the vital activities whereby the disease may be aborted. Fomentations promote suppuration in fully developed boils, or "bring them to a head," as the laity say, but it is exceedingly questionable whether under any circumstances the suppurating process should be encouraged. If pus is present, it should be reached as quickly as possible by means of the surgeon's knife, and antiseptic treatment should be applied at once. Fomentations are, however, exceedingly valuable in these cases, notwithstanding the wrong theory of their use; for if applied early enough, suppuration may be averted by the stimulation of the vital activities of the tissues, and the increased fluxion of healthy blood through the infected parts. During the painful stage, when pus is forming, very short hot applications afford relief by producing strong revulsion, distributing the blood to surrounding parts. The common practice of applying hot poultices to boils is uncleanly and inconvenient, and has no advantages over moist heat derived from fomentations with soft and easily moistened fabrics, as the hot cotton poultice.

The moist heat of a fomentation, properly managed, affords more relief than any other measure in cases of *rheumatic pains* in either muscles or joints. The fomentation should be applied all about the joint, and should also cover the limb for several inches above and below the joint, if possible. These applications may all be made several times daily. During the day it is best to follow the fomentations with dry coverings to protect the joints, and at evening the application, made just before the patient retires for the night, may be followed advantageously by the heating compress. The latter should be made of soft, very thin material,— four to six thicknesses of cheese-cloth, — and covered with oiled muslin or some other water-proof material, then with a thick layer of wool or cotton, and several layers of woolen bandage outside of all.

Very hot applications made to the upper part of the neck

or back of the head, also the top of the head and the face, constitute one of the most efficient means of relieving *cerebral congestion*. This measure is especially useful in that form of congestion or hyperemia of the brain due to overwork. *The temperature should be 135° to 140°, or high enough to induce slight pain at the beginning of the application. A lower temperature than this has the effect to produce slight congestion in a normal brain, or to increase the congestion when the blood-vessels are overdistended.* The compresses should be light, and should be renewed every two or three minutes. Two compresses are required for applications of this sort, so that when one is removed, a freshly heated one may be applied instantly, allowing no time between for cooling of the surface by evaporation. The sensation of weight and pressure at the back of the head, of which anemic neurasthenics often complain, and which commonly results from excessive mental work, loss of sleep, and other exhausting influences, generally yields promptly to these applications.

Light, very hot fomentations are exceedingly useful in nearly all forms of nervous headache, whether occipital or frontal. The compresses should not be large or heavy, and should be frequently changed.

In cases of low-pressure headache (anemia of the brain) relief is best obtained by the heating compress to the head and by moderately warm applications around the neck, whereby the blood supply of the brain is increased.

In cases of great *loss of blood*, fatal syncope may be prevented by making moderately hot applications to the head, and so encouraging the circulation of blood in the brain. The application should be made especially to the neck and the top of the head. Hot applications made to the face alone, or to the sides of the head or the occiput, might temporarily decrease the volume of blood in the brain. Very hot applications may also momentarily increase the anemia.

For *indigestion*, *colic*, *suppression of urine*, *constipation* accompanied by abdominal pain and tenderness, *torpid liver*,

and *dysmenorrhea*, the very hot fomentation is a remedy of great value, and may be used with brilliant results. The efficiency of this measure in relieving *sick-headache* is unrivaled, the applications being made to the spine, head, neck, or stomach.

When employed to relieve suppression of the urine from *congestion* of the *kidneys* or in *acute nephritis*, the fomentation should cover the whole central and lower part of the back, extending well around to the sides. The application should be as hot as the patient can bear, for 10 minutes, and should then be followed by cold friction for 1 minute, the parts being afterward well protected by dry flannel. The procedure may be repeated every 30 minutes. If the patient has good power to react, the heating compress may be applied instead of cold friction, and may be left in place until the following application of heat.

In *hysteria*, very hot fomentations may with great advantage be applied over the hysterogenous zones when pain is present.

Dr. Noir, a French physician, a few years ago pointed out the fact that very hot applications are of great value in the treatment of *herpes circinatus*, the applications being made daily, at a temperature of 122°. When the disease affects the scalp, bichloride of mercury should be added to the water employed for the fomentation, in the proportion of one part to two thousand. It is well in some cases of this kind to make the bichloride application continuous by means of layers of gauze saturated with the solution and covered with oiled muslin.

Very hot water (140° F.) is wonderfully successful in the treatment of *acne* of the *face*. For many years the author has made use of hot applications to the face in the form of the hot spray or small hot fomentations, or hot water applied by means of a soft sponge, in cases of this sort. The temperature required is about 140°. The greatest inconvenience in the use of this remedy for acne is the fact that the effect

of the hot water can not be confined to the diseased parts. In order to avoid this objection, the author has had made a simple device for applying moist heat to acne, which he finds very convenient. It consists simply of a conical, hollow copper cone (Fig. 177), furnished with a handle. The cylinder is closed with a small cork, and the point covered with a small mass of moist cotton. Being filled with boiling water, and the cork placed so as to prevent spilling, it is ready for use. The cotton-covered tip is moistened, then applied to each pimple or blotch, and held there for one or two seconds, or as long as the heat can be endured. By this simple device, the applications can be made in rapid succession, and to the diseased structures alone. The application should be renewed at least twice a day, each pimple being touched from four to six times at each sitting.

Fomentations have been successfully used for the relief of *irreducible hernia.*

The fomentation to the spine or abdomen may be used as a heating measure preparatory to a general cold procedure. Used in connection with cold wet friction, it aids in lowering the temperature in febrile conditions accompanied by diminished heat elimination.

It is impossible to enumerate all the morbid conditions in which the fomentation is found useful. We might mention, further, the following: *Hysteria, hysterical anorexia, leptomeningitis, spinal irritation, acute chorea, chorea major, general tic, paralysis agitans, tetany, occupation neuroses, angioneurotic edema, scleroderma, muscular contraction, alcoholism, delirium tremens, morphinism, cocainism, lead poisoning, heat stroke, dermalgia;* over the liver and spleen in *malarial fever;* as a means of relieving *abdominal pain* occurring during *gestation;* as an application to the abdominal surface in *parturition;* as a *spinal, cardiac,* or *cephalic application* in *collapse* or *shock;* in *retinitis, keratitis, chronic granular conjunctivitis, typhus, typhoid fever, the plague, smallpox, scarlet fever, influenza, chronic dysentery,*

miliary fever, febricula, locomotor ataxia, diabetes, chronic gastritis, tuberculosis of the *lymph glands, Weil's disease, lithemia, increased peristalsis, gastric ulcer, cholera morbus, cholera infantum, Asiatic cholera, appendicitis, torticollis, ascending paralysis, Bell's palsy, Meniere's disease, paralysis* of the *circumflex nerve, myelitis, anterior poliomyelitis.*

The thorough application of the fomentation two or three times a day for a week or two preceding an abdominal operation, in cases in which chronic or subacute peritonitis is present, aids much in preparing the patient for safe transit through the perils of the operation. The operation should not be delayed, however, when urgently indicated.

The hot compress has many uses in connection with other procedures, particularly the cold compress in producing analgesic, revulsive, and derivative effects.

1334 **Contraindications and Precautions.**—1. The fomentation has been greatly abused. When this procedure gives rise to profuse and weakening general perspiration, it should be discontinued, and hot sponging substituted. The temperature of the water in hot sponging may be some degrees higher than that used for the fomentation, for the reason that a smaller area of the skin is involved in the treatment at a given moment.

2. It is generally wise to follow the fomentation by a very brief application (4 to 30 sec.) of cold by means of a compress wrung very dry out of cold water.

3. Great care must be exercised in the use of the fomentation to avoid damage to the skin in cases of paralysis or diminished sensibility.

4. When used for the relief of neuralgic pain, as sciatica, toothache, and nervous headache, and also when employed for the purpose of producing remote vasomotor effects, as for the relief of congestion of the liver, in hyperesthesia of the lumbar ganglia of the abdominal sympathetic, in cases of chronic gastritis, pelvic inflammation, and in similar conditions, the heat of the fomentation should be as great as can

be borne without injury to the skin, and sufficient to produce slight pain when the application is first made.

5. As the fomentation usually produces more or less perspiration, care should be taken to protect the patient after the removal of the fomentation, and in most cases a tepid or cool shower, towel, or sponge bath is advisable. When for any reason a cold application can not be made, the patient should be wiped dry with a soft towel, and covered sufficiently to prevent chilling; but the covering should not be so warm as to induce continued perspiration.

6. In cases in which the fomentation is applied for the relief of an acute inflammatory condition in which the part affected is so situated that the application comes in immediate contact with it, it must be very brief (not more than 5 to 10 minutes) repeated at intervals of two or three hours, cold compresses being applied during the interval. In case the inflammatory affection is situated in an internal viscus, the application may be continued for half an hour, or even for a longer period, provided there is not at the same time a considerable general elevation of temperature. The reason for this will be apparent when it is considered that heat is directly stimulating; and while heat may be briefly applied directly to the inflamed parts, as a means of relieving pain, a long-continued application might result in stimulating the inflammatory process. When the inflamed part is more deep-seated, however, the heat of the fomentation does not reach the diseased part, but its blood-vessels are made to contract through the influence of the heat upon the vasomotor nerves, and through the induced collateral hyperemia.

7. In some painful affections, especially when the skin is in a state of hyperesthesia, the application of intense heat aggravates the pain as well as other symptoms. In such cases more moderate heat — neutral or even cold or heating compresses — should be employed.

8. It should be remembered that if a fomentation is left in contact with the part long enough to allow the temperature

to fall very considerably, an effect the very opposite from that desired may be induced.

9. Vaseline should be freely applied to the skin before the fomentation, when the latter is employed daily.

10. The fomentation must be avoided, or, if employed at all, only with great care and for short periods (5 to 10 minutes), when the abdominal walls are relaxed and the intestines distended with gas, since the natural effect of heat is to increase these conditions.

THE HOT-WATER BAG (Fig. 178).

335 Heat, either with or without accompanying moisture, may be applied by a variety of other methods, as by means of a rubber bag filled with hot water. The exact effect of the fomentation may be secured by wrapping a hot bag with a moist flannel cloth. Hot bricks, bottles filled with hot water, and other heated objects may be used in a similar manner when it is desirable to employ heat for a considerable time.

Dr. Chapman recommended the use of a hot bag to the spine, the effect being, he claimed, to stimulate the sympathetic nerve centers, and thus diminish the size of the small vessels throughout the body. He insisted that the temperature of the application to the spine should not be higher than 120°. I have for twenty years made use of the spinal hot bag, and had constructed for the purpose a rubber bag somewhat broader and longer than that of Chapman. The application is made not to the spine, but to the back, and hence should cover a sufficiently broad area to bring under the influence of heat a considerable portion of the cutaneous branches of the posterior spinal nerves. The results to be obtained are due, not to the action of heat upon the nerve centers, but to reflex and fluxion effects.

THE SYPHON HOT-WATER BAG.

336 The syphon bag (Fig. 179) devised by the author some twenty-two years ago is a convenient method for applying

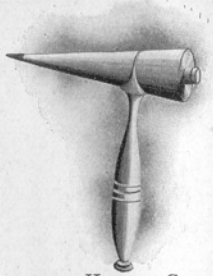


FIG. 177. HOLLOW CONE FOR ACNE (p. 809).

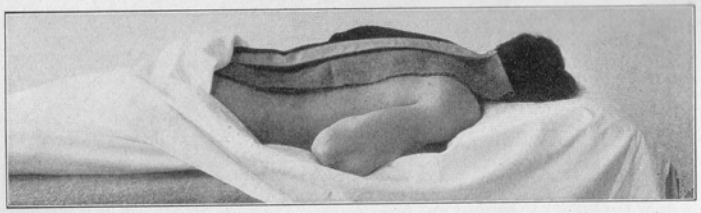


FIG. 178. HOT-WATER BAG (p. 812).

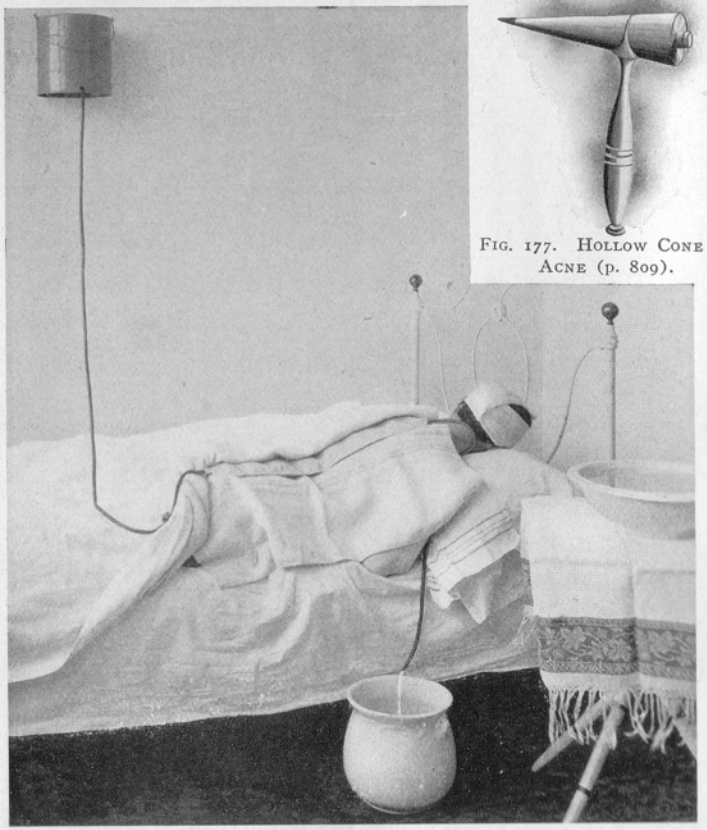


FIG. 179. APPLICATION OF SIPHON BAG TO SPINE (p. 812).

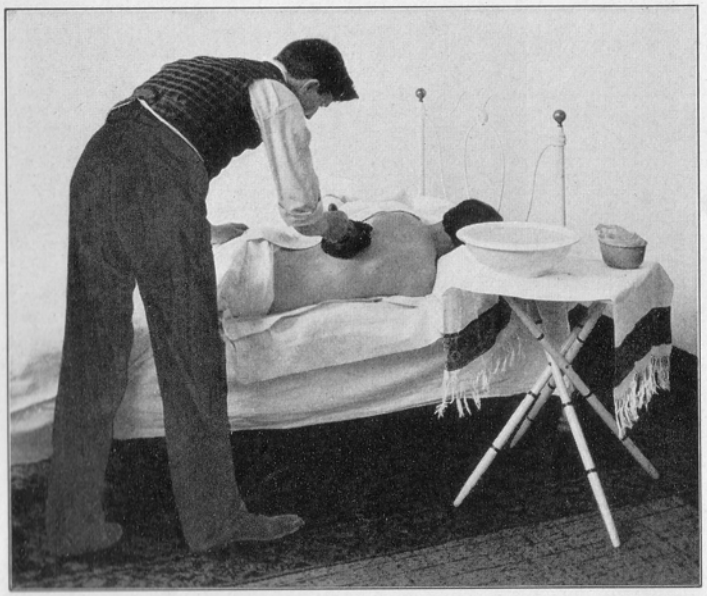


FIG. 180. (*a*) ALTERNATE APPLICATIONS TO SPINE (p. 822).

either heat or cold continuously. It is used in precisely the same manner as the cooling or heating coil (**1323**). The device consists of a bag, the sides of which are connected to prevent excessive bulging, and with an opening at either end. A tube connected with one end of the bag communicates with a fountain, either in the ordinary manner or on the syphon principle. Another tube connects the opposite end of the bag with a receptacle at the bedside. The flow of water is easily regulated by means of a proper stopcock, or simply by tying a string about the outlet tube. By means of a series of bags properly constructed for fitting different parts of the body, either heat or cold may be continuously applied in a most effective manner, and the temperature may be perfectly regulated. The author has had prepared bags of different shapes, which are adapted to use for different parts of the body. He prefers the bag to the coil for the reason that the amount of non-conducting material between the water and the patient is less. The bag also fits the surface more smoothly and completely than does the coil, and is more uniformly heated.

THE THERMOPHORE.

1337 This is a rubber bag containing a quantity of a chemical compound which acquires the property, after being heated for a definite time, of giving off heat at quite a uniform rate for several hours,—from two or three to ten hours, according to the conditions. Wrapped with a moist flannel, the thermophore makes an excellent continuous fomentation. Without the moist covering, it constitutes a most convenient and serviceable means of applying dry heat for any desired therapeutic purpose. In preparation for use the bag is immersed in boiling water for some minutes, until the contents are liquefied.

The thermophore is especially indicated in cases in which continuous and long-continued heat is necessary.

THE MUSTARD FOMENTATION.

338 This measure consists of an ordinary fomentation in which mustard is added to the water employed in the proportion of a tablespoonful of ground mustard to the quart of water. It is not necessary to prepare a large quantity of water. One quart of boiling water into which a tablespoonful of mustard has been thoroughly stirred, and steeped for a few minutes, should be poured upon the fomentation cloths placed in a basin or pail.

The effect is that of the fomentation intensified by the addition of the chemical irritation of the mustard.

The mustard fomentation is especially applicable to cases in which a very quick and strong revulsive effect is desired, as for the relief of severe pain, or to secure strong derivative effects. Care must, however, be taken to avoid excessive irritation or blistering of the skin.

THE NEUTRAL COMPRESS.

339 This is a compress at 92° to 97°, its temperature being so nearly that of the skin that neither thermic nor circulatory reaction is produced. Its effects are simply those of a poultice. The sensibility of the cutaneous nerves is lessened by the imbibition of moisture, as in the neutral bath. The surface covered by the compress is protected from external irritants of all sorts. A quieting effect is thus exerted upon that portion of the interior of the body which is in reflex relation with the cutaneous surface treated.

Therapeutic Applications.— The neutral compress is by no means so useful as the cool or the cold compress, but nevertheless renders extremely valuable service in special cases. It is useful as an application to the spine in *locomotor ataxia*, especially as a means of relieving *lightning pains*. When applied to the spine for this purpose, it should cover the whole lower half of the back. It may be usefully applied over the abdomen in cases of *hyperesthesia* of the skin due to an irritable condition of the abdominal sympathetic centers. It may

replace the poultice in all cases in which this old-fashioned measure might be profitably employed. It should be remarked, however, that the use of a poultice or any substitute for it as a means of encouraging suppuration is not in harmony with the principles of modern rational medicine. The retention of the body heat encourages the growth of the pathogenic microbes, causing the diseases together with the toxins.

The neutral compress may be usefully employed as a soothing application for *painful wounds*, and in *dermatitis*, when the acute stage of the inflammatory process is past. The addition of an antiseptic of some sort in very small proportions is often useful in preventing the development of micro-organisms, which is favored by the compress.

The heating compress applied after a fomentation is useful in relieving the excrutiating articular pain of *acute rheumatism*. As the compress is rather lightly covered, and with flannel only, the neutral rather than the stimulating effect is obtained. The same measure renders valuable service in cases of *sprain*, joint injury from *dislocation*, *chronic inflammation* of the joints, and even in cases of *tuberculosis* of the joint.

The neutral compress sometimes proves more serviceable in relieving the pain of *neuralgia* in certain cases than either hot or cold applications. The temperature should be about 95°, or as near that of the body as possible. It operates simply by excluding irritation, preventing contact with the air, and filling the tissues with water, whereby the nervous sensibility is diminished. It is especially indicated in cases of neuralgia affecting nerves very near the surface, as in *dermalgia* and the neuralgia following *herpes zoster*. It sometimes proves successful also in most obstinate cases of hyperesthesia of the skin in which other measures have failed.

The heating chest pack and the moist abdominal girdle, also the general pack, owe certain of their effects to the properties which are characteristic of them in common with the neutral pack. It is largely through its nerve-quieting

influence as a general neutral compress that the wet-sheet pack renders such signal aid in combating insomnia. The author could easily cite many scores of cases of insomnia which have been promptly relieved by this simple means. The neutral abdominal compress acts with equal efficiency in relieving hyperesthesia of the "abdominal brain," the solar plexus, and the lumbar ganglia of the sympathetic.

THE ALTERNATE COMPRESS.

1340 This measure consists in the application of very hot and very cold compresses in alternation.

Method.—The procedure is simply a succession of compresses renewed every half minute, — every other compress consisting of a fomentation, and the alternate a compress wrung quite dry out of cold or very cold water. The duration of each application respectively may be timed so as to meet any special condition. For example, the hot compress may be given a duration twice that of the cold compress, or the reverse. As a rule, the duration of the hot application should be equal to or greater than that of the cold. The procedure must always begin with a hot application and end with a cold one.

Physiological Effects.—The effects of alternate or successive applications of heat and cold to some extent combine the effects of both the cold and the hot compress. The sedative effects of both applications are, however, absent, as only the first effects are developed. The general effect of the application is exciting or stimulating. The hot application, with which the procedure begins, widely dilates the cutaneous vessels, and especially the veins. The cold application causes, first, contraction, then with the reaction which immediately follows, active dilatation of all the vessels of the skin, with an increased movement of the blood. When the hot and cold applications are of equal length, or when the cold application exceeds the hot in intensity, a decided thermic reaction occurs, with marked stimulation of the metabolic

processes. The application is thus both revulsive and exciting to a high degree.

The internal vascular spasm occasioned in reflexly related internal organs by the cold application is quickly terminated by the hot application which follows in alternation at regular intervals during this procedure. After the ordinary cold compress the internal vascular contraction gradually disappears as the skin returns to its natural temperature; but when the skin is suddenly heated by the fomentation, the irritating effects of the cold application are abolished at once, and the blood-vessels of the part are dilated, thus encouraging the general movement of blood.

There is probably no other procedure which is capable of so intensely and rapidly exciting the movement of the blood in superficial parts and in deeper parts associated with them, either in sharing the blood supply, as in the case of an underlying muscle, or through reflex nerve connections (**1259**), as when applied to a cutaneous area having vasomotor relations with the liver or some other viscus.

Therapeutic Applications.—The alternate compress may be advantageously employed to combat the tendency to suppuration in cases of *localized suppuration* when beginning blueness of the parts shows stasis of the blood and the establishment of a condition of the circulation favorable to the suppurative process. By these alternate applications better effects may be obtained than from the application of either heat or cold alone. Continuous cold lowers the vitality of a part, and thus lessens the ability of the tissues to combat the microbes present, and lessens the supply of oxygen, by slowing the movement of the blood. Hot applications excite the the tissues to increased activity which is increased by the thermic reaction following the short cold application. Heat applied to the skin widens the surface vessels, and narrows the vessels of the deeper structures; while cold produces the very opposite effect. Thus by the alternate application of heat and cold the vessels of the deeper parts, in which sup-

puration is threatened, may be kept in such constant movement, contracting and dilating, that the cell-paralyzing ptomains will be washed out, the stagnant blood will be moved on, and a new supply of fresh, active leucocytes will be brought into the part. This effect of the alternate procedure in some cases renders it superior as an analgesic measure to either the cold or the hot compress alone, through the relief of *venous stasis*.

The alternate compress is superior to most other measures for combating the tendency to *bed-sores*, which are so likely to appear in typhoid fever, tuberculosis, and other wasting disorders. The alternate compress may be usefully employed as an application to *paralyzed limbs*, and to parts affected by *chilblains*, also as a means of stimulating absorption in *dropsy* of the abdomen, dropsy of the chest, and in *chronic pleurisy* and *pneumonia*, in which the parts damaged by the acute inflammatory process have not been wholly restored. Alternate hot and cold applications made to the spine powerfully impress the whole central nervous system, and form a most effective means of arousing a patient from the lethargy of *opium poisoning*, profound *alcohol intoxication*, or poisoning by any other narcotic drug. The author recalls very vividly a case of opium poisoning to which he was called in consultation some twenty-five years ago, in which a patient's pulse was reduced to less than twenty, and respiration to four per minute. Thoroughgoing hot and cold applications to the spine quickly brought the pulse to a nearly normal count, the respiration became twelve per minute within five minutes, and the change in the entire aspect of the case was so marvelous as to seem little short of a miracle to the by-standers, who had never before witnessed the powerful stimulating effects of thermic applications properly managed.

THE REVULSIVE COMPRESS.

1341 The revulsive compress differs from the alternating compress in its mode of application only in the different timing of

the heat and cold. In the alternating compress the applications are of equal time, or at least the hot application does not exceed the cold. In the revulsive compress the hot application is applied for several minutes, while the time of the cold application is only a few seconds. Usually the hot application, or fomentation, remains in place for 4 or 5 minutes, or at least until its maximum heating effect is reached. It is then withdrawn, and a cold compress is instantly applied and allowed to remain in place for 20 to 40 seconds, or just a sufficient length of time to absorb from the skin the heat communicated to it by the fomentation.

Physiological Effects.— The purpose of this mode of procedure is to secure a strong circulatory reaction without thermic reaction. The vascular dilatation resulting from heat is transient in character. Within a short time after the heat is withdrawn and the skin exposed to the air, the blood-vessels are made to contract by the cooling resulting from the evaporation and contact with the air at the ordinary atmospheric temperature. The circulatory reaction following a cold application is, however, much more lasting in character, and is also more thoroughgoing, since it is an active rather than simply a passive or paralytic dilatation of the blood-vessels, and influences the arteries to fully as great an extent as the veins. By a short cold application following a hot application, the atonic reaction is converted into the tonic reaction of cold, the state of the blood-vessels being thus very materially changed, and active fluxion of the blood in the skin is thereby maintained for a considerable length of time (**667**).

The alternate compress produces both circulatory and thermic reaction. In the revulsive compress the procedure is so managed that the thermic reaction is wholly suppressed. This gives to it superior power as an analgesic measure, in which respect it is, in fact, superior to all other hydriatic processes. This end is attained by superheating the skin before the cold application, then making a cold application of just sufficient intensity and duration to absorb the surplus

heat without reducing the skin temperature below the normal point. Under these conditions, thermic reaction can not possibly occur; hence metabolic activity is not increased, neither do systemic or local disturbances occur, and a purely revulsive, non-excitant, and analgesic effect is obtained.

Therapeutic Applications.— The revulsive compress is especially applicable to all forms of *neuralgia* and painful affections of every description. In some cases relief may best be obtained by very hot applications, in others by cold applications, and in still others by alternate applications; but in quite a large proportion of cases in which pain is present, applications of a character which produce thermic reaction increase the pain by exciting the affected nerves. This is especially true of cases in which inflammation is present. For this class of cases the revulsive compress is indispensable.

This compress is also a powerful decongestant and derivative. It is of value in cases of *visceral congestion*, especially in such painful conditions as *gastric congestion*, *gastritis*, *enteralgia*, *acute sciatica*, *neuritis*, *painful affections* of the *eye*, and *spinal irritation*. It often affords immediate relief from the excruciating pain of *toothache*. It is applicable also in cases of *gastric crises*, and other painful conditions accompanying *locomotor ataxia*.

ALTERNATE APPLICATIONS TO THE SPINE.

1342 The importance of this special procedure will amply justify its separate consideration as a special measure for securing other than purely local results. In addition to hot, cold, and neutral applications, there may be made to the spine a number of alternate applications in the form of either the Scotch douche, the alternate douche, or the revulsive douche, all of which are useful under special circumstances. There are other non-percutient applications capable of producing similar effects, which may also be employed.

Alternate applications so managed as to produce the effects of the Scotch, the revulsive, or the alternate douche,

minus the percutient or mechanical effects, may be conveniently made by the use of two bags, one filled with very hot water, the other with cold water; by the fomentation and the cold or ice compress in alternation; by alternate hot and cold sponging; and by the hot and cold pour. The method of applying these several measures to the spine is not different from that pursued with other regions of the body, but may be briefly described by way of general illustration. The hot and cold water bags, hot and cold compresses, hot and cold sponging, are all best applied with the patient lying down upon the face, or upon the side and inclined toward the face. The hot and cold pour must be applied with the patient sitting upon a stool, leaning slightly forward, with the arms folded in front. The hot and cold water bags are the most convenient means for prolonged applications. The hot and cold compress, or the fomentation followed by the cold compress, or rubbing the spine with a piece of ice covered with two or three thicknesses of cheese-cloth, are more vigorous measures which may be employed when it is desired to secure results by a short intense application.

Alternate sponging is a less vigorous application than the alternate compress, and is most frequently employed when calmative effects are desired, through the tonic influence of this application upon the spinal centers. The alternate pour may be used in cases in which the alternate douche is not readily available.

In the use of the hot and cold water bags, the hot bag may remain in position for 10 to 15 minutes, the cold bag 30 seconds to 2 minutes. In the employment of the alternate compress, the fomentation is first applied for 10 or 15 minutes, then a very cold compress for half a minute. A thin compress wrung very dry out of ice-water is best for the purpose when the object sought is the relief of the pain which accompanies so-called spinal irritation. If exciting effects are desired, the hot and cold applications should be of about equal length; viz., 15 to 20 seconds each.

Alternate sponging is a measure which may be continued for as long a time as is found agreeable to the patient, and may be repeated as often as indicated. The hot sponging is best done with a very soft sponge attached to a handle (Fig. 180). The sponge should be of good size, and great care should be taken to press out the hot water sufficiently to avoid risk of blistering the spine. A sponge wet in cold water may be used in alternation with the hot sponge, or a piece of ice wrapped in thin muslin, or a couple of thicknesses of cheese-cloth wet in cold water may be quickly rubbed up and down the spine for 3 to 10 seconds after the hot sponging has been continued for a few seconds.

In the employment of the hot and cold pour, care must be taken to adapt the application carefully to each individual case. A somewhat prolonged (5 to 8 min.) hot pour to the spine, followed by a cold pour for 15 to 20 seconds, is a most excellent means of relieving congestion of the cord. The pour may be very conveniently administered with the patient sitting over the edge of a full bath-tub, or upon a low stool in a bath-tub, the feet being placed in hot water for derivative effects, and to protect them from contact with the cold water. When exciting effects are desirable, the duration of the heat and the cold should be about 15 seconds each. Powerful exciting effects may be produced by this means.

Therapeutic Applications.— The alternate process is of great value in *neurasthenia;* especially in very feeble cases, a remarkable reviving effect is at once experienced by the patient during the application, and for some time afterward.

Alternate compresses or sponging to the spine afford one of the most efficient means of arousing the patient from *opium* or *alcohol narcosis*. It is equally indicated in *Prussic acid poisoning*, and in cases in which there is a depressed condition of the *spinal* centers, as in *syncope*, *asphyxia* from coal-gas or carbonic acid gas poisoning, or *drowning*. The application should be continued not only until the patient shows evidences of returning consciousness, but for some time

FIG. 180. (*b*) ALTERNATE APPLICATIONS TO THE HEAD (p. 823,)

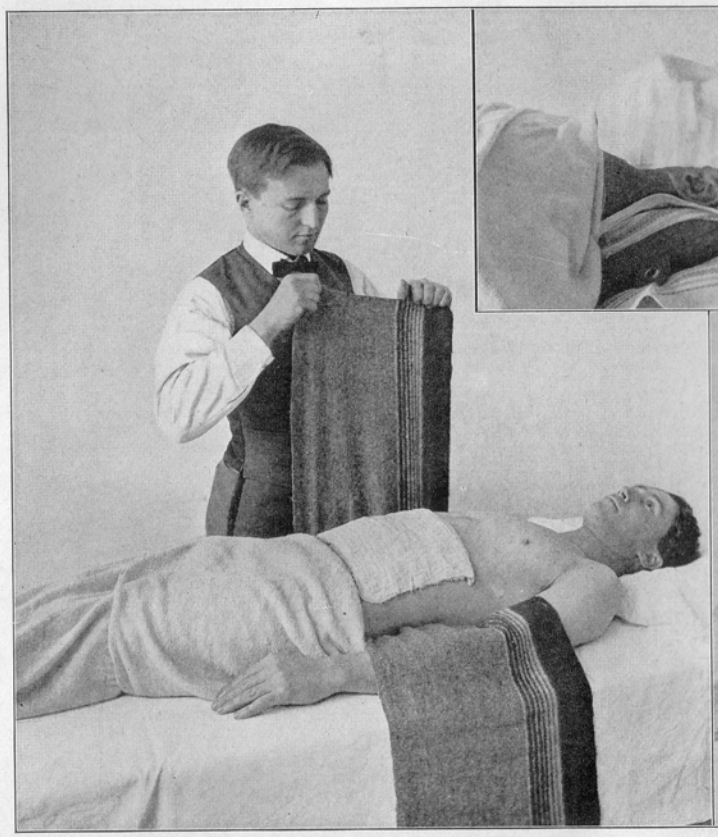


FIG. 181. ABDOMINAL HEATING COMPRESS — Unprotected (p. 824).

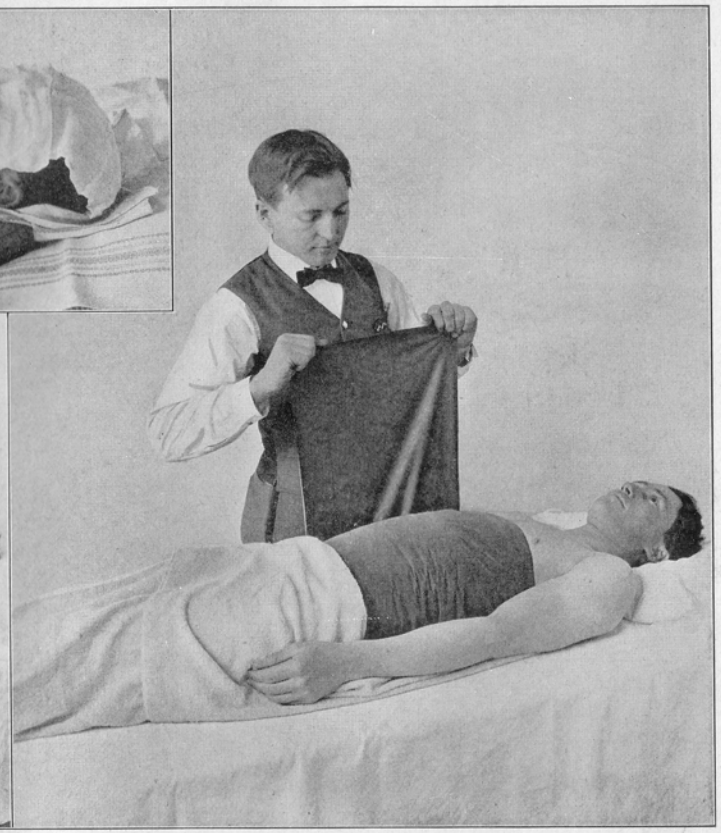


FIG. 182. ABDOMINAL HEATING COMPRESS — Protected with Mackintosh (p. 825).

after, to maintain the necessary degree of nervous and vital activity. The author has more than once employed this measure with success in threatened *collapse* under *chloroform*, and to combat grave symptoms arising from the injection of cocaine, years ago, when the anesthetic properties of this drug were first known and its toxic properties not so well understood as now. Alternate applications to the spine may be systematically employed in *general paresis*, *acute ascending paralysis*, *pachymeningitis*, and *muscular atrophy*. It is frequently serviceable in *chronic anemia*, *toxemia* from gastro-intestinal disorders, and general systemic depression in various acute and chronic affections.

ALTERNATE APPLICATIONS TO THE HEAD.

In some cases of violent headache, especially the con- **1343**
gestive form, most excellent results are obtained by alternating hot and cold compresses, or hot and cold sponging of the upper portion of the spine. The application should begin at the occiput, and extend to a point midway between the shoulders.

Very hot sponging (160°), followed by the application of an ice-bag, is one of the most efficient means of relieving cerebral congestion. In severe cases an ice compress may be applied over the top of the head and the face, the hair being well moistened, at the same time that the hot sponging is being applied at the back of the neck.

Another alternate measure which the author has found serviceable in relieving cerebral congestion and headache is the application of steam to the face by means of a metal mask constructed for the purpose, alternating with a cold blast. The face is exposed to the action of steam for 2 or 3 minutes, then for about half a minute to a strong blast of cold air from a fan. Thus the face is cooled not only by contact with the cold air, but by the rapid evaporation taking place from the moist surface (Fig. 237).

THE HEATING COMPRESS OR LOCAL PACK (Fig. 181).

1344 This most valuable hydriatic procedure consists in a thick moist linen compress well covered with flannel, with or without an outer covering of impervious material.

The heating compress may be applied to any part of the body. Its most useful applications are to the trunk, the chest, the neck, the spine, and the joints.

Method.— The principle upon which the effects of the heating compress depend is the production of reaction by a primary cold application, and the accumulation of heat by protecting the cold compress in such a manner as to prevent, wholly or in part, the escape of heat by means of radiation or evaporation.

The degree of protection may be regulated by the number of thicknesses of flannel applied as a covering, or if complete protection is desired, by the application of an oilcloth, rubber cloth, or some other impervious material. Oiled paper may be used in an emergency, in the absence of anything better. In all cases it is necessary to cover closely the edges of the compress so as to prevent the formation of air currents at any part, as such currents produce cooling by evaporation. Even though the area thus cooled may be very small, the refrigerant effect produced may be sufficient to greatly disturb or even wholly destroy the legitimate effect of the compress.

The degree of protection will be regulated by a number of conditions; as,—

1. If the patient's temperature is elevated and the skin hot, one or two thicknesses of flannel sheeting or one thickness of flannel blanket will suffice, as the purpose is simply to limit evaporation so as to prevent too rapid cooling. When the surface is cool or cold, even though the temperature may be elevated, several thicknesses of flannel (three or four) may be employed. The covering should be sufficient to insure slight warming of the compress, but not enough to prevent drying by evaporation.

2. When the purpose is to control a deep-seated inflammation by producing fluxion of the parts, the compress being changed once in 30 or 40 minutes for this purpose, the compress should be covered with flannel, so as to cause prompt reaction.

3. When it is desired to produce the effect of a poultice by the fullest possible accumulation of heat and consequent dilatation of the surface vessels, the compress should always be protected, not only by several layers of flannel, but also by some impervious covering, as thin mackintosh, or rubber cloth, or oilcloth; or in the absence of some convenient, impervious material, ordinary newspapers may be employed. The efficiency of paper may be increased by saturating it with oil, wax, or paraffin. This is the *protected heating compress proper* (Fig. 182).

The rate at which the heat accumulates in the heating compress depends, of course, primarily upon the degree of protection; but many other factors are involved, as the temperature of the water employed, the amount of water left in the compress, the reactive powers of the patient, and the condition of the cutaneous circulation in the surfaces to which the application is made.

Other things being equal, very cold water produces a quicker and more vigorous reaction than water of a higher temperature. The more water the compress contains, the longer the time required to heat it, hence the longer the delay in the establishment of the reaction. If the protection is but partial, evaporation may take place at such a rate as to prevent accumulation of heat, the heat being dissipated by the evaporation as rapidly as it is generated. If the compress dries rapidly, this fact is evidence that rapid evaporation is taking place; and of course the heating of the compress will be much less than when it is protected by an impervious covering.

Physiological Effects.— The effects of the heating com- **1345**
press are like those of the wet-sheet pack, somewhat mixed

or varied. At the beginning and for some minutes after the cold wet cloth is brought in contact with the skin, there exists strong contraction of the vessels, and by reflex action the same condition is produced in the related internal area. When reaction takes place, however, heat begins to accumulate, and dilatation of the vessels occurs, which increases with the accumulation of heat,—a characteristic which gives to the procedure its name. This dilatation is at first an active or tonic dilatation, in which there is an increased movement of blood to the skin; but later, when the temperature has risen above the normal temperature of the skin, the vessels lose their tone and become relaxed. This is especially true when an impervious covering is employed, so that the highest degree of heating effect is produced. The degree of this paralytic dilatation of the blood-vessels and the congestion will, of course, depend upon the exact mode in which the bandage is applied, and the degree of the protection. A series of experiments made by Winternitz and Strasser, which the author has repeatedly verified, shows that heating takes place at quite a different rate, the maximum temperature being reached at very different periods, according to the mode of applying the bandage and the degree of protection afforded (Exp. 69, 70).

When lightly covered, the heating compress slowly cools by evaporation, producing an active fluxion in the associated viscera; and by the improved circulation and nutrition, the normal conditions are restored, and the passive congestion is overcome. With each reapplication there is contraction of the arterial walls, which empties the blood-vessels, and dislodges the leucocytes which may be adhering to the vessel walls, thus antagonizing inflammation and chronic congestion. As the compress warms up, the vessels gradually dilate again, and the blood moves with increased velocity.

The degree of reaction also depends very much upon the condition of the patient. Bloodless, very feeble patients sometimes react very slowly, and in a particular case the effect

Fig. 184. HOT AND COLD HEAD COMPRESS (p. 843).

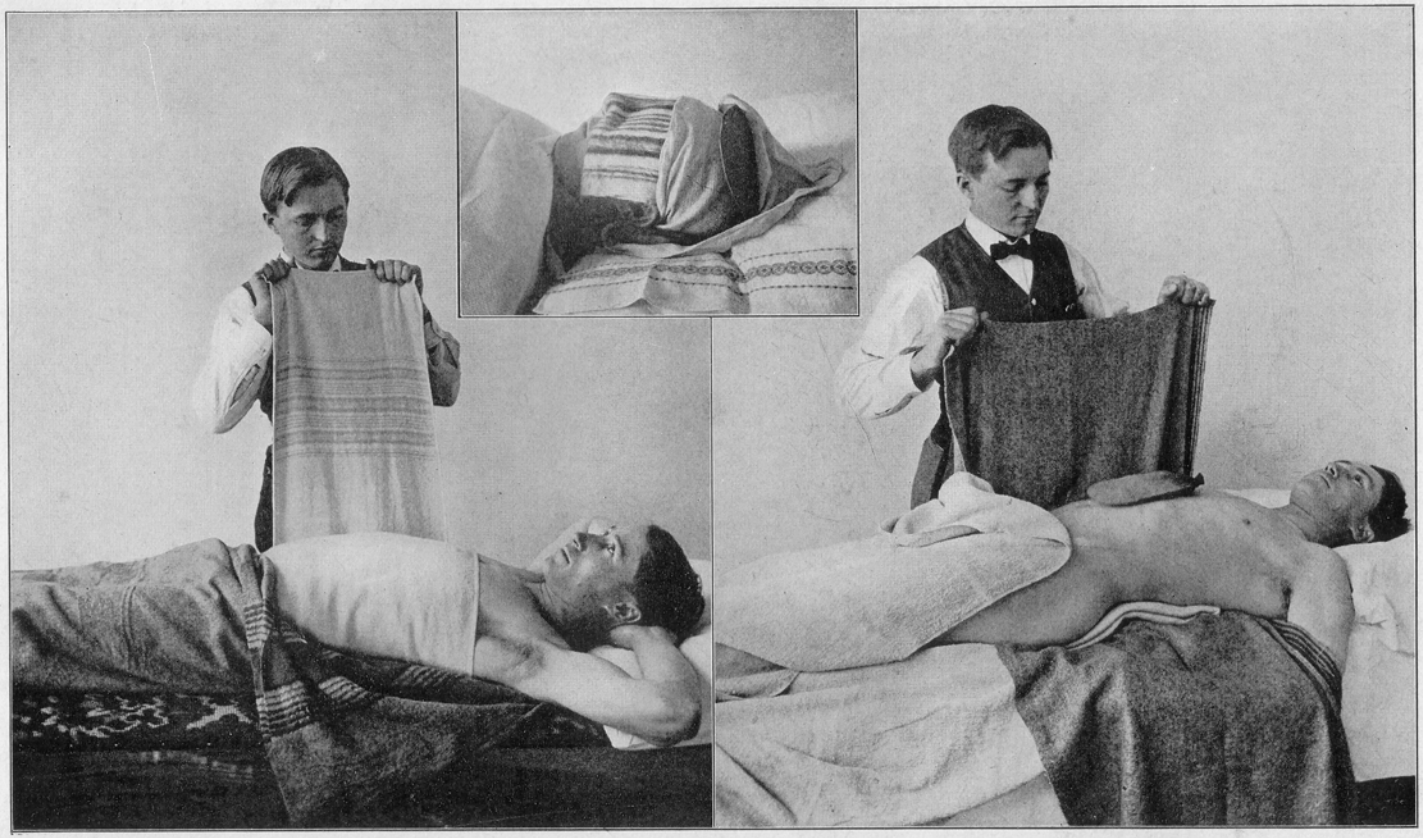


Fig. 183. WET GIRDLE (p. 829).

Fig. 185. HOT AND COLD RENAL COMPRESS (p. 846).

of a well-protected compress may not be greater than that of a partially protected compress with another person. This fact must be constantly considered in giving directions respecting the application of the heating compress.

In persons in whom reaction takes place very slowly after the application of the compress, so that uncomfortable chilliness and other disagreeable symptoms are experienced, the surface with which the bandage is to come in contact should be vigorously rubbed with the dry hand until red, or with the hand or a friction mitt dipped in water at a temperature ten or fifteen degrees below the temperature of the bandage.

The colder the water, the drier should be the compress. The smaller the compress, the sooner will reaction occur. During the warming-up period, before superheating begins, the effect of the heating compress is highly tonic, exciting all the functions of the skin and the internal parts connected with the area treated. During the period of superheating, or that in which the temperature rises above the normal temperature of the skin, the peculiar excitation characteristic of heat is produced, including analgesic effects upon the skin and associated parts, and also developing atonic thermic reaction, and producing powerful derivative or revulsive effects.

If it is desired to emphasize the tonic effect of the application, it is only necessary to lower the temperature and make the covering relatively less, so that excessive heating may not occur.

If the effects of heat are desired, with the strongest possible revulsive effects, the moist bandage should be very warmly covered with blanket flannel, and the impervious protection carefully applied. It may be well to remark that when the greatest heat accumulation is secured by the impervious covering, the skin is most strongly stimulated, and the most powerful derivative effects are induced; but when the impervious covering is omitted, vascular activity and tone being maintained in the skin, a strong tonic effect is exerted upon the viscera, and most powerful fluxion effects occur.

These facts should be borne carefully in mind in the therapeutic application of the heating compress, especially in its use in the form of the abdominal compress or the wet girdle.

1346 **Therapeutic Applications.**— This measure is indicated in *insomnia, indigestion, constipation, bronchial catarrh, laryngitis, articular rheumatism,* and a great variety of other conditions. Whenever there is need for increased movement of blood, absorption of *exudates* or *effusions*, quickened functional activity, or to relieve *swelling* from venous stasis, the heating compress may be advantageously used. The protected heating compress proper should be used in cases of *old joint trouble*, in which the leading object sought is to promote absorption of exudates; in cases of *chronic bronchial catarrh;* to relieve cough in *tuberculosis* and spasm of the bronchioles in *asthma;* for the abdominal compress and the leg compress when strongly derivative effects in favor of the cerebral circulation are desired; to the head for the relief of *acute coryza, headache, vertigo,* or *insomnia* due to anemia; to the spine for spinal irritation (**1355**).

Impervious protection should also be used for the gastric or abdominal heating compress in cases of *hypopepsia*, in *hyperesthesia* of the abdominal sympathetic, and in cases in which patients chill easily, and whose circulation and heat-making powers are so sluggish that the compress does not become sufficiently heated to accomplish the result desired unless evaporation is wholly prevented.

One of the most practical and effective applications of this compress is in the treatment of chronic rheumatism for the relief of pain and to restore lost joint motion. Hot fomentations applied night and morning, followed by the heating compress to be worn during the succeeding twelve hours, constitutes a good method in the treatment of *rheumatic joints.*

A very important use for this procedure is in the treatment of *pneumonia.* The compress should be large enough to cover the whole chest, and should be renewed as soon as well

warmed, so as to encourage energetic fluxion in the lungs, the importance of which has been pointed out elsewhere.

The heating compress likewise finds useful employment as an application to the trunk in *acute* and *chronic peritonitis* (frequently renewed, in the acute form), *amyloid infiltration* of the *liver*, *amyloid kidney*, *acute ascending paralysis*, *congestion* of the *spleen*, *ascites*, *infectious jaundice*, *icterus neonatorum*, *appendicitis*, *enteralgia*, *intestinal catarrh*, *gastric ulcer*, *hyperorexia*, *Addison's disease*, *chronic migraine;* to the spine in *locomotor ataxia* and *occupation neuroses*, *spinal neuralgia*, *hyperpepsia*, and as a local measure in *muscular rheumatism*, *chronic appendicitis*, *chronic ovaritis* and *salpingitis;* to the scalp in *anemic insomnia;* and as a derivative measure in *acute coryza.*

Precautions.— Few measures of treatment are capable of producing more disastrous results than the heating compress when improperly used, and especially when so applied that prompt reaction does not occur. The slow but prolonged chilling produced by the evaporation resulting from the loosely applied or imperfectly protected heating compress, when not indicated as a therapeutic measure, is certain to result in visceral congestion and aggravation of the condition for which it is applied, with rheumatic pains and numerous other inconveniences, both general and local. The effects, in fact, are precisely the opposite of those desired. There is no other hydriatic measure the success of which depends more wholly upon exact technique; and few which yield more gratifying results when properly applied.

THE WET GIRDLE (Fig. 183).

This application is practically the same as the half-pack, 1347
except that it covers a more limited area. The region to which it is applied is bounded by the nipple line above and the hip joints below. The application is addressed especially to that portion of the skin having most immediate reflex relation with the abdominal viscera.

This measure has been exceedingly popular in Germany for at least a hundred years, and possibly a much longer time, under the name of "Neptune's girdle."

Requisites.— A linen bandage usually eight or nine inches wide and about three yards in length, or sufficiently long to pass three times around the body; a flannel bandage three or four inches wider; and a water-proof covering of oiled silk or other impervious material.

Method.—The application is to be made in accordance with the principles already pointed out in relation to the heating compress (**1344**). The girdle may be wide enough to reach from the axillæ to the hips, when it is termed the *trunk pack*. In some cases also it is better to reduce the size of the bandage at the start, covering only the abdominal surface instead of passing the bandage around the whole trunk. The impervious covering may be applied or omitted as indicated.

1348 **Physiological Effects.**— The wet girdle certainly produces a powerful effect upon the vasomotor centers, and through them upon the abdominal viscera. It is without question one of the most effective and well-known means for combating visceral irritation and congestion. The slight chilliness which is at first produced disappears more quickly than when a larger surface of the body is involved, as in the wet-sheet pack. The patient soon experiences a pleasant, cool sensation, and a sense of well-being, with relief of any sensation of heaviness of the epigastrium or of the head, vertigo, and other unpleasant symptoms which may have previously existed. Later, perspiration may appear. General perspiration is less likely to occur than when the wet-sheet pack is employed. If the covering is properly adjusted, the pack may be continued for several hours without inducing perspiration or other than a simple prolonged tonic reaction with powerful derivative and calmative effects upon the internal viscera. The wet girdle acts powerfully upon the sympathetic, the moist warmth which follows the first chill soothing and relieving the visceral irritation. That there is a most intimate relation between

the viscera and the structures of the abdominal wall is clearly shown by the strong contraction of the abdominal muscles frequently occurring in connection with visceral irritation. In these cases, extreme hyperesthesia is often present in both the right and the left ganglia, and in the sub-umbilical sympathetic ganglia, or the so-called lumbar ganglia of the sympathetic and the lumbo-aortic plexus. The application of cool water to the abdominal walls stimulates contraction of the bladder, uterus, and bowels,— another evidence of the intimate nervous relation between the skin and the muscles of the abdomen and the viscera contained within its cavity. The wet girdle may be so managed as to be practically a prolonged neutral bath; or it may be made a powerfully derivative procedure, according to the degree of protection provided.

Elsewhere full explanation has been made of the influence of induced cutaneous hyperemia upon the portal circulation, and both the arterial and the venous circulation of the stomach, liver, lungs, and other viscera (**1271** to **1277**).

Therapeutic Applications.— The moist abdominal bandage **1349** is one of the most valuable of what might be termed the minor hydrotherapeutic measures. Its use is applicable to all cases in which there is evidence of visceral irritation or hyperesthesia of the abdominal sympathetic ganglia, a condition which is almost universally present in *chronic dyspepsia, constipation, gastric* and *intestinal catarrh, hepatic congestion* and other disorders of the liver which result from chronic gastric disorders, and in many *chronic pelvic disorders.* It is almost a panacea in cases of *chronic backache,* also in heaviness across the abdomen, when the seat of the discomfort is not located in the pelvis.

The therapeutic effect of the wet girdle differs somewhat, according to the exact point at which it is applied. Over the lower portion of the abdomen the chief effect is concentrated upon the bowels, allaying irritation, increasing secretion, and thus tending to promote normal activity and to relieve *chronic*

constipation. Applied around the upper portion of the abdomen, the bandage is useful as a means of promoting healthful activity of the stomach and liver. Its effect is powerfully revulsive. It stimulates the vasomotor centers, and hence relieves *congestion* of the *liver*, *kidneys*, and other abdominal viscera. It is also of much service in ordinary *dyspepsia* with *dilatation* and *prolapse* of the *stomach.*

There is no more serviceable measure in the treatment of chronic indigestion in all its forms. In *hyperpepsia*, it should be applied very cold, wrung very dry, covered just sufficiently to secure good reaction, superheating being avoided by omitting the impervious covering. This is also true in each of the conditions above mentioned.

In *hypopepsia*, the bandage should be wrung out of water at a temperature of 60° to 70°, very dry, and should be well covered with flannel, the impervious covering being also applied when necessary to secure good reaction, as it is desirable to secure the most powerful revulsive effects possible, and also the atonic thermic effect of heat.

For *flatulence* of the stomach or intestines, a cold, well-wrung bandage with a moderate amount of flannel covering should be employed. *Dilatation* of the *colon*, *enteroptosis*, lack of normal sensibility in the lower bowel, are best treated by the bandage wrung very dry out of very cold water, and lightly covered with flannel. The bandage should be renewed just before it becomes dry, or every three to four hours.

A well-protected heating compress may be advantageously employed in cases of *hyperesthesia* of the *lumbar ganglia*, general *sensitiveness* of the *abdominal sympathetic*, *enteralgia*, *chronic peritonitis*, painful conditions resulting from peritonitis, recurring *appendicitis*, or inflammation of the cecum when the case is for any reason not suitable for operation.

The moist abdominal bandage, either with or without the impervious covering, is a most excellent means for combating *insomnia.* The reaction should be strongly pronounced, so

as to divert the largest possible amount of blood into the skin of the trunk as well as into the portal circulation, which is alone capable of holding all the blood in the body. As this system is associated with the venous vessels of the abdominal wall, it is possible by means of the heating compress to divert a large portion of the blood into this portion of the circulatory system, thus causing contraction of the cerebral vessels and an accumulation of lymph beneath the dura mater, whereby conditions favorable for sleep are secured (Schüller).

For the relief of insomnia the wet bandage or girdle should be applied at bedtime, and may be renewed to advantage at least once during the night, as the bandage must be kept moist in order to be effective. The patient is apt to be nervously irritated when the bandage becomes perfectly dry. It is also highly important that reaction should take place promptly, as otherwise prolonged chilliness may result, and the patient become so nervous and disturbed that the hypnotic effect of the application is wholly lost.

The wet girdle, when properly managed, is a more valuable hypnotic in combating insomnia than any or all medicinal drugs.

The wet girdle may be advantageously employed in nearly all forms of *visceral irritation.* Care should be taken, however, to avoid impervious covering. In *hyperpepsia* especially, this is necessary, and the bandage should be changed every three or four hours. In *hypopepsia* the impervious covering should be applied, especially in cases in which there is marked evidence of congestion, as in *chronic gastritis*, and in congestion of the mucous membrane arising from *cardiac insufficiency* or *cirrhosis* of the *liver.* The wet girdle is of value in disorders of the menopause, serving to lessen morbid sympathetic reflexes and vasomotor disturbances. In the preparation of patients for abdominal operation the wet girdle without impervious covering is of service. The bandage should be covered with flannel only, and should be changed every four to six hours, the purpose being to increase the

movement of blood through the viscera, and thus prepar them for the ordeal which the patient must undergo. Thi measure is also of great advantage in *gestation.* It may b used with benefit during the entire period, and especially dur ing the later months.

1350 **Precautions and Contraindications.**— 1. It should b remembered that the wet girdle is serviceable only whe moist. When it becomes dry, it should be removed, and dry flannel put in its place, after rubbing the parts with th hand dipped in cold water; or it should be renewed.

2. With the majority of persons it is sufficient to wear th girdle at night only. In cases of enteroptosis in which patient suffer from backache and abdominal pain when on their feet the moist girdle may, however, often be advantageously wor during the day, and should be supplemented by an abdomina supporter.

3. When worn night and day, the wet girdle frequentl gives rise to an eczematous, or, in some cases, herpeti eruption of the skin; sometimes boils make their appearanc in the region covered by the bandage. These morbid proc esses are in no way desirable, and care should be taken to pre vent them. The old notion that effete matters are eliminate through purulent discharges was long ago exploded. Neithe is any special benefit to be derived from the irritation pro duced by an eruption or any other morbid process. Th resources of hydrotherapy enable us to stimulate the ski to the highest degree, and a healthy skin is more ready t respond to physiological stimuli than is a diseased skin.

The eruption occurs as the result of wearing the mois abdominal bandage only when it is not kept scrupulousl clean. It should be boiled daily, or rinsed in a ten-per-cent solution of chloride of lime, or a ten-per-cent. solution of sul phate of zinc, or a one-to-one-thousand bichloride of mer cury solution. If cleansed daily by any of these methods the troublesome eruption which sometimes follows the pro longed use of the bandage may be readily prevented. Ther

is no advantage whatever in this eruption, but on the contrary, a positive disadvantage. There are always present upon the skin pus-producing germs, the development of which is encouraged by the continuous warmth and moisture secured by the bandage. The accumulation of perspiration in the bandage furnishes a culture medium for the development of these germs, and thus encourages the infection to which the eruption is due. The surface treated should be daily washed with hot water and yellow soap, and a little vaseline should be applied.

4. Chronic invalids sometimes become addicted to the wet girdle. They rely upon it to such an extent that they may be said to be quite dependent upon it. This is quite undesirable. As a means of preventing irritation and other inconveniences arising from the constant employment of the girdle, it is wise to omit the application either during the day or night, as may be most advantageous and convenient; or if for any reason it must be worn continuously night and day, it should be left off for a day at least once a week, a dry flannel bandage being worn in its place.

5. As the protected heating compress, when applied to the trunk, accumulates blood in the portal system, it is obviously unwise to make use of this measure in conditions involving chronic disease of the liver or spleen, and in *inflammatory affections* of the *stomach* and *bowels*, in *ulcer* of the *stomach*, in *varicose* conditions of the *gastric veins*, in *hemorrhoids*, *intestinal catarrh*, *bleeding fibroid* of the uterus, and in acute pelvic inflammations or congestions. In these cases the wet girdle covered with flannel only may be used with great advantage.

THE ABDOMINAL HEATING COMPRESS.

This is a procedure similar to the wet girdle, but more **1351** limited in extent, being applied only to the anterior portion of the trunk, from the pubis to a point an inch or two above the epigastrium, and extending to the loins on either side.

Method. — The same materials are needed as for the wet girdle. A compress of proper size, consisting of six or eight thicknesses of soft cheese-cloth, fits the skin better than one consisting of coarse toweling. The compress wrung out of cold water is applied to the front of the trunk between the sternum and the pubis, and a dry bandage placed over it in such a manner as to hold it in place. The woolen and water-proof coverings are then added.

Physiological Effects. — The effects of the abdominal heating compress are essentially the same as those of the wet girdle (**1347**), but somewhat less pronounced. This application acts especially upon the sympathetic centers and the viscera.

Therapeutic Applications. — This procedure is extremely useful in minor cases of *visceral irritation* or *congestion*, indicated by sensitiveness in the region of the liver, spleen, or bowels, *hyperesthesia* of the *lumbar ganglia* of the abdominal sympathetic, *constipation*, *flatulence*, *gastric* and *intestinal catarrh*, *insomnia*, and other nervous affections arising from irritation of the abdominal sympathetic. The abdominal heating compress may be used as a milder or introductory procedure in all cases in which the wet girdle is indicated.

1352 **Precautions and Contraindications.**— In the use of the wet girdle or the abdominal compress for the relief of insomnia, it must be remembered that the brain is relieved at the expense of congesting the portal circulation. The portal system is a reservoir capable of containing all the blood in the body. When the heating compress is applied in such a way as to accumulate the largest possible amount of heat, as when covered very thick with flannel or protected by oil-cloth, mackintosh, or other impervious material, both the cutaneous and the visceral vasoconstrictors are relaxed, thus diverting into these parts an enormous amount of blood, and relieving the cerebral vessels by a sort of internal blood-letting.

If kept moist, and not too warmly covered, the walking

powers are improved; but when excessively covered, it becomes exciting and weakening, and when worn at night, may cause dreams, fidgets, and insomnia, by reflexly producing cerebral congestion. This is a point worthy of the most careful consideration in the use of the procedure.

This intense portal congestion is wholly harmless in conditions of health, for it is evidently a part of the function of the portal system and the distensible and elastic viscera connected with it, especially the spleen, to serve the body in this fashion as a sort of overflow reservoir, whereby the regulation of the circulation may be effected under conditions which without this aid would baffle the efforts of the other regulators of the blood supply. But what is true in normal conditions by no means always holds good in conditions of disease. When the portal system is the seat of pathological states involving changes in the vessel walls, as in the *varicose condition of the veins of the stomach* and intestines which often accompanies *hepatic sclerosis;* in the *acute congestions* of the spleen and liver which are present in chronic malarial infection, typhoid and other continued fevers; in acute congestions of the liver due to infection from the alimentary canal, as in *catarrhal* or *infectious jaundice;* in *chronic gastritis* and *gastro-intestinal catarrh;* in *abdominal dropsy;* and in *constipation* due to atony and dilatation of the colon,—in these and kindred states, any procedure whereby the portal congestion already present is increased can not be otherwise than damaging in a high degree; and hence in these conditions the portal reservoir can not safely be utilized as a means of diverting blood from the cerebral circulation. In such cases the desired end may be accomplished by other means almost, if not quite, as effective. The cutaneous envelope of the body, while a less capacious reservoir than the portal system, is, nevertheless, capable of holding fully one half of all the blood of the body, and, fortunately, can not be easily filled to a really dangerous degree. By means of the heating pack (**1186**), the wet-sheet rub, cold friction, or even the shallow bath and the Scotch douche,

the skin may be readily congested to such a degree as to render the cerebral vessels anemic while the lymph spaces are filled, thus securing the conditions necessary for sleep and repair of the cerebral energies.

A *varicose* condition of the abdominal veins should always be taken as an indication that the protected abdominal girdle should not be employed. This condition is easily discovered, when present, by making the patient stand up. The varicose vessels will then be seen just above the pubes running outward, nearly parallel with the groin. Other veins may be seen near the epigastrium.

It should be remarked that in these cases the abdominal girdle is not altogether interdicted, but only when imperviously covered so as to cause superheating of the skin and consequent paralysis of the vasoconstrictors; the flannel-covered compress may often be advantageously used, as in dropsy of the abdomen.

The abdominal compress has a decidedly laxative effect. The cold abdominal compress, renewed every hour or two, is a most efficacious remedy in diarrhea and intestinal flatulence.

When necessary to employ the abdominal compress in cases of menorrhagia, the bandage should be confined to the region of the umbilicus, to avoid congesting the pelvic viscera.

To obtain the best tonic effects, the compress should be renewed every two or three hours.

In feeble persons, the measure may begin with a small folded napkin applied over the epigastrium.

THE DRY ABDOMINAL BANDAGE.

1353 This measure consists in a broad flannel bandage of sufficient length to extend two or three times around the body. In cold weather, it should be applied whenever the moist abdominal bandage is omitted. If the moist bandage is worn during the night, the dry bandage should be applied in the morning, and worn during the day, after cool sponging and rubbing of the parts on removal of the moist bandage.

The dry abdominal bandage is valuable, first, as a means of supporting the viscera when enteroptosis exists, although for this purpose it is not very effective as an abdominal supporter, as it constricts the trunk to some degree, and does not elevate the viscera to the extent desirable in most cases.

The warmth afforded by the abdominal bandage is exceedingly helpful in many cases in which the digestive functions are feeble and the sympathetic ganglia irritable. Indigestion and other disorders may be greatly mitigated by a dry flannel bandage applied about the abdomen.

THE HEAD PACK.

1354 A cheese-cloth compress wet in very cold water is applied to the head after the hair and scalp have been thoroughly wet with cold water. A rubber cap like a lady's bathing cap is then placed over all, and the retention of heat soon warms the compress and develops the usual effects of such an application. Where there is a heavy growth of hair, simply wetting and covering it with the rubber cap is sufficient to develop the full effects of the stimulating compress.

On rising in the morning, the scalp should be well drenched with cold water, then rubbed dry, and protected by a cap during the day to prevent taking cold. This is an excellent measure for promptly relieving an acute "cold in the head."

The use of the stimulating head cap is indicated in *chronic headache*, when due to *anemia;* in *chronic neuralgia* and *rheumatic affections* of the *head;* in *chronic nasal catarrh* with *diminished secretion*, and in *acute coryza.* The stimulating compress may be preceded by a very short hot application for the relief of *headache* — to the face when due to nasal catarrh, to the top of the head when due to anemia. It is also useful in *baldness* due to failing nutrition of the scalp.

THE SPINAL PACK.

1355 While less frequently employed than many other forms of the heating compress, the spinal pack is sufficiently useful as a hydriatic procedure to be worthy of brief description.

Requisites.— The requisites are: an ordinary towel, a piece of woolen blanket sufficiently large to cover the entire back when folded four thicknesses; if special protection is required, a piece of mackintosh a little larger than the folded flannel, and a roller cheese-cloth bandage one foot wide, three thicknesses, and four yards long.

Method.— The towel is folded lengthwise and wrung dry from water at 60°, and applied the whole length of the spine from the cervical region to the coccyx, after first rubbing the skin surface with the hand dipped in water at 50° until reddened. The flannel is laid over the towel, over this the mackintosh, and the cheese-cloth bandage is then applied in such a manner as to hold the pack in snug contact with the skin.

Therapeutic Applications.— The spinal pack produces, first, strong fluxion in the spinal vessels; later, hyperemia of the skin, whereby the spinal cord is drained. If impervious protection is employed, the superheating of the skin finally produces accumulation of blood in the spinal vessels. This procedure may therefore be employed either to combat *anemia* or *hyperemia* of the *cord*, according as it is more or less protected. Partial protection (**1344**) maintains active fluxion in the spinal vessels, and thus combats passive congestion. The prolonged protected spinal pack, by congesting the spinal vessels, antagonizes *chronic degenerations* of the *cord*. It is very useful in some cases of *insomnia*.

The neutral pack, applied at 80°, covered with two thicknesses of flannel only, without mackintosh, is a calmative procedure of great value in *spinal irritation* with *hyperesthesia* of the *spine*, and in conditions in which *irritability* of the *spinal centers* exists, as in *locomotor ataxia* and other degenerations at certain stages.

THE HOT AND COLD COMPRESS.

1356 This procedure consists in the simultaneous and continuous applications of a hot and a cold compress to separate skin surfaces collaterally related to a single internal part

This unique procedure is not applicable to all parts of the body, but may be applied under appropriate conditions to the head, chest, spine, abdomen, pelvis, and legs. The hot and cold compress is a combined application of peculiar interest and value, since it can be relied upon to accomplish, under certain conditions, results which can be attained in no other way, and sometimes affords relief in cases of great suffering and imminent peril.

Method.— The adjustment of the hot and the cold compresses respectively varies for different parts of the body and the different viscera, the circulation of which it is desired to influence. The management of the cold and hot compress should be the same as previously indicated for continuous applications; that is, the nervous sensibility of the cutaneous surface to which the cold application is made must be kept alive by rubbing the parts with a dry warm flannel for one minute each time the compress is changed. The compress should be renewed every 10 or 15 minutes, or as soon as its temperature begins to approach that of the body. The hot application likewise should be exchanged every 15 or 20 minutes for a cold application of 30 seconds to 1 minute, so as to empty the veins, restore the tone of the vessels, and prevent too great accumulation of heat in the deeper parts.

The duration of the hot and cold compress may be from 15 minutes to one or two hours, or even longer. A good rule is to continue the application until the effect desired is produced, unless decided indications for its interruption appear.

In the employment of the hot and cold compress it must be borne constantly in mind that the application should be made in such a way that the blood-vessels of the congested organ in the interest of which the application is made will be caused to contract by the cold compress, the veins or the arteries of the part being at the same time drained into another collaterally related cutaneous area by means of the hot application, in accordance with principles explained elsewhere (**1290**).

To secure the best effects, the compresses should be

adjusted with special relation to internal parts, as explained for each special form of this procedure.

1357 **Physiological Effects.**—The hot and cold compress is a hydriatic measure of great power. It is perhaps the most effective means of controlling the movement of the blood in internal parts. It acts both reflexly and derivatively. A cold application applied to one cutaneous surface causes contraction of the vessels of the associated internal organ through stimulation of its controlling vasomotor centers, while the hot compress applied to another cutaneous surface, the vessels of which are collaterally related to those of the part, drain off a portion of blood into the dilated cutaneous veins and arteries. The partial reaction following the first impression made by the cold compress and the frequent renewal of the cold application facilitates the movement of blood through the affected part, thus insuring a constant supply of oxygen, fresh nutrient material, the removal of wastes, and the influx of leucocytes, while at the same time the hot application combats stasis by drawing the blood into collateral venous and arterial channels, at the same time facilitating the rate of movement of the blood through the arteries of the parts by lowering the pressure in the veins. By this combination of effects the distension of blood-vessels and stasis of blood is prevented, while the movement of blood is accelerated, thus restoring the normal status of the circulation and greatly facilitating the healing processes. How this may be accomplished in the interest of any particular internal viscus may be clearly seen by a careful study of paragraphs **1262–1291.**

Therapeutic Applications.—The conditions under which the hot and cold compress attains its special successes are those in which ordinary hot or cold applications, if they afford any relief at all, secure no more than partial amelioration of the urgent symptom present, the beneficial effects which might be obtained through the revulsion produced by cold being antidoted by the thermic effects produced by the application;

while, on the other hand, hot applications prove too exciting, depressing the heart when long continued, or causing other untoward effects. By a combination of the two, however, in these cases the evil effects resulting from each are antidoted, while the good effects of each are intensified.

The following forms of the hot and cold compress have been tested and found practical and useful: —

The Hot and Cold Head Compress.— Place an ice-bag to the 1358
back of the neck and the ice compress to the vertex (Fig. 184). Apply very hot compresses to the face and ears. The hot compresses should not extend below the level of the jaw, thus avoiding the heating of the large vessels of the neck. The ice-bag causes contraction of the vertebral arteries ; the cold compress to the vertex causes reflex contraction of the meningeal and cerebral vessels, and cools the brain; while the fomentation to the face and ears dilates the external branches of the carotid artery, thus establishing collateral anemia of the brain. The fomentation also dilates some of the venous channels by which the cerebral sinuses are drained (**1262**).

A reverse method may sometimes be used advantageously in applications to the head, as follows : —

A rubber bag filled with hot water and covered with a moist flannel, or a fomentation, is applied to the upper and back part of the neck, while a soft cheese-cloth compress wrung out of cool or very cold water is applied to the face and the top of the head.

The effect of the compress in relieving cerebral congestion is greatly increased by the application of the ice compress or ice-bag to the front of the neck, whereby the blood supply of the brain is lessened by contraction of the carotid arteries.

The combination of heat and cold to the head in this manner renders it possible to make applications of heat to the head for a much longer time than could otherwise be tolerated, the cold antidoting any ill effect which might be produced by the heat, while encouraging the good effects of the application.

The author has made use of this application for many years as a means of relieving certain forms of *neurasthenic headache.* It is exceedingly useful also in so-called *nervous headache* accompanied by marked congestion of the brain.

This procedure is especially useful in *passive congestion* of the brain, and serves a useful purpose as an adjunct procedure in the treatment of *insomnia* when due to cerebral hyperemia. It should be avoided, however, in cases of insomnia due to excessive excitability of the cerebral cells, and is of course contraindicated in insomnia due to anemia.

1359 **The Hot and Cold Lung Compress.**—A thick and very hot fomentation is applied over the back, reaching from the middle of the neck to the lumbar region, and extending to the axillary line on each side. The cold compress should cover the top of the lungs, the lower half of the neck in front, and the whole anterior surface of the chest to the level of the lowest ribs. The fomentation diverts the blood from the bronchial arteries by dilating the cutaneous branches of the intercostals, while the cold compress contracts the bronchial arteries through reflex stimulation of the vasomotor centers controlling them. The effects of the application may be intensified by hot applications to the arms and legs applied simultaneously, especially hot packs, which produce decided derivative effects.

This procedure is exceedingly useful in the early stages of *pneumonia*, in *broncho-pneumonia*, in *pulmonary hemorrhage*, *acute pulmonary congestion*, and the congestion resulting from the use of ether in anesthesia. Its use in the last-named condition is especially important when much mucus is present, and when cyanosis, or blueness of the skin, indicates stasis from cardiac weakness or interference with oxygenation. It has for some time been the author's custom to apply a heating chest pack immediately after removing the patient from the operating table when the foregoing symptoms were present. More recently the plan of applying the hot and

cold lung compress in cases in which an anesthetic is administered has been tested. When ether is employed, the application extends to the whole chest surface, as above described; when chloroform is used, a hot bag is placed to the back and an ice-bag or a cold compress over the heart. The compress should be at least as large as the surface covered by the patient's two hands placed side by side. The cold compress should be removed for a few seconds every ten minutes, and the surface rubbed with a dry, warm flannel till red, so as to maintain the cutaneous reflexes upon which this compress depends for its efficiency as a cardiac stimulant.

The author has made use of the hot and cold chest pack for fifteen years or more, and believes it to be one of the most valuable of all means for combating pulmonary congestion. The circulation of the lungs is controlled by the vasomotor centers located at the upper portion of the dorsal region, and the purpose of the hot application is to stimulate the activity of these centers; while the cold application to the anterior portion of the chest causes first a contraction, and later active dilatation and fluxion of the vessels of the lungs, thus combating passive hyperemia and inflammation.

This is an excellent means of relieving acute congestion of the lung in pulmonary hemorrhages, and combating the hypostatic congestions which occur in fevers of a low type. The application may be continued for half an hour or more, and should be repeated two or three times a day.

This measure is of very great value for removing the pulmonary congestion which follows ether anesthesia, and thus combats the tendency to bronchial pneumonia, which is often a greater risk in old subjects than the operation itself.

A special form of the hot and cold compress is of particu- **1360**
lar service in asthma. An ice compress is applied to the back of the neck and head while a fomentation is applied to the whole front part of the chest, extending from the clavicles to the umbilicus. The back may be included. The cold application lessens the blood supply of the medulla, and so dimin-

ishes the excitability of the respiratory centers, while the fomentation relaxes the spasm of the bronchioles.

361 **The Hot and Cold Renal Compress (Fig. 185).**—The hot application covers the back from the middle dorsal region to the coccyx. The cold application should consist of an ice-bag or a cold compress covering the lower third of the sternum. The connection of the portal circulation with the renal vein makes it undesirable that any of its outlets should be closed or its tension raised by reflex impressions from the general abdominal surface. The fomentation diverts the blood from the branches of the lumbar artery which are distributed to the capsule of the kidney and leads off a portion of the blood from the renal vein into the anastomosing muscular branches, while the cold application causes reflex contraction of the blood-vessels of the kidney and increases its activity (**1098**). (See Fig. 152.)

This measure is of special service in cases of acute congestion of the kidney, especially in connection with acute febrile diseases, as scarlet fever, typhoid fever, smallpox, and diphtheria. It should be used in connection with the hot blanket pack or other general hot applications in the intervals as a means of continuing the effect of the general hot application. Care must be taken that the patient does not become chilled by the cold application.

362 **The Hot and Cold Gastro-Hepatic Compress.**— This compress influences not only the stomach and liver, but also the spleen and the pancreas through the intimate association of the circulation of these organs. The application is almost exactly the reverse of that of the renal compress. The fomentation is applied anteriorly from the fourth rib to the umbilicus, extending to the axillary line on each side, while a cold bag at least eighteen inches long is applied to the dorsal and lumbar spine. Through the dilatation of the branches of the internal mammary arteries and associated veins, the blood is drawn off from the stomach, liver, spleen, and pancreas while the reflex stimulation of the controlling vasomotor centers contracts the vessels of the arterial circulation.

The Hot and Cold Intestinal Compress.— The cold compress is applied over the whole abdominal surface, extending from the xyphoid cartilage to the pubes. The fomentation is simultaneously applied to the lumbar region and the left side, as it is desirable to divert the blood from the left kidney both by establishing collateral hyperemia of the overlying structures, and also by diverting the venous blood from the kidney into the anastomosing muscular channels. 1363

This procedure is of special value in chronic duodenitis and colitis.

The Hot and Cold Pelvic Compress.— The cold compress is applied to the hypogastrium in combination with a fomentation across the lower part of the back. The fomentation may also profitably become a hip pack, or a hot leg and hip pack. When the inflammation is confined to one side, an ice-bag instead of the cold compress may be placed over the affected part. The ice-bag may be used in combination with the hot pelvic pack (Fig. 153.). 1364

This measure is especially valuable in the treatment of *acute inflammations* of the *uterus*, *tubes*, *ovaries*, and *bladder*, in *appendicitis* and *pelvic peritonitis*. In cases of *inflammation* of the *prostate*, in *proctitis*, and *cystitis*, the ice-bag may be applied to the perineum in connection with the hip pack, or with the hip pack and the hot leg pack or foot bath applied simultaneously.

THE HOT AND COLD HEATING COMPRESS OR PACK.

This procedure differs from the hot and cold compress in the same way in which the ordinary heating compress differs from the cold compress. In the hot and cold compress the hot application is made continuous, or practically so, by the frequent renewal of the compress. In the hot and cold heating compress or pack the cold application is not renewed, but allowed to accumulate heat through reaction. The area covered by the cold application in this procedure is usually much greater than in the hot and cold compress. The duration is usually from one to two hours. 1365

This procedure is especially applicable to the chest, the abdomen, and the pelvic region.

Physiological Effects. — The hot and cold pack is, next to the hot and cold compress, perhaps the most powerful of all known means of controlling the movement of blood through the viscera of the chest and abdomen. The heating pack depends for its special features upon the anatomical fact that the collateral relation between the arteries and the veins with internal parts does not closely coincide as regards the location of the related vessels in the skin, thus making possible the simultaneous application of two procedures differing in method, but each assisting the other.

The explanation of the effects of the hot and cold compress (**1356**) applies only in part to the hot and cold heating compress or pack. In the former, the action of the cold application is continuous or nearly so, while in the heating process the stimulant effect of the cold soon disappears, giving place, under the influence of the powerful reaction, to extreme dilatation and great activity of the cutaneous vessels. As the heat accumulates, venous stasis is developed, producing powerful derivative effects upon the associated venous trunks, and thus by lessening the pressure in the veins, hastens the movement of blood through the arteries of the congested part. At the same time, the hot compress, being applied to a cutaneous area, the arteries of which are collaterally related to those of the deeper structures which it is designed to influence, produce powerful collateral anemia of the vessels of the congested organ. Several very powerful therapeutic factors are thus brought to bear simultaneously upon the diseased part as follows: —

1. By the application of the cold compress the vessels of the part are made to contract, thus forcing the stagnating blood onward into the veins.

2. As the heating compress warms and the cutaneous veins become filled with blood, the veins of the congested viscus are emptied, thus draining the tissues of the toxins which have accumulated in them.

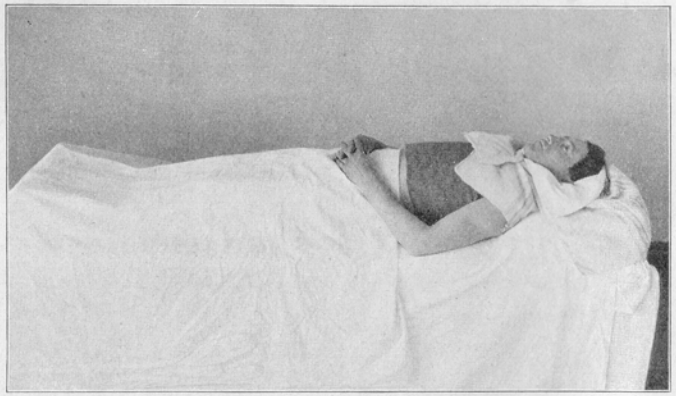


FIG. 186. HOT AND COLD CHEST PACK (p. 849).



FIG. 188. COLD CEPHALIC COMPRESS (p. 853).

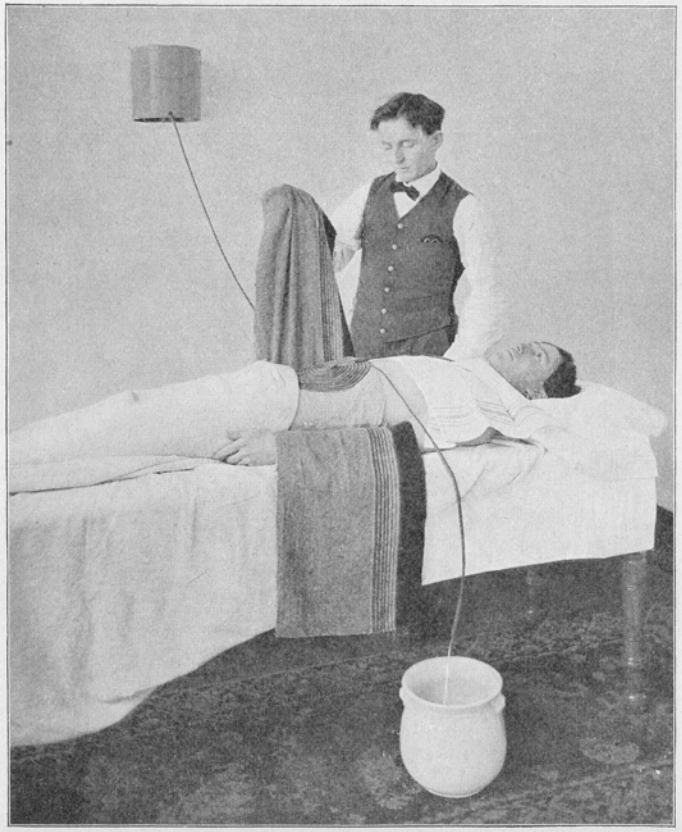


FIG. 187. HOT AND COLD ABDOMINAL OR TRUNK PACK (p. 849).

3. By lowering the pressure in the veins, the arterial circulation through the affected part is facilitated, thus encouraging the nutrition and functional activity of the cells which are engaged in combating living germs, or which are seeking to repair damages which may have originated in any way.

4. The hot application diverts the blood into the cutaneous branches of the collateral arteries or into anastomosing vessels, thus preventing undue accumulation of blood and consequent embarrassment of the affected tissues. The anatomical relationships through which these results are attained have been described elsewhere (**1262–1278**).

The Hot and Cold Chest Pack.—The chest pack is applied in the ordinary way. The form known as the square chest pack (**1374**) is preferable. After the wet pack has been adjusted and before the woolen wrapping is arranged, a spine bag filled with water as hot as can be borne safely (140° to 160°) is applied between the shoulders, reaching from the lower cervical to the lumbar region. The woolen wrapping is then brought snugly in place, and fastened in such a manner as completely to cover the back, leaving no openings about the neck. As an extra precaution it is a good plan to adjust a flannel about the neck in the manner shown in Fig. 186. **1366**

The Hot and Cold Abdominal Pack (**Fig. 187**).—In this procedure the moist bandage is placed around the trunk at the level of the umbilicus in the usual manner for the *umschlag*, or wet girdle (**1347**). A rubber or aluminum coil is placed upon a wet towel just over the epigastrium. The blankets are then tucked snugly about the patient, and a stream of hot water is kept flowing through the coil continuously during the application, at a temperature as high as the patient can bear. The author has made use of this application ever since it was first suggested by Professor Winternitz, using instead of a coil, however, a rubber bag filled with very hot water, a thermophore, or a syphon sack. **1367**

The first information printed in this country in relation

to this valuable hydriatic measure was an article contributed by Professor Winternitz, by request of the author, to his journal, *Modern Medicine.**

If necessary to continue the application for a considerable length of time, the hot water bag may be refilled once or twice. In general, however, it is better to remove the hot bag or coil at the end of the first 30 minutes, thus avoiding overheating.

The hot and cold abdominal pack has rendered most valuable service in a great number of cases; and so positive and satisfactory have been its results in the hands of the author that in his estimation it stands almost unrivaled as a hydriatic procedure in the certainty with which it produces the effects expected from it. This measure has proved especially successful in both *sensory* and *motor disturbances* of the *stomach*, especially in cases in which the patients complain of *pain* soon after eating, *flatulence*, *eructations* and *regurgitations* of *food* and *vomiting* of *bile*.

In one case in which a lady had suffered four months from regurgitation of bile into the stomach, being reduced to a very low state, the reflux of bile was at once controlled by the application of this pack. It was applied half an hour before each of the two daily meals given the patient, and was retained two hours, so that the process of digestion was begun under the influence of the pack. During the first few weeks of the treatment the difficulty returned occasionally when the compress was omitted, but after a few months, the patient was able to dispense with the pack, and was not only entirely relieved of the distressing symptom, but had gained twenty-five pounds in flesh, and was restored to health. In another case a man had been for years afflicted in the same manner, having frequent attacks, lasting for several weeks, during which time vomiting occurred within a few minutes after each meal. The patient was brought to the Battle Creek Sanitarium in an extremely feeble condition. The hot

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and cold abdominal compress, however, controlled the vomiting in a few days, and the patient's stomach was soon trained to the digestion of a reasonable amount of wholesome and simple food. Scores of similar cases might be related.

Hyperesthesia of the lumbar ganglia of the abdominal sympathetic and of the solar plexus, when extreme in degree, also requires the application of this powerful analgesic procedure. By its daily application for a few weeks, cases in which the ganglia are so sensitive that even very slight pressure excites almost excruciating pain, and in which as a result the abdominal viscera are subject to painful affections of various sorts, may often be made completely comfortable, other constitutional measures being of course employed at the same time. In nervous asthma and disturbances due to disorders of the abdominal sympathetic, this measure renders invaluable service, as may also be noted in the majority of cases of *nervous headache*, or *migraine*, which is likewise a sympathetic nerve disorder. Obstinate vomiting, nausea, including the nausea and *vomiting* of *pregnancy*, yield to this procedure with most satisfactory readiness in nearly all cases.

The hot and cold trunk pack has been found of great service in cases of *hyperpepsia* and in *hypopepsia* attended by *gastric irritation.*

The Hot and Cold Lumbar Pack.— This application is 1368
made the same as for the hot and cold abdominal pack, except that the hot bag or coil is applied over the lumbar region. A large square bag is used for this purpose. This application is of special service as a means of combating portal or renal congestion. Care must be taken to apply the heat over the left kidney, as there is a direct communication between the left renal vein and the portal system.

The Hot and Cold Spinal Pack.— A half sheet, one thick- 1369
ness, wrung out of very cold water, is placed about the trunk in the usual manner for the trunk pack. The patient then rolls to one side, and a long rubber bag half filled with

hot water is placed in such a position that when he returns to the dorsal position, the bag will lie in contact with the center of the back its whole length. The blankets are then drawn around the patient in the usual manner.

This procedure is especially valuable in cases of spinal irritation which are aggravated by cold applications, and in which there is general passive congestion of the viscera of the chest and abdomen,—conditions present in a large proportion of cases of chronic dyspepsia, especially in women. In these cases there is generally an exceeding tenderness of the lumbar ganglia, of the intercostal nerves, and of the whole dorsal region. Hot applications to the spine usually afford temporary relief, but are exhausting and weakening when long continued or often repeated. Much better results are obtained by the application of heat and cold as described.

1370 **The Hot and Cold Pelvic Pack.**—This measure is applied in the same manner as the ordinary cold pelvic pack (**1390**), with the exception that a rubber bag filled with hot water or a coil is placed over the lower abdomen next the wet sheet. The effect of this application is to afford relief in congestions of the pelvic viscera, in which it is as useful as is the hot and cold abdominal pack (**1367**), in congestions of the abdominal viscera.

Method.—The mode of application is precisely the same as that of the ordinary pelvic pack (**1390**), except that a hot water bag or coil is slipped in between the folds of the blanket with one thickness intervening, and so placed as to fall over the uterus and bladder.

Therapeutic Applications.—The hot and cold pelvic pack is indicated in hyperesthesias of the uterus, ovaries, and bladder, in *acute congestion* of any of the *pelvic viscera*, accompanied by *pain* or *muscular spasm*, as *tenesmus* of the *bladder* or *rectum*, and *vaginismus*. Painful *ovarian congestion*, *congestion* and *hyperesthesia* of the *uterus*, *vesical irritation*, *ovarian irritation*,—these and other like conditions indicate the employment of this useful measure, and are gen-

erally very readily relieved by it. *Sexual erethism, irregular* and *painful menstruation*, and the heaviness and indescribable but distressing symptoms with which so many invalid women suffer, yield to this remarkably efficient measure.

SPECIAL FORMS OF COMPRESS.

In addition to the various forms of compress which have been described in the foregoing pages, there are several special compresses worthy of description because of their great practical utility, and concerning which there are various practical points which need to be understood, especially in relation to the technique of their application. These are the *cephalic compress*, the *chest pack*, the *throat compress*, the *neck compress*, the *joint compress*, the *cotton poultice*, the *hip pack*, the *pelvic pack*, the *leg pack*, the *foot pack*, and the *hot* and *cold compress*.

The *roller compress* consists of a long strip of cheese-cloth folded to three thicknesses, and of proper width. Thus prepared, the bandage is rolled up. When wanted for use, it is immersed, wrung out quickly, and applied as soon as possible, so that its temperature may not be modified by contact with the air of the room. A number of such bandages of different widths should always be in readiness for use.

THE CEPHALIC COMPRESS (Fig. 188).

The application is usually made to either the top or the 1371
back of the head. When applied to the back of the head, the upper part of the neck is usually included in the application. The application may be made to the top of the head and the face, to the face and the neck, or to the entire head, — scalp, face, and neck.

In the application of the cold cephalic compress it is necessary to bear in mind the fact that a cold application to the face may have the effect to produce collateral hyperemia of the brain, by contracting the external branches of the carotid artery (**1282, 1262**). A napkin moistened with ice-water

and laid upon the forehead may do more harm than good, by contracting the supraorbital branch of the internal carotid, and thus diverting more blood into its internal branches in the cerebrum. This effect may be readily antagonized by a cold application about the neck, which will contract the carotids and the vertebral arteries and all their branches, and thus aid the reflex action from the face and scalp in lessening the volume of blood in the brain.

These contrary and undesirable effects of cold applications are most likely to occur in conditions in which the vascular tension is low and fluctuating. They may give rise to local or circumscribed cyanosis from vascular spasm, and simultaneous collateral congestion.

In making cold applications for the relief of cerebral congestion, special care should be given to the eyes. The compress should always cover them, and should be well pressed down upon them, so as to utilize the powerful reflex relations which exist between the eye and the brain through the sympathetic.

The same principle governs applications to the hands and feet for relief of inflammatory conditions involving deep structures. An ice-bag over the trunk of the supplying artery (axilla, bend of elbow, groin, popliteal space) will lessen the local congestion, as well as or even better than an application to the whole arm or leg; while an application to the part alone might produce collateral internal congestion.

Physiological Effects.— The effects of the application of cold to the head have already been considered (**1315**). It may be mentioned further that the head compress is less exciting and more sedative than the cephalic douche. Applied continuously, or frequently renewed, the prolonged cold head compress is highly sedative, lessening the cerebral blood supply, and diminishing the activity of the brain. In active congestion, a continuous *very cold* application is best; in passive congestion, it is better to secure vasomotor exercise and fluxion of the brain by means of the repeated impressions obtained by frequent renewals of the cold compress, allowing

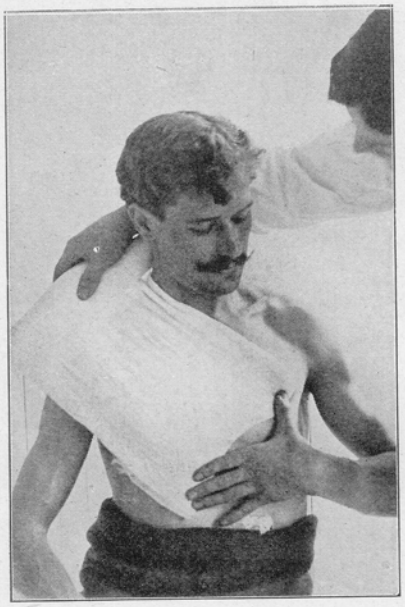


FIG. 189. ROLLER CHEST PACK — First Step (p. 858).

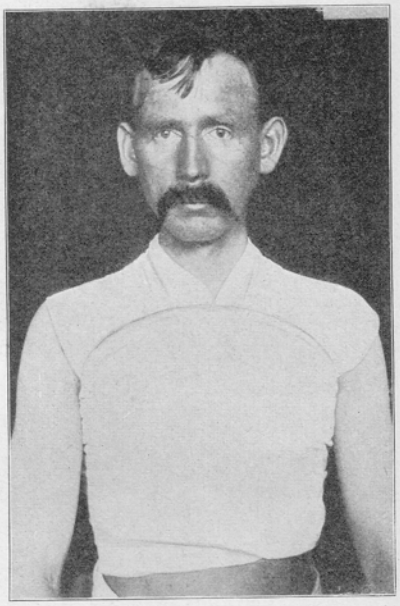


FIG. 190. ROLLER CHEST PACK — Second Step (p. 858).

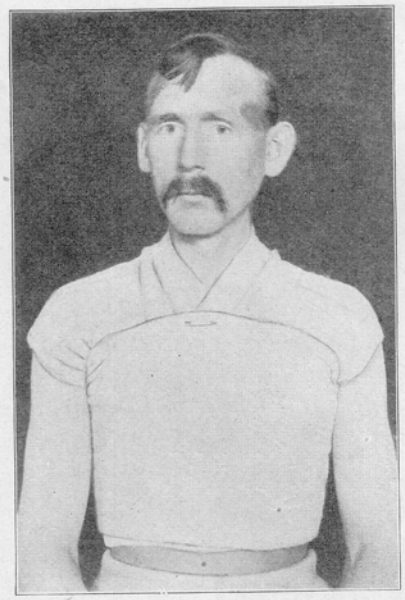


FIG. 191. ROLLER CHEST PACK — Complete (p. 858).

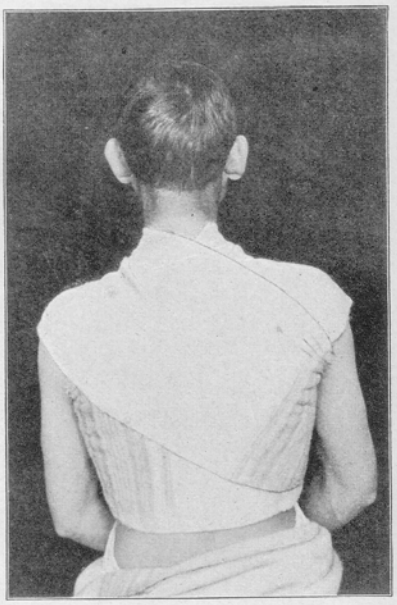


FIG. 192. ROLLER CHEST PACK — Complete (p. 858).

only time for the beginning of reaction effects or slight warming of the compress.

The *short cold* compress increases the cerebral blood supply by reflex reaction effect.

The *hot* or *warm* cephalic compress, or fomentation to the head, congests the cerebral vessels when long applied.

A *short hot* application acts by revulsion to diminish the blood supply of the deeper parts.

Therapeutic Applications.— All forms of *cerebral congestion*, *insomnia* from *cerebral hyperemia*, the *delirium of infectious fevers*, and *congestive headache*, require the cold head compress.

The *hot* head compress, or fomentation to the head, excites cerebral activity, and is of great service in *anemia* in *syncope*, *shock*, and in *collapse* from any cause when associated with cerebral anemia.

The *short cold* compress, followed by drying and rubbing of the scalp, may be used in the same conditions. The hot compress is to be preferred when pain is present, because of its powerful revulsive and analgesic effects.

Continuous cooling of the head may be secured by wetting the hair and allowing the head to remain uncovered. This mode of cooling, however, as also the use of the evaporating compress, is likely to give rise to rheumatic pains of the scalp, because of the long-continued action of a degree of cold sufficient to chill by slow abstraction of heat, but not vigorous enough to induce reaction. The pain is doubtless due to disturbance of the blood supply of the nerve trunks.

The ice-bag applied to the back of the head is a valuable measure in *spermatorrhea* accompanied by frequent losses. The application should be prolonged. It should be applied before going to bed at night, being so adjusted as to rest against the base of the skull while the patient is asleep. In *vaginismus*, and in *masturbation* in women due to sexual erethism, the ice-bag may be applied with advantage to the upper cervical region for twenty minutes several times a day.

In *anemic headache*, the ice-bag may be applied to the upper part of the neck for 1 to 3 minutes. The reaction following increases the supply of blood to the brain. In *nervous asthma*, prolonged applications of the ice-bag to the back of the head will be found advantageous (**1360**). For very rapid beating of the heart, apply the ice-bag for 10 to 20 minutes to the back of the head or to the neck. A precordial compress should be applied at the same time.

THE COLD SPINAL COMPRESS.

372 Cold may be applied to the spine by means of the cold wet compress, or by long rubber bags filled with ice, ice-water, or some cooling mixture. The application may be made to the entire spinal column, or to a particular region, as may be desired. Those portions of the spine which it is most commonly designed to influence are the cervical, central, upper dorsal, middle dorsal, and lumbar regions.

In all cases in which the very cold spinal compress is employed for reflex effects, the compress should be removed every 15 or 20 minutes, and the surface rubbed with warm, dry flannel for half a minute, or until reddened. The surface should never become blue or numb. The frequently renewed cold compress (60°, changed every 15 to 30 minutes) produces powerful fluxion of the spinal cord, and is a useful means of improving the nutrition of the cord, and combating degenerative processes.

Therapeutic Applications.— By means of ice-bags or ice poultices, or cloths wrung out of ice-water and renewed every 3 or 4 minutes, most powerful and useful antiphlogistic effects may be obtained in *meningeal inflammation* of the *spine.* The same measure is useful in *apoplexy* of the spine, in cases of *fever* with very high temperature when spinal complication is feared. Localized cold applications to the cervical region are useful in *congestion* of the *brain, paroxysms* of *dyspnea* in nervous asthma, and *irritation* of the *cerebellum;* to the upper dorsal region for *pulmonary hemorrhage;* to the lower

dorsal region in *nervous vomiting;* to the lumbar region in *uterine* and *renal hemorrhage;* to the whole spine in certain cases of *hysteria*, and in connection with the cephalic compress in the *epileptic state;* to the lower dorsal and the upper lumbar regions in cases of extreme *irritability* of the *genito-urinary centers.*

Cold applications of all sorts to the spine are *contraindicated* in most cases of so-called *spinal irritation*, and in cases of *locomotor ataxia* in which lightning pains or gastric crises are present.

THE CHEST PACK.

This procedure does not differ essentially from packs to 1373
other regions, except that it is confined to the chest. It is commonly applied to the entire chest, both front and back, extending from the neck to the level of the floating cartilages.

Method.— The chest pack may be conveniently applied by means of a sort of jacket fitted to the patient, or better still, by means of a bandage made of one or two thicknesses of linen, or four to six thicknesses of cheese-cloth. The bandage should be eight to ten inches in width, six to eight feet in length, and should be loosely rolled up, dipped into water at the proper temperature, and wrung out without unrolling. The bandage is applied in a sort of "figure 8" fashion, which may be described as follows: The nurse taking the roll of bandage in her right hand, and seizing the end of the bandage with her left, stations herself in front of the patient, who is sitting or standing with the clothing removed to the waist. The end of the bandage is placed against the right side of the chest, and held in place by the patient's hand; or, the application may begin under the patient's right arm, which is pressed against the bandage to hold it in position. The bandage is then carried obliquely across the chest and over the left shoulder; then, passing obliquely downward across the back, it is carried forward under the right arm and then horizontally across the chest in front, under the left arm obliquely upward to the right shoulder, over which the end

of the bandage is drawn and tucked under the transverse fold crossing the chest. The transverse portion of the bandage is then pulled up toward each shoulder, and fastened as snugly as possible by means of safety-pins. The wet bandage should be made to fit the patient tightly everywhere (Figs. 189–192).

A flannel bandage of the same width and a little greater length is applied over the moist bandage in precisely the same manner, care being taken to cover the wet bandage completely, and to make it fit snugly at every point so as wholly to exclude the air. The flannel bandage may be long enough to extend several times about the chest so as to protect the wet bandage as thoroughly as necessary. A bandage of mackintosh cut as in the square pack (Fig. 193) may be placed next the wet bandage when needed.

1374 **The Square Chest Pack.**— This is one of the most convenient and perhaps on the whole the most satisfactory of all the several forms of the chest pack (Figs. 193–197).

Requisites.— A rectangular linen bandage of the proper length, and a woolen bandage of the same shape but larger. The length of the linen bandage should be one and one-half times the circumference of the patient's chest over the largest part, and the width should be sufficient to reach from the top of the shoulder to the lowest rib; the woolen bandage should be two inches wider and the same length. The thickness of the linen bandage depends upon the effect desired: a single thickness of heavy linen toweling is sufficient; if linen sheeting is employed, two thicknesses will generally be required, or four thicknesses of cheese-cloth. The woolen bandage should be of blanket stuff, heavy, soft, and at least two thicknesses. Starting at a point one third the distance from the upper edge of the linen bandage, a slit is torn one third its length; a similar slit is torn at the other end. The woolen bandage is prepared in the same way; also a mackintosh if needed.

Method.— The woolen blanket is spread out on a smooth surface. The linen bandage is now wrung dry out of water

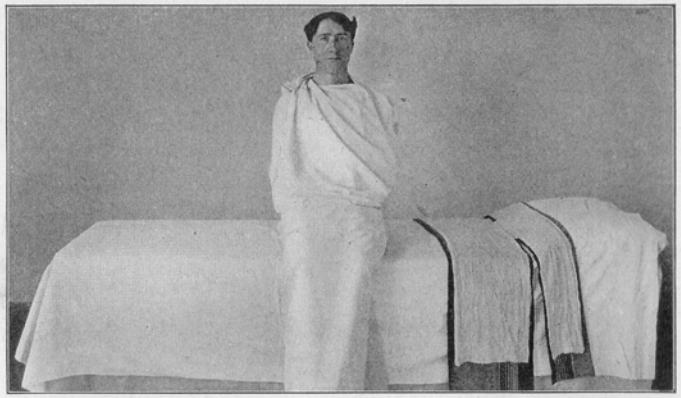


FIG. 193. SQUARE CHEST PACK — First Step (p. 858).

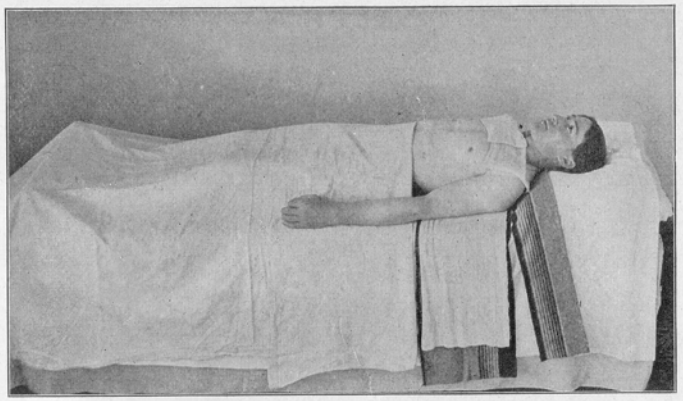


FIG. 194. SQUARE CHEST PACK — Second Step (p. 858).

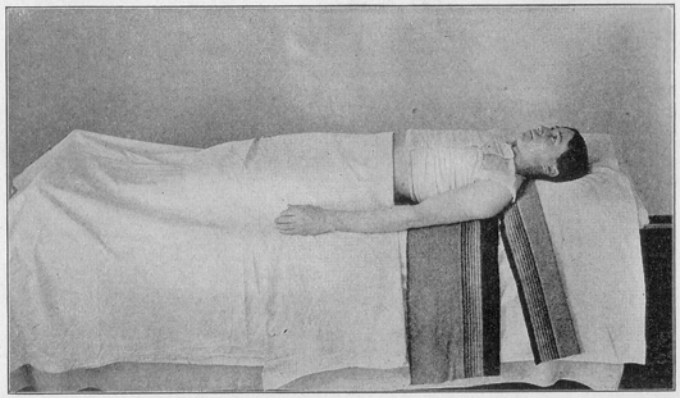


FIG. 195. SQUARE CHEST PACK — Third Step (p. 858).

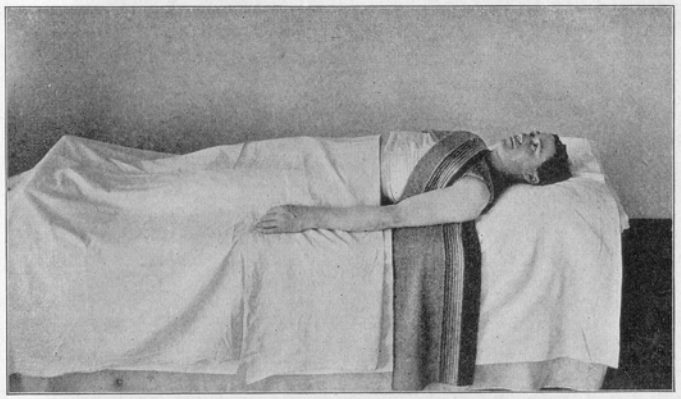


FIG. 196. SQUARE CHEST PACK — Fourth Step (p. 858).

at 60°, and spread out upon the woolen blanket (Fig. 193). The patient having been previously prepared, he sits or is held up for a few seconds while the bandages are spread out on the bed beneath him in such a position that the end of each slit falls exactly at the top of the axilla on each side. When the patient lies down, the upper edge of the woolen bandage should just reach the hair.

The upper tail of the bandage on one side is now drawn across the shoulder toward the opposite side, and the surplus folded back (Fig. 194). The corresponding part of the bandage on the opposite side is adjusted likewise. The rest of the bandage is then adjusted, one side and then the other being drawn over, as shown in Fig. 195. In cases of pharyngitis in connection with acute catarrh of the lungs, the edges of the two shoulder pieces may be brought together close up under the chin, thus making a throat compress. The flannel bandage is now brought across in like manner, care being taken to cover thoroughly all portions of the moist bandage so as to prevent cooling by evaporation. This bandage has the advantage that it is simple, can be very easily and quickly applied, and completely envelops the chest.

The Triangular Chest Pack.— This is a very convenient 1375
form of bandage for use in cases of acute inflammatory processes in the lungs, as pleurisy, pneumonia, bronchitis, tubercular disease, and in patients too feeble to sit up, as in some typhoid cases.

Requisites.— One thick woolen blanket, one linen sheet folded twice lengthwise, one woolen sheet folded cornerwise, a triangular linen or cheese-cloth bandage of three thicknesses, with base four to six feet, height of triangle, three feet.

Method.— Spread the woolen blanket on the bed. Lay the linen sheet folded lengthwise across the bed at such a point that the upper edge will fall an inch above the level of the axilla when the patient lies down. Lay the triangular woolen bandage across the bed with the apex down and the base at such a point as to be level with the occiput when the

patient lies down. Now, wet the triangular linen bandage in the following manner: Fold it by placing the two equal angles of the triangle together, grasping the bandage with the left hand at the middle of the base. Continue folding in like manner until three or four inches wide, then turn the lower end upward, still retaining the hold with the left hand. Dip the whole in water, wring out dry so as not to drip, still retaining hold with the left hand as at the beginning. After the bandage is wrung dry, shake with the left hand until it is completely unfolded. Spread out with the apex down, the base upward, falling parallel with the base of the triangular woolen bandage and one inch below it (Fig. 198). Now let the patient lie down in such a position that the occiput will fall just below the upper edge of the bandage. Next let the attendant lay hold of one lateral angle of the wet bandage, and draw over the shoulders, then the other, covering each shoulder well, and carrying the tips of the bandage across the chest and under the side opposite, leaving the arms out. The woolen triangle is then adjusted in similar fashion, and lastly the folded sheet is brought around the chest, first one end and then the other, binding all together (Fig. 199). When necessary to renew the compress, it may be easily withdrawn after opening the woolen wrappings.

1376 **The Towel Chest Pack.**—This is the simplest and one of the best of all the various forms of the chest compress or pack. It differs from the preceding only in having two large towels used in place of the linen triangle. These are wrung out very dry, and then applied one over each shoulder and across the chest in front and behind, care being taken to cover the whole surface of the chest (Fig. 200). The outer wrappings are then closed about the chest as in the triangular pack. The wet towels must be wrung as dry as possible.

In applying the chest pack in either form described, it is of the utmost importance that the application be made accurately. If the compress is applied in such a way that evaporation takes place, the parts will be chilled, producing an effect

the very opposite to that desired. On the other hand, overheating with too much covering, or by impervious covering, is equally harmful in cases in which it is desired to maintain vascular tone rather than to produce strong hyperemia for derivative effects.

The temperature should be 60° or less, except for very feeble patients who are not accustomed to cold, in which case it may be 70° to 75°, for the first application. If from previous experience it is known that the patient is not able to warm the bandage rapidly, the hand should be dipped in water at 50°, and this should be applied to the chest and neck with vigorous rubbing, followed by drying and rubbing with a warm flannel just before the bandage is applied. This insures good reaction.

The Half Chest Compress.— In certain cases it may sometimes be best to confine the application of the cold compress to one half of the chest. The following simple device answers the purpose admirably, covering the top as well as the sides of the chest, a precaution which should not be forgotten in the treatment of chest affections: — 1377

A broad towel about two feet in length is split down the middle one third its length. It is then wet and wrung out in the usual way, and applied in such a manner that the arm occupies the slit, while one of the two legs passes in front of the shoulder, falling over the top, while the other covers the back of the shoulder (Fig. 201). The flannel covering is then applied in the usual way, and lastly a flannel bandage of square or triangular form, as most convenient.

Another method employs a wide towel of the ordinary length. After being wet and wrung out, it is laid across the shoulder. The upper corners of the towel are carried across the chest, one in front, the other behind, and made to overlap close under the axilla, well covering the side (Fig. 202). The application of the flannel bandage secures the towel in position. The towel may be doubled if necessary, and if long enough, or two towels may be used. If necessary, a

safety-pin may be applied at the top of the shoulder in such a way as to attach the towel to the flannel to prevent its slipping down over the shoulder.

The hot and cold chest pack (**1366**) and the hot and cold lung compress (**1359**) have been fully described elsewhere. They are important modifications of the chest compress which are of special value in the morbid conditions in which they are particularly indicated. The special directions for the use of the chest compress in pneumonia and other pulmonary maladies are given elsewhere.

1378 **Physiological Effects.**— There is no therapeutic agent the use of which rests upon a more thoroughly sound and rational basis than does the employment of the compress in pulmonary affections, especially in pneumonia.

The experiments made by Winternitz and Schlikoff showed that the temperature of the cavity of the chest is diminished within ten minutes after the application of the cooling thoracic compress. The blood-vessels of the chest are made to contract instantly when contact with the cold compress is made. The tidal air is increased more than one third in volume (Exp. 71).

1379 **Therapeutic Applications.**— The chest pack acts powerfully upon the pulmonary mucous membrane. It is of great value in *pulmonary congestion*, and has also been used with considerable success in *pulmonary tuberculosis*. In this disease it controls the *cough*, lowers the temperature, lessens the *night sweats*, and facilitates the healing process by aiding leucocytosis. In *bronchial catarrh* it is of very great service, relieving the congestion by bringing the blood to the surface, thus relieving the cough and the *expectoration*.

In spasmodic asthma the application of the chest pack sometimes brings on a paroxysm of difficult breathing. This tendency may be largely obviated by the application of fomentations to the chest just before the application of the cold compress. The chest pack is a very valuable measure in all cases of *chronic bronchitis*, *chronic pneumonia*, and *chronic pleurisy*,

in connection with fomentations, which should in these cases precede the application of the pack, and especially in that very common affliction known as a cold on the lungs. The fomentations should be very hot and of short duration — 5 to 8 minutes.

The cooling chest compress is applicable in all cases of *congestion* and *inflammation* of the *lungs* and in *pulmonary hemorrhage*. Its employment is especially important at the beginning of pulmonary inflammation. In cases of hemorrhage, very cold compresses should be applied and frequently renewed. Special attention should be given to the surface above the clavicle. The effect of the compress may be intensified by applying ice-bags to the apices of the chest over the cold compress.

A cold compress over the whole chest or over the cardiac region alone is valuable in cases of over-action of the heart, cardiac irritability, or threatened cardiac failure. The effect secured by this application is often very remarkable and almost immediate.

The heating chest compress has great therapeutic value in the treatment of tuberculosis and in chronic bronchial catarrh. When employed for this purpose, the compress should be covered with thin mackintosh or gutta-percha tissue if the patient is feeble and reaction defective. When febrile action is marked, flannel covering only should be used.

The heating chest compress is very useful in cases of chronic pleurisy accompanied by affusion. The pack should be removed once in three or four hours for the application of the revulsive compress, consisting of a fomentation for 4 or 5 minutes, followed by a cold compress for 15 to 20 seconds, the alternation being repeated three or four times.

In cases of chronic bronchitis, the compress should be covered with mackintosh, and should be changed as often as once in every four hours. If allowed to remain too long, so that it becomes superheated, palpitation of the heart and faintness are likely to occur.

When considerable fever is present, as indicated by a temperature of 101° to 102°, the compress should be wet in cool water, or water at a temperature of 60° to 70°, and wrung lightly, so that it may contain, when applied, as much water as possible without dripping. While the fever lasts, this chest compress should be worn night and day. It should be covered lightly, with flannel only, in the summer-time. In the winter-time, if the temperature of the sleeping-room falls below the ordinary living-room temperature, and the patient's powers of reaction are deficient, the impervious covering may be applied. When the cough and the fever are both troublesome, the compress may be worn both night and day.

Precautions.— 1. Every precaution must be taken to avoid chilling the patient. If the towel is too wet, a feeble patient may not be able to warm it up, and may chill.

2. Especial care must be taken to make the dry flannel bandage extend an inch beyond the wet towel above and below, in order to prevent the air from getting under the bandage.

3. When the chest pack is applied at night, the chest must be bathed with cold water and vigorously rubbed on arising in the morning, and a thick flannel wrapping must take the place of the pack, to be worn during the day.

THE HOT CHEST PACK.

1380 This differs from the ordinary chest pack chiefly in that the wet bandage is of flannel, doubled, and is wrung out of hot water. The square form of pack is preferable (**1374**).

The hot chest pack stimulates the circulation of the surface of the chest, thus withdrawing the blood from the bronchial arteries into the intercostals. The pleura is drained into the cutaneous branches of the internal mammary.

The hot chest pack relieves the *pain* of *pleurisy* and *pneumonia*, *cardialgia*, and *spasm* of the *bronchioles* in nervous asthma.

It should not be forgotten that in applying heat to the chest the heart, as well as the lungs, is profoundly affected;

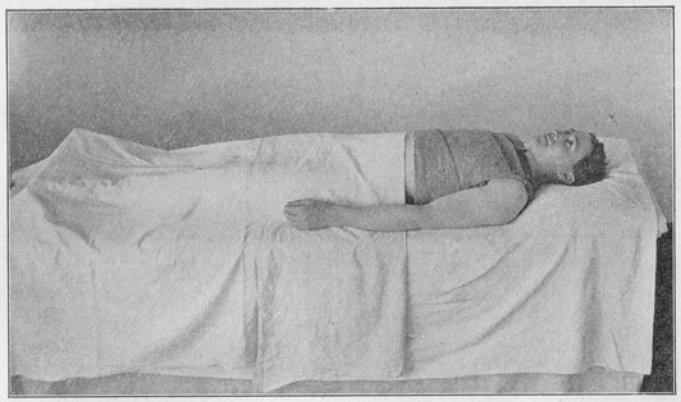


FIG. 197. SQUARE CHEST PACK — Complete (p. 858).

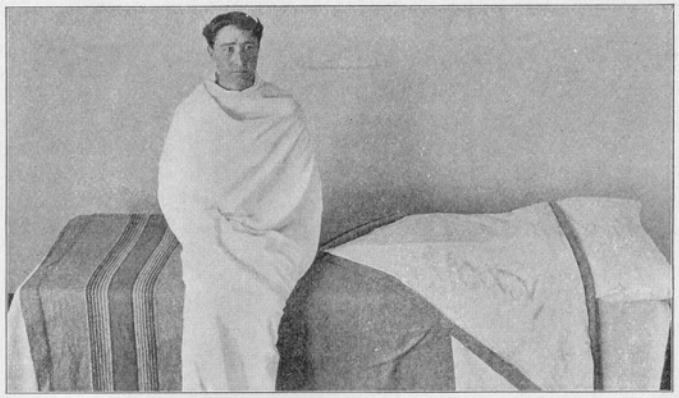


FIG. 198. TRIANGULAR CHEST PACK — Ready for Application (p. 858).

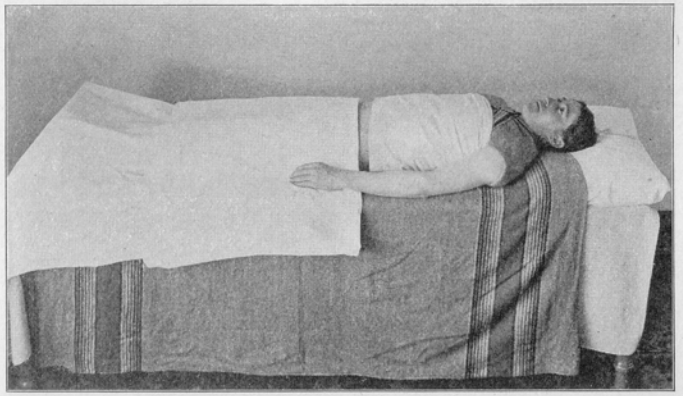


FIG. 199. TRIANGULAR CHEST PACK — Complete (p. 860).



FIG. 200. TOWEL CHEST PACK (p. 860).

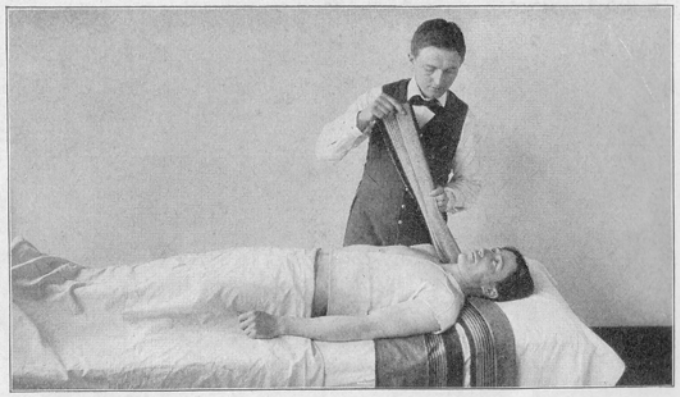


FIG. 201. HALF CHEST COMPRESS (p. 861).

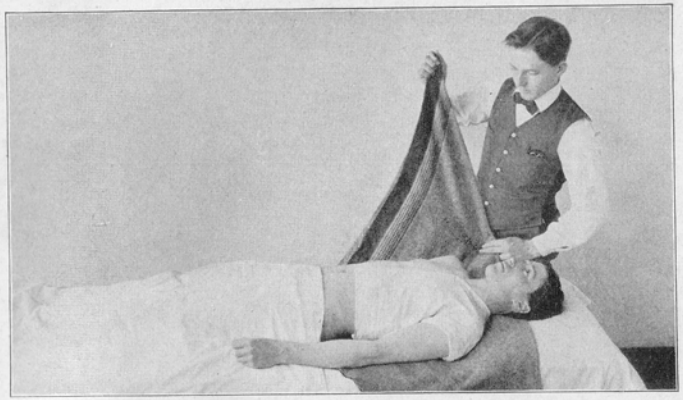


FIG. 202. HALF CHEST COMPRESS — Applied (p. 861).

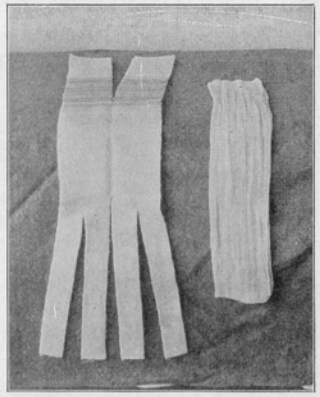


FIG. 203. COMPRESSES FOR THROAT (p. 865).



FIG. 204. THROAT COMPRESS — First Step (p. 865).



FIG. 205. THROAT COMPRESS — Second Step (p. 865).

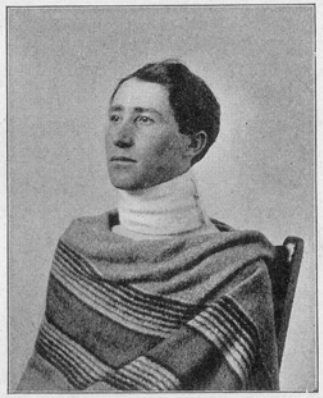


FIG. 206. NECK COMPRESS (p. 865).

hence care must be taken to avoid this application in cases in which there is grave organic disease of the heart, especially when cardiac weakness is marked.

THE THROAT COMPRESS.

In this compress it is desirable to bring under the influ- 1381
ence of the application the skin covering the lower jaw from the chin backward, the sides of the face from the angle of the jaw to the ear, and the sides and back of the neck. The compress wound about the neck is of very little use for the ordinary sore throat in which the fauces and perhaps the tonsils are involved.

The compress is prepared as follows: For the wet compress, fold a piece of cheese-cloth to four or six thicknesses, four inches in width, and length sufficient to reach one and one-half times around the neck. For the flannel covering, provide a piece of soft blanket flannel eight inches wide and long enough to reach around the head and beneath the chin and overlap an inch. Fold the flannel crosswise, and split it down the middle to within an inch of this fold. Open, and split again each of the two legs of one end. Apply first the wet bandage from behind, crossing the ends under the chin and folding up against the sides of the neck, covering also the back of the cheek to the ear. Now apply the flannel bandage as shown in Figs. 203, 204, 205. If protection is required, apply a strip of mackintosh next the wet cloth.

This is a very excellent application for the relief of chronic sore throat. It may be applied at bedtime and removed in the morning. On removal rub the throat with very cold water.

The throat compress in acute inflammation should be covered with flannel only. If mackintosh is used, apply flannel outside to prevent too rapid radiation.

The hot compress for sore throat is applied across the jaws behind the chin and to the sides of the face. The dry ends may be fastened above the head, and a cold compress applied about the neck at the same time.

THE NECK COMPRESS (Fig. 206).

1382 This consists simply of a linen cloth wrung out of water at the right temperature and wound about the neck, covered with flannel or flannel and oilcloth.

For acute laryngitis the bandage should be wet in water at 60° to 70°, wrung moderately dry, and covered with flannel only. It should be changed just before the bandage becomes dry. In cases of chronic laryngitis the bandage should be wrung out of very cold water, and covered with flannel and mackintosh. On removing the bandage in the morning, the parts should be thoroughly rubbed with cold water, and should be protected by the dry bandage during the day.

Physiological Effects.—Through the reflex effects to be obtained by the application of this bandage to the skin over the larynx, and through its influence upon the sympathetic centers of the neck, the procedure is capable of exerting a very decided influence upon the mucous membrane of the larynx and the various organs concerned in speech, promoting activity of the mucous membrane, and relieving congestion and irritation of the larynx and the pharynx, which are often the cause of chronic cough.

It must be remembered, also, that warm applications to the throat enlarge the great arterial trunks conveying blood to the head, and hence may produce cerebral congestion. For this reason, throat wrappings should not be unnecessarily warm. The compress should generally be covered with flannel only, and *should not be left in place after it becomes dry.*

Therapeutic Applications.—The heating throat compress is useful in *colds*, *acute inflammation* of the *larynx* and *pharynx*, in *whooping-cough*, *diphtheria*, *croup*, *clergyman's sore throat*, and in all cases in which a derivative effect is indicated in this region of the body.

Sore throat, *catarrh* of the *larynx*, and so-called "cold in the head" are promptly relieved by the heating compress, if applied immediately after the cold has been contracted. The compress should be wrung out of cold water; and if applied

for sore throat, should be lightly covered with flannel, and changed every four hours; if for *chronic catarrh* of the *larynx*, it should be covered with impervious material, so as to secure vigorous revulsive effects. General treatment is also required.

The continuous warm compress to the throat may sometimes render useful service in cases of marked *cerebral anemia*, as also in *pernicious anemia*.

When used for antiphlogistic effects, a simple compress of six or eight thicknesses of cheese-cloth is required. This is freshly wrung out of cold water every four or five minutes. It should never be allowed to become heated, it being necessary to suppress reaction completely and contract the deep vessels, in order that the antiphlogistic effect desired may be produced.

Duval* reports a case of very severe *torticollis* cured by the heating compress in connection with general cold ablutions. The compress was renewed every two hours, and remained in place until profuse sweating was occasioned.

THE PRECORDIAL OR CARDIAC COMPRESS.

The application consists of a compress applied to the por- **1383**
tion of the chest wall over the heart. This comprises the space bounded by the second rib above, the right border of the sternum, a line falling one-half inch to the right of the nipple, and the sixth rib below. The compress should be large enough to cover this space and to extend at least two inches outside it. Ordinarily, the best effects are produced by employing water at a temperature of about 60°. The compress should be wrung moderately dry, and should be very lightly covered. It is desirable that cooling by slow evaporation should be encouraged, and should continue for some time. The heating compress, when applied over the heart, may produce a depressing effect. The compress should be changed as soon as it becomes decidedly warm, or before.

* "Ann. de Cher et d' Orthod.," 1896, IX, 73, 76.

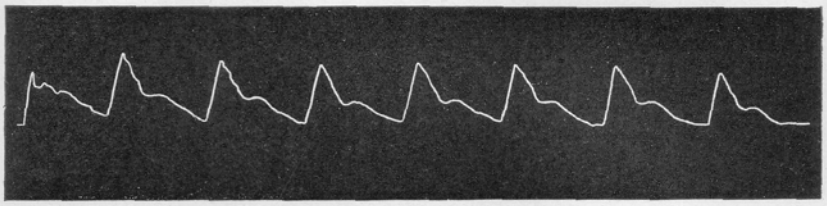
Ordinarily the cooling compress will need to be changed every 15 to 20 minutes. The ice-bag may be used in place of the cold compress, and has even been used continuously with excellent results to control high temperature. A single thickness of flannel should protect the skin.

Physiological Effects. — The effect of the precordial compress is first to increase the activity of the heart. The heart makes stronger, more vigorous and frequent contractions than before the application; within a few minutes, however, the rate of the heart-beat will become slower; and within half an hour, when the application has been rightly adapted to the case, the pulse-rate will be considerably slowed, arterial tension increased, and the first sound of the heart considerably accentuated, the upstroke in the sphygmographic tracing being much quicker and longer, indicating a larger movement of the heart (Fig. 207, A and B). (Exp. 72).

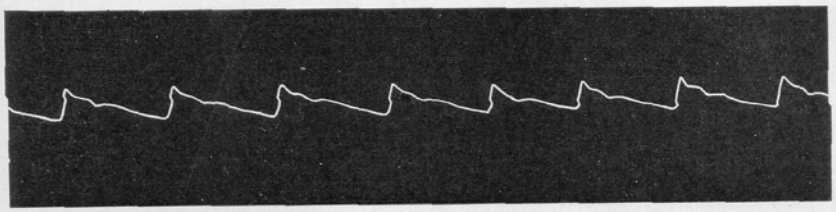
Experiments made with the heart separated from the body have shown that cold water dropped upon the heart slows its action, while hot water quickens it. That the opposite effects are produced by the application of hot and cold water to the skin is due to the fact that the impression made upon the heart by cutaneous applications is reflex. When the heart is directly cooled by an ice-bag long applied, the uniform effect is slowing of its action.

The effect of cold upon the heart has been quite fully discussed elsewhere in this work, and need not be further dwelt upon here (**514**).

1384 **Therapeutic Applications.** — Frequent application of cold over the heart is indicated in the feeble heart of *low fevers*, especially when *cardiac failure* is threatened, in the early stage of the disease. Very cold or continuous cold applications should not be made when there is evidence of cardiac degeneration resulting from neglect of proper treatment of the case during the first week or two after the beginning of the attack. If continuous applications are employed, the compress or ice-bag should be removed every half hour, and the



(*a*). Before Application (Tension Low).



(*b*). After Application (Tension High).

FIG. 207. SPHYGMOGRAPHIC TRACINGS SHOWING THE EFFECTS OF THE COLD CARDIAC COMPRESS IN RAISING THE BLOOD PRESSURE (p. 868).

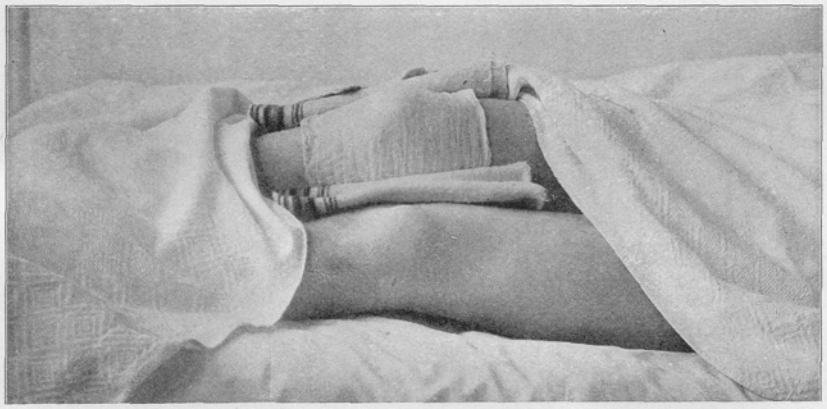


FIG. 208. JOINT COMPRESS (p. 872).

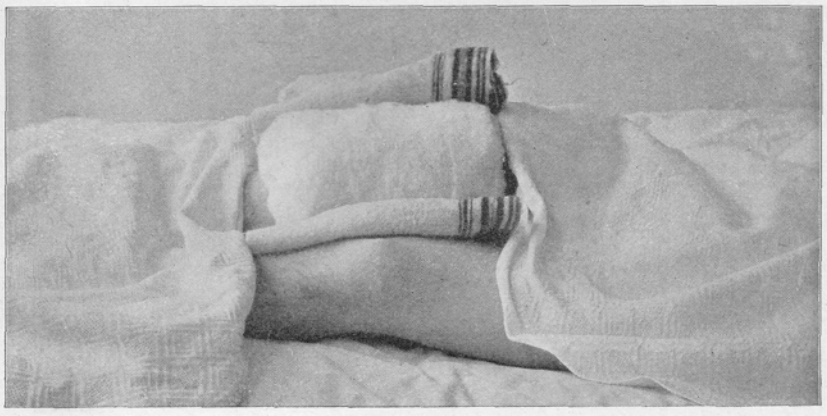


FIG. 209. COTTON POULTICE (p. 872).

skin surface to which the application is made should be rubbed vigorously, or sponged with hot water. In many cases of cardiac weakness, especially in *chronic cardiac insufficiency*, *bradycardia*, *tachycardia*, and other functional disorders of the heart, the cool or cold compress may be applied three times a day (15 to 30 minutes). This measure is also valuable in cases of overaction and irritability due to valvular disease of the heart in which there is no degeneration of the heart muscle.

In the acute form of *endocarditis*, and in *myocarditis*, the cool compress should be applied continuously. Each time the compress in changed the moistened surface should be rubbed with the warm hand until red through reaction. In *chronic endocarditis*, the cold compress should be applied for half an hour three times a day. The effects of the precordial compress are greatly augmented by general cold friction and other general procedures.

The cold compress is indicated in most cases in which the prevailing practice calls for alcohol, digitalis, or strychnia. All the good effects which it is possible to obtain from these drugs may be secured by the precordial compress, combined with other hydriatic measures, thus avoiding the undesirable effects of the drugs. Alcohol lowers the blood pressure instead of raising it, and adds to the toxic elements in the blood, lessening vital resistance, and also weakening the heart. Digitalis and strychnia, while they seem to strengthen the heart, at the same time increase its work, and add to the toxins already present in the body another powerful poison. The precordial compress is valuable in cases of aortic insufficiency with dilatation, or beginning degeneration of the vessels, also in endocarditis, whether acute or chronic.

A very useful application for the cold precordial compress is during *chloroform anesthesia*. It is the author's invariable custom to employ a cold compress for this purpose whenever the administration of chloroform is necessary. An ice-bag is used, which is applied, not directly to the skin, but over one thickness of thin flannel. Every ten minutes the ice-bag is re-

moved, and the parts rubbed with dry flannel until warm and reddened. A failure of the parts to react or the appearance of an areolar cyanosis (a mottled bluish appearance) constitutes a warning sign of excessively depressed nerve centers, so that the application becomes a guide to the physician administering the anesthetic. Its most important use, however, is to support cardiac activity by maintaining powerful reflex stimulation of the cardiac centers. It is the author's opinion that few deaths from chloroform would ever occur if this measure were uniformly resorted to. The ice-bag should not be applied at the beginning of the anesthesia, except in cases of extreme cardiac weakness. The proper time for the application is after the first or irritant effects of the anesthetic have disappeared, and the secondary effects have become pronounced. This will usually be within five to six minutes after the beginning of the administration.

The same measure is also of value in *ether anesthesia*, but it is well in the latter case to employ a cheesecloth compress rather than the ice-bag, and to extend the application to the whole anterior surface of the chest. The compress should be applied at 60°, and changed every 15 or 20 minutes. The square compress wrapping may be advantageously used in these cases. If the anesthesia be prolonged, the pack may be changed once in 10 to 15 minutes and the precordial region vigorously rubbed with the hand dipped in ice-water for 20 seconds. This procedure may be employed in connection with anesthesia with very little inconvenience, and enormously lessens the risk of death from heart failure in chloroform poisoning or from acute pulmonary congestion or bronchopneumonia after ether administration.

385 *Indications for the Application of the Cold Cardiac Compress.*— According to Winternitz, the indications for this measure are the same as for digitalis:—

"1. The application of cold over the heart diminishes its temperature, and is therefore useful in inflammation of the heart and pericardium.

"2. The temperature of the blood is by this means reduced, and hence this measure may be usefully employed in fever in connection with other antithermal measures. If antithermal drugs are employed, cold applications should be applied over the heart, for the reason that antipyrin acts injuriously upon the heart, and lessens the tone of the vessels, thus leading to collapse; whereas the cold precordial compress has the opposite effect.

"3. In all conditions of cardiac weakness, no matter from what cause, cold applications over the heart may be employed.

"4. When the blood pressure is low, the application of cold is especially useful; hence this measure may be employed in all serious disturbances of the heart, as in adynamic fevers and in functional disorders of the heart.

"5. By aiding the pulmonary circulation, cold applications over the heart are useful in a congested condition of the lungs, in bronchial hemorrhages, and bronchial catarrh resulting from stasis in the pulmonary vessels."

A moderately hot compress may be applied over the heart in the weakness of that organ which occurs in hysteria with anemia (110° for 10 min.).*

Contraindications.— The cold precordial compress is to be **1386** avoided in the *fatty degeneration* of the *heart* muscle which occurs in the advanced stages of cardiac disease, and in *diabetes* and *nephritis*. In *emphysema*, when the disease is well advanced, the beneficial effects of cold applications upon the heart are diminished, because of the condition of the lungs. One of the most important, but not sufficiently appreciated, effects of hydric applications consists in the modification of the elasticity and tonus of both the vessel walls and the tissues. As a loss of tonus and elasticity in the vessels produces stasis, hyperemia, and predisposes to inflammation, the restoration of the tonus of the vessels and tissues removes the disease of the vessels thus caused.

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* Thermes. *Ann. Soc. Hydrol. Med.*, Paris, 1879-80, XXV, 224-295.

It has been clearly demonstrated that diminished tone of the vessels and tissues produces a positive and decided diminution of cardiac energy, and that the restoration of the vessel tone will, to a marked degree, remove the derangements which may be produced by organic ailments of the heart. From a hydriatic standpoint, the loss of vessel tone is a symptom the removal of which is of the highest importance to restore normal conditions of the circulation.

THE JOINT COMPRESS (Fig. 208).

1387 This consists simply of a bandage wet in water of the proper temperature, wound around the joint, and covered with flannel, cotton, and oiled muslin, or some other impervious material. In cases of acute joint disease with pain and swelling, a moderately wet compress should be applied, at a temperature of 60° to 70°, and flannel or cotton-wool protection should be used. In *chronic joint affections* accompanied by stiffness, *exudates*, etc., the compress should be wrung dry, out of very cold water, and should be very thoroughly protected by means of several coverings of flannel or a thick mass of cotton and oiled muslin or mackintosh outside of all. In the acute form of the disease, the compress should be changed often enough so that it will not become dry. In chronic cases, the compress may be worn at night only, in ordinary cases. In the morning the joint is rubbed first with the hand dipped in cold water, then with oil, and protected by several thicknesses of flannel bandage, properly adjusted, to be worn during the day.

THE COTTON POULTICE (Fig. 209).

1388 This consists simply in the application to a part of a mass of dry cotton covered with mackintosh or other impervious material. The cotton is soon moistened by the retained perspiration, and thus the effect of a poultice is obtained, but in a much more cleanly and convenient manner. The cotton poultice is especially valuable in *chronic joint affections.*

THE HIP PACK (Fig. 210).

1389 This application is confined to the skin area extending from the umbilicus to the middle of the thighs.

The materials needed are the same as for the half-pack (**1196**), and the method is the same. For the cold pack a folded linen sheet is used; for the hot pack, a folded woolen blanket.

The cold hip pack has a pronounced effect upon the pelvic viscera, just as the trunk pack affects profoundly the abdominal viscera. Judiciously used, it has a powerful tonic and alterative effect upon the organs of the pelvis.

The *cold* pack should be avoided in cases in which severe neuralgic pain is present, in *acute inflammation* of the appendages, *chronic uterine* or *ovarian pain*, and *menstruation*.

The *hot* hip pack is a highly stimulating procedure, and one of the most excellent means of relieving, temporarily at least, *menstrual pains*, whether of uterine or ovarian origin, by the powerful revulsion produced. If the menstrual flow is increased by the application, this tendency may be counteracted by the hot vaginal douche applied immediately before or afterward, the patient remaining in bed.

Not infrequently the good effect of a hot hip pack is lost by exposure of the body to chill directly afterward. It should be remembered that, like all other very hot applications, it usually gives rise to general sweating, and hence may readily expose the patient to chill with all the resulting consequences, if proper precautions are not adopted.

Some form of the cooling bath, as cold friction (**1209**), the wet-hand rub, or cool towel rub, should be employed directly after the hot hip pack, and care should be taken to secure gradual cooling off.

THE PELVIC PACK (Figs. 211, 212, 213).

1390 Spread a woolen blanket on the couch as for the wet-sheet pack. Fold a woolen sheet once lengthwise, place transversely across the couch in such a way that when the patient lies

down upon it, the sacrum will fall in the center of the sheet each way. Fold another woolen sheet cornerwise, and lay across the table with the apex pointing down and the base at such a point that when the patient lies down, the upper edge of the blanket will fall a couple of inches above the umbilicus and a little below the sheet folded lengthwise. Now wring out a cotton sheet cut or folded cornerwise in the shape of a triangle a little smaller than the woolen triangle, and place upon the couch with the apex down and the base an inch below that of the woolen triangle.

The patient should now lie down upon the couch face upward, and in such a position that the upper border of the wet sheet will fall at about the level of the umbilicus. The legs are drawn up and the knees widely spread, and the feet placed one on each side of the apex of the triangular wet sheet. The apex of the wet sheet is drawn upward until it fits the perineum tightly, the apex lying upon the sternum, the sides being spread out over the abdomen as much as possible. The legs are now extended, and the lateral triangles of the wet sheet are brought over one by one and wrapped about the thighs in such a way that the skin of the abdomen, hips, thighs, and perineum is everywhere covered by one thickness of sheet. The apex of the triangle is now turned down over the abdomen so that the fold will come at the level of the umbilicus.

The woolen sheet is adjusted in just the same way, only the lateral angles are carried over and tucked under the opposite thigh. Now draw over the ends of the folded sheet, and tuck under the sides, drawing as snugly as possible, so the patient will warm up very quickly. Last of all, wrap the patient in the large woolen blanket first spread upon the couch. The remainder of the procedure is now the same as for the general wet-sheet pack.

Three stages may be recognized:—

1. The *tonic* stage,—from the beginning of the pack until the patient feels warm and comfortable. The effect upon the pelvic viscera is to excite vascular and nervous activity.

2. The *neutral* stage,— while the patient is reacting until the normal temperature of the skin is reached. When the temperature of the skin begins to rise, the neutral stage ends. This stage is quieting, calmative.

3. The *heating* stage commences when the temperature of the skin begins to rise, and continues to the point when perspiration begins. This stage is *derivative.*

4. The *sweating* stage begins at the end of the heating stage, and lasts as long as the patient continues to perspire, which may be two or three hours. This stage is exciting. It is rarely used with the pelvic pack.

In cases in which reaction is poor, a hot sitz may be administered for 4 or 5 minutes just before the pack, or a hot hip pack for 6 to 8 minutes, or a fomentation over the hypogastrium. This pack is generally used for tonic effects and as a training for the cool sitz bath. The application is continued from 20 to 30 minutes, or until the patient feels comfortable.

In the *hot and cold* pelvic pack when used to relieve chronic pain, ovarian irritation, etc., for which it is a most excellent measure, the procedure is precisely the same, except that a bag filled with hot water is slipped between the blankets over the lower abdomen in such a way that one thickness of flannel will intervene between it and the wet sheet. The temperature of the bag should be as high as the patient can bear. The thermophore is preferable to the hot water bag, as the heat is more evenly distributed, and lasts longer. The duration of the pack varies from 20 minutes to two hours, according to the indications.

In applying the *hot pelvic pack*, the procedure differs somewhat from the preceding. The several coverings are arranged exactly as in the wet-sheet pelvic pack, except that the triangular linen sheet is folded so as to be about two feet greater in width, and is not wet. The triangular woolen sheet is wrung as dry as possible out of water at 160°, and laid over the triangular sheet. The patient, his head having

been previously protected by cooling and the application of a cold towel, lies down upon the couch, and is enveloped as previously described, the dry triangular sheet being adjusted so as to maintain close contact with the body at every point. Then the side angles are brought up and tucked in; the apex is firmly drawn up between the legs and securely fastened. The cotton sheet is then adjusted in like manner, and a folded woolen blanket drawn about the hips.

1391 **Physiological Effects.**— The pelvic pack is intended especially to influence the pelvic viscera, the bladder, the lower colon, the rectum, the testes and prostate in men, and the ovaries and uterus in women. Applied in the manner indicated, it acts upon those surfaces which are in most intimate reflex relation with the viscera of the pelvis; namely, the cutaneous surfaces of the lumbar region, the lower abdomen, the inner surface of the thighs, and especially the cutaneous covering of the external genitals. If the sheet is simply wrapped about the hips, instead of being drawn up between the legs in the manner described, the genital surfaces and the inner surfaces of the thighs are not reached, and hence these most important reflex areas are not brought under the influence of the procedure.

The effects of this procedure upon the pelvic viscera depend upon the exact mode of application, the temperature of the water employed, the length of the application, and the special conditions or susceptibility of the patient, as is the case with other hydric procedures. If the wet sheet is wrung very dry out of very cold water, and the application continued only until reaction is well established, the effect is to encourage the circulation of the pelvic viscera and to energize all the other functions. Such an application is in brief an excellent physiological tonic for the pelvic viscera. If an application given in the manner described is continued for an hour or two, or until the skin is strongly excited, a powerful revulsive effect is exercised upon the viscera of the pelvis. This is one of the most effective means of decon-

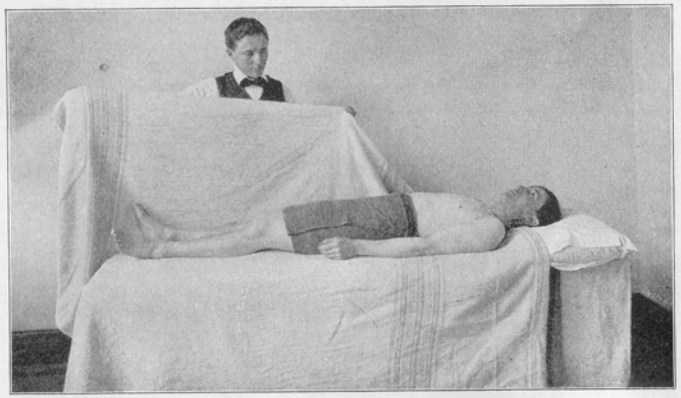


FIG. 210. HIP PACK (p. 873).

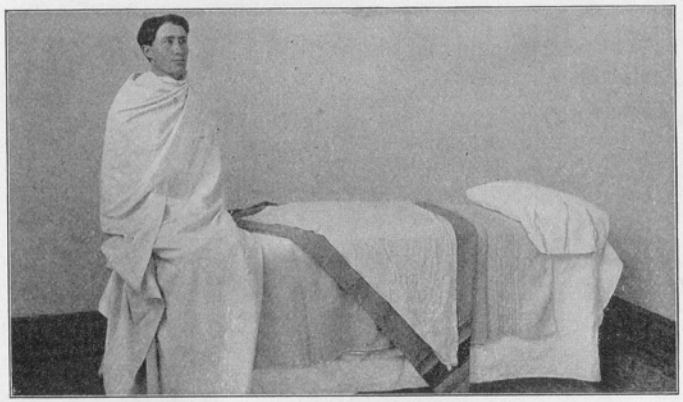


FIG. 211. PELVIC PACK — First Step (p. 873).

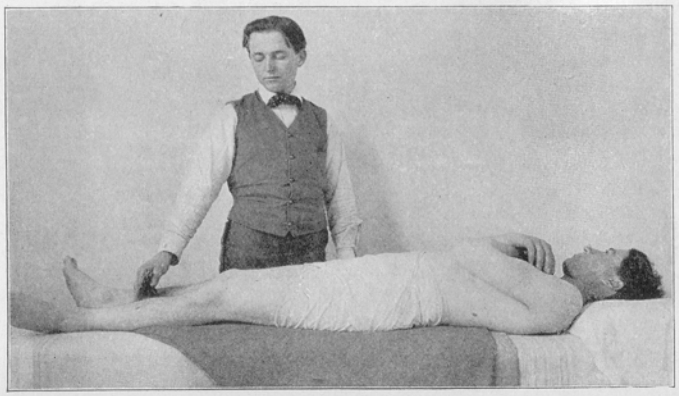


FIG. 212. PELVIC PACK — Second Step (p. 873).

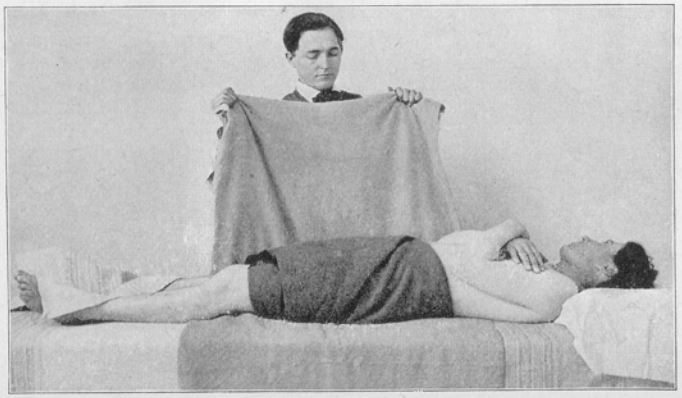


FIG. 213. PELVIC PACK — Third Step (p. 873).

gesting these organs. The application of the pelvic pack at a temperature of 60° to 70°, the application being renewed every 20 to 30 minutes, exercises a powerful influence upon the pelvic blood-vessels. By its continued excitant effect upon the vaso-constrictors, permanent contraction is produced in the small vessels of the pelvic circulation. If the wet sheet is slightly wrung out of very cold water, the effect is to produce powerful constriction of all the pelvic vessels.

The hot pelvic pack exercises a powerful revulsive effect upon the pelvic viscera. If continued for some time, pronounced excitant effects are produced through the stimulation of the sympathetic nerves in relation with these parts. Very pronounced and permanent derivative effects may be produced by the hot pelvic pack, followed by a prolonged cold pack applied to the same surface.

Therapeutic Applications.— Of the four principal methods 1392
of applying the pelvic pack, each has its special therapeutic indication. The *short cold* pack, with the wet sheet wrung very dry, is tonic in its effects, and is of the greatest value in most cases of *chronic pelvic disease* in which neither active inflammation nor acute congestion is present, and in which pain is not a prominent symptom. It is indicated under the same conditions as the rubbing sitz, but is a less vigorous procedure, and may be employed with very feeble patients who have poor powers of reaction or who are too fatigued to react properly to the rubbing sitz. It is a hydriatic procedure of great service in cases of *uterine* and *ovarian prolapse* due to a relaxed condition of the muscles and ligaments connected with the pelvic viscera, in *amenorrhea*, *irregularities* of *menstruation*, *chronic inactivity* of the *lower bowel*, *backache*, *enteroptosis*, *sexual weakness*, and *impotence*.

The cold-sheet pelvic pack, prolonged until cutaneous excitation is produced, or as it may be termed, the *heating* pelvic pack, may render special service in cases of *chronic passive congestion* of the pelvic viscera, as *chronic colitis*, *chronic metritis*, *chronic ovarian congestion*, *amenorrhea* resulting

from arrested development, *excessive involution* after childbirth. It should be followed by a short cold application, as the cold douche, cold friction, affusion, or cold rubbing sitz for 20 to 30 seconds, at a temperature of 70° to 75°. The length of the application and the temperature must of course be suited to the particular case in hand.

The *repeated* pelvic pack, employing water at 60° to 70°, with a quite wet sheet, changed every 30 to 40 minutes, is a measure of great efficiency in cases of acute *congestion* or *inflammation* of the *pelvic viscera.* The blood-vessels of the viscera are not only contracted, thus preventing stasis and an increase of the inflammatory process, but the vital activities are excited and maintained by stimulating impulses continually received from the surface; and thus the disease process is antagonized and brought to an early and successful issue. This measure is of great value in *non-suppurating inflammations* of the *ovaries* and *tubes*, *pelvic peritonitis*, *acute metritis*, *vaginitis*, *proctitis*, *dysentery*, *prostatitis*, *urethritis*, and *orchitis.* By the application of water at a moderate temperature to the entire cutaneous surface reflexly associated with the pelvic circulation, much more pronounced effects may be obtained than by water at a lower temperature applied to a smaller surface. These cool and moderately cold applications are also much more effective than extreme cold in relieving visceral congestion. Their efficiency is greatly increased by a hot leg pack given at the same time.

When an acute inflammation or congestion is accompanied by pain, a *hot* pelvic pack or fomentation may be substituted every hour or two for the cold application; but the duration of the hot pack should not be more than 15 to 20 minutes, and the temperature should be as hot as can be endured.

The *very cold* pelvic pack sometimes renders valuable service in cases of *uterine hemorrhage.* The author has been able by this means to control at once uterine hemorrhages which had resisted all other measures for weeks. A hot application must be made to the feet simultaneously.

The *hot* pelvic pack is most useful as an analgesic measure in all *painful affections* of the *pelvis*. It renders the highest service in cases of *dysmenorrhea*, *ovarian neuralgia*, and all neuralgiac affections of the pelvic viscera, also in *enteralgia*, *sciatica*, and *coccygodynia*.

The *hot and cold* pelvic pack (**1370**) may render special service in cases in which the combined influence of heat and cold is desirable. The procedure may consist of a hot pelvic pack with an ice-bag over the inflamed part, or a cold pelvic pack with a hot bag over the part interested.

Contraindications and Precautions.— The pelvic pack, to be of real service, must be carefully adapted to the condition in hand. For example, prolonged cold applications must not be made in cases in which pain is a prominent symptom, as the almost certain result will be a great increase of the pain. The very cold pack should also be avoided in inflammatory conditions, because of the resulting reaction and the collateral hyperemia induced. Long-continued hot applications also tend to increase inflammatory action in salpingitis, peritonitis, and other similar conditions. In such cases the hot pack may be used only at intervals of three to four hours, the cooling pelvic pack being employed in the interim.

Care should be taken in the employment of the cool or cold pelvic pack that general chilliness is not induced, or the proper effect of the application will be negatived. Likewise, in applications of the hot pelvic pack profuse perspiration is to be avoided.

THE LEG PACK (Fig. 214).

Either one or both legs may be included in this procedure. **1393**

Requisites.— The same materials are needed as for the trunk pack, though the wrappings may be smaller.

Method.— In the application of a leg pack, each leg should be wrapped in the wet sheet separately and closely (Fig. 214). The legs may be rubbed outside the wrappings, if necessary, to encourage the circulation. The temperature should be

60° for the cold pack, and as hot as can be borne for the hot pack. A linen sheet is used for the former, a blanket for the latter.

Physiological Effects.— The leg pack is a powerful derivative measure. Applications made to the legs affect to a marked degree the circulation in the head, throat, chest, and pelvis.

Therapeutic Applications.—The leg pack may be used to excellent advantage as a derivative measure in quite a large class of cases, as in *cerebral congestion*, *pulmonary congestion*, *coldness* of the *feet* and *legs*, resulting from irritation of the sympathetic nerves and spasm of the blood-vessels of the lower extremities. The cold leg pack is of special value in cases of *paralysis* in which the skin is cold, purplish, and inactive. The application should be preceded by a hot leg bath. The *hot* leg pack is exceedingly useful in cases of *neuralgia* of the legs, in *hemiplegia*, and *paraplegia* with defective circulation, as shown by a purplish tint of the skin. It is also a very useful measure in cases of *chronic rheumatism* confined to the knee and ankle joints, and as a derivative measure.

THE FOOT PACK (Fig. 215).

1394 This resembles the leg pack, but differs from it in that the feet and ankles only are involved.

The patient lies upon a cot while each foot is separately wrapped in a towel wrung out of cold water, and a blanket carefully folded about the feet and legs to the height of the knees. The entire body is then wrapped in another blanket, so as to suppress any disposition to chilliness.

Therapeutic Applications.— The foot pack is of great value as a means of relieving *cold* or *sweating feet*, and for *insomnia*. The pack should be applied at night, and allowed to remain in place for a few hours, or overnight. On its removal, the feet should be carefully sponged with cold water, and afterward dried and rubbed.

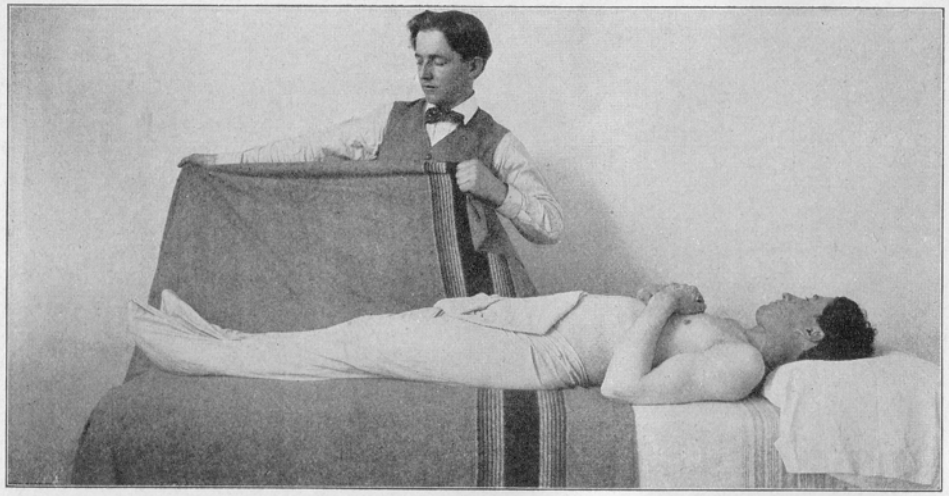


FIG. 214. LEG PACK (p. 879).

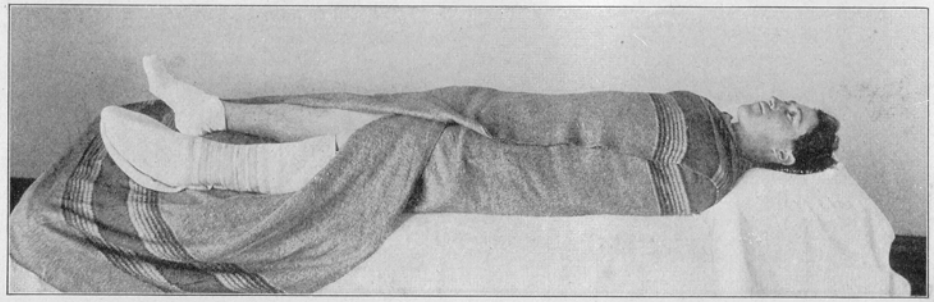


FIG. 215. FOOT PACK (p. 880).

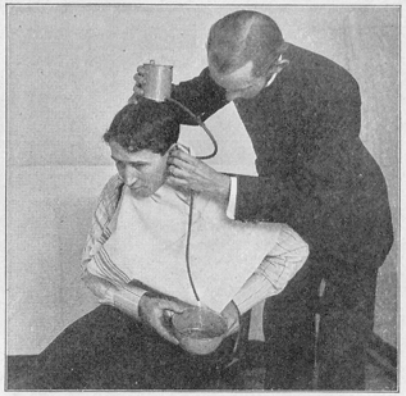


FIG. 216. IRRIGATION OF EAR (p. 881).



FIG. 217. IRRIGATION OF EYE (p. 883).

THE PERINEAL COMPRESS.

For rectal, bladder, or genito-urinary affections requiring **1395** antiphlogistic treatment, the cold compress may be applied in such a manner as to cover the perineum and the external genitals, extending over the bladder in front and the anus and nates behind. The temperature of the water employed should be about 60° to 70° F. The compress should be changed every 20 to 40 minutes. It should be lightly covered.

Therapeutic Applications.— This measure is especially valuable in cases of *rectal irritation*, *leucorrhea* of the *rectum*, *acute inflammation* of the *prostate*, *chronic gleet*, *vaginal leucorrhea*, and *uterine* and *ovarian congestion*. Fomentations may be applied to the region when required for revulsive effects, or to relieve pain or tenesmus in the rectum, bladder, urethra, or uterus. A hot perineal compress combined with a heating pelvic pack (**1390**) is a most efficient analgesic and antiphlogistic procedure.

IRRIGATION.

Irrigation differs from the douche in the fact that the element of mechanical excitation is entirely eliminated through the application of water without pressure. Irrigation is applied to both the skin and the mucous membrane. The application is made by means of a reservoir or fountain placed a few inches above the surface to be irrigated, the water being allowed to flow through a small rubber tube, and the stream regulated to the amount desired by compression of the tube or regulating the height of the reservoir. Either hot or cold water may be applied by this as well as by other means, or alternate applications may be made.

The principal applications of this procedure are to the ear, eye, nose, throat, stomach, rectum, bladder, vagina, and uterus.

IRRIGATION OF THE EAR.

Fig. 216 shows an excellent method of applying the **1396** irrigation to the ear by means of a glass or hard-rubber de-

vice. The water passes into the ear and out through a tube thus enabling the patient to receive the treatment in an position, as the instrument exactly fits into the outer extremit of the external canal of the ear. The temperature may b from 100° to 130°, according to the effect desired. Th fountain should be on a level with the top of the head. Forc should never be employed, for the reason that perforation c the ear often exists, and serious injury might result from th introduction of the water into the middle ear with any con siderable degree of force. The head should be incline toward the side under treatment.

The canal of the ear should afterward be carefully drie and covered with a napkin or with the warm hand for a fe minutes. In cold weather the ear should not be expose out of doors for at least an hour after the application of warm ear douche, and even then it is well to protect the can by a little cotton placed in the outer extremity.

This measure affords great relief in the pain of acut *otitis media* and earache due to other causes. In chron suppurative disease of the ear, this measure is indispensabl as a means of cleansing and disinfection.

NASAL IRRIGATION.

1397 Nasal irrigation may be administered by means of an ord nary good fountain syringe, a properly constructed tube bein passed into one nostril, and the water allowed to flow int one and out the other, the head being held forward to perm of this taking place. This measure of treatment was fo merly considered indispensable as a means of cleansing th nasal cavity in catarrh, but is now seldom used, and migh well be entirely discarded, as it is a fruitful source of acut and chronic disease of the ear. The nasal cavity can b much better cleansed by means of antiseptic volatile oil or by cleansing solutions introduced into the nose by mean of vaporizers or atomizers.

The very hot nasal irrigation (104° to 105° F.) is usefu

for checking hemorrhage from the nose. A saline solution, one or two drams to the quart, is best for the purpose.

POST-NASAL IRRIGATION.

1398 The post-nasal douche or irrigation is administered by means of a curved tube passed into the post-nasal space by introducing it behind the uvula, and throwing a stream of water forward toward the anterior nares. The irritation produced in the region of the Eustachian tubes is frequently a source of serious inconvenience, and it is probable that more harm than good results from the use of this measure in chronic nasal catarrh.

This measure, which was once very generally employed, is now rapidly becoming obsolete.

IRRIGATION OF THE EYE (Fig. 217).

1399 This application should be made with very little pressure. The reservoir should be placed not more than six inches above the head. With the eyes closed, the water is allowed to fall upon the outer surface of the lids and the forehead above the brow. The hot eye douche is very valuable in cases of chronic inflammation of the mucous lining of the eyelids.

Hot irrigation of the eye has been proved to be more useful as a means of relieving even acute inflammatory troubles of the eye than cold applications. The beneficial effects are the result of powerful revulsion, producing hyperemia of the skin with collateral anemia of the inflamed mucous membrane.

IRRIGATION OF THE THROAT.

1400 This is perhaps the proper term to be applied to the application commonly known as "gargling." A large sip of water is taken into the mouth and passed to the back of the throat and held there by closure of both the esophagus and the epiglottis. Air is then forced upward through the epiglottis, thus producing a violent agitation of the liquid, and so bringing it in contact with all the structures of the post-nasal

region. The application of very hot water by this means may be recommended in cases of *chronic pharyngitis* with tickling of the mucous membrane and dryness of the throat, *irritation*, *hacking cough*, and *rawness*, giving rise to frequent clearing of the throat or a *tickling cough*.

IRRIGATION OF THE STOMACH, OR GASTRIC LAVAGE (Figs. 218, 219, 220).

1401 This procedure does for the stomach precisely what the enema or the coloclyster does for the colon. By its aid the stomach may be washed out, hot or cold applications may be made to it, and cleansing and medicated solutions may be applied to the gastric membrane.

Method.— In the use of the stomach-tube, several points require special attention: First, the tube should be of the most approved pattern, of medium size, very soft and flexible, and perfectly smooth. It should not be forced into the stomach, as in the use of the old-fashioned stomach-pump, but should be simply swallowed as one would swallow food or drink. One end of the tube being passed into the mouth and well back into the throat, the patient makes movements of swallowing, while the attendant gently urges the tube along into the stomach. Water at about the temperature of the body is poured in either with or without the addition of common salt and soda in the proportion of a teaspoonful of each to a quart of water.

A powder consisting of three parts of bicarbonate of soda, one part of sodium sulphide, and one part of chloride of sodium may be advantageously used in cleansing the stomach. Use one teaspoonful of this powder to each pint of water. After a pint or so of water has been poured into the stomach, the outer end of the tube is lowered, and by coughing or similar movements the contents of the stomach are forced through the tube into some proper receptacle. The operation should be repeated until the water is clear.

In withdrawing the tube it should be pinched tightly be-

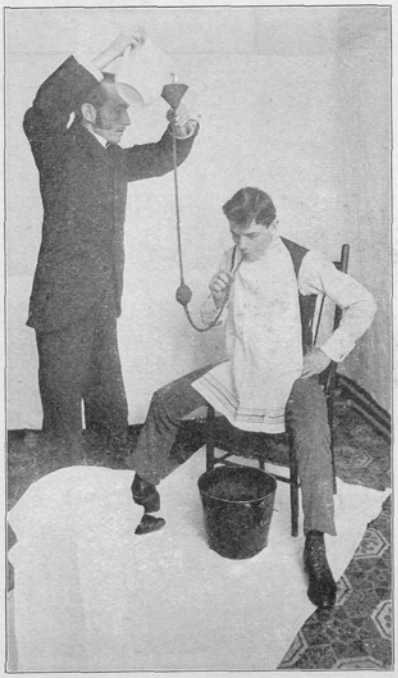


FIG. 218. GASTRIC LAVAGE (p. 884).



FIG. 219. GASTRIC LAVAGE — Emptying the Stomach (p. 884).



FIG. 220. GASTRIC LAVAGE — Withdrawing Tube (p. 884).

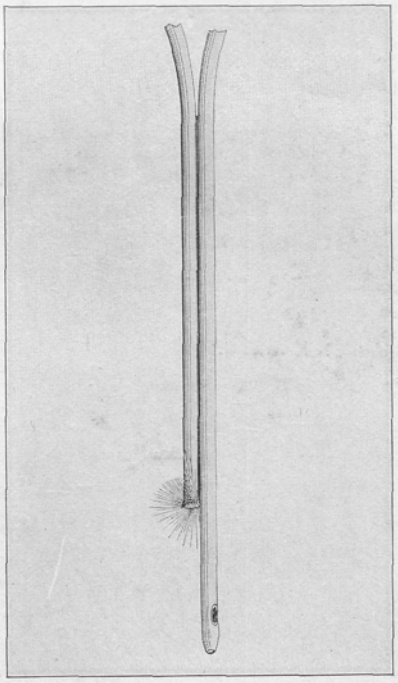


FIG. 221. GASTRIC IRRIGATOR (p. 886).

tween the thumb and finger just in front of the teeth, so that it is completely closed, before beginning the withdrawal. It should then be drawn out quickly. The object of this is to prevent the entrance into the larynx of the fluid or portions of food which the tube may contain. Such an accident has sometimes resulted in serious dyspnea and even syncope.

When lavage is employed in cases of catarrh of the stomach, or for removing decomposing contents, the cleansing solution of which the formula has been given above, or some similar preparation, should be employed. It should be remembered, however, that washing the stomach is not in itself a radically curative measure. The stomach is simply cleansed for the time being of mucus or decomposing food or of noxious substances which may have been swallowed. It is not directly curative except through the fact that removal of the products of disease from the stomach greatly aids the natural curative process by which the organ may be brought back to its normal healthy state.

The application of very hot water to the mucous membrane of the stomach in cases of hyperpepsia and gastrorrhea may be made by means of the ordinary stomach-tube or by the use of a return-flow tube. The maximum temperature of the water employed for this purpose should be 140°, the application being begun with the water at 110°, and the temperature rapidly increased to the desired degree. The temperature must be regulated somewhat by the patient's sensations. Two or three pints of water may be passed through the stomach in this way with advantage. Care must be taken to employ the tube very gently.

The cardiac excitation resulting from very hot irrigation may be readily controlled by an ice-bag over the the heart (**1383**).

Rosenbaum maintains that great benefit is derived from the application to the inside of the stomach of a spray consisting of many streams of water applied with considerable pressure, at a temperature of 95° to 110°. This measure he

finds especially beneficial in so-called *nervous dyspepsia* and *gastritis*. Dr. Türck, of Chicago, Ill., has made large use of this measure in gastric disorders, and places a high value upon it. A return flow tube is employed for the purpose (Fig. 221).

In cases of *hypopepsia* and *apepsia* the tonic circulatory reaction and excitation which follow cold applications may be advantageously induced by the aid of the stomach-tube. The depressing effect of severe cold, however, when applied to such large surfaces as the gastric membrane, suggested to the author the advisability of employing alternate applications instead. The variations of temperature should not be so great as those employed upon the skin, because of the active sympathetic reflexes connected with the stomach.

At the beginning of the treatment, the temperature of the hot water should be 105°, that of the cold, 80°. The temperature of the hot water may be gradually raised, and that of the cold water lowered, one or two degrees at a time, until a temperature of 115° for the hot and 70° for the cold is secured. The application must be made with the greatest care, and should be discontinued at once on the appearance of any untoward symptoms. By means of this application, powerful stimulation of the stomach and its glands may be induced, resulting in the return of the patient's appetite, an increase in the amount of hydrochloric acid secreted, and a radical change for the better in every way, in many cases which have resisted ordinary measures of treatment.

The hot water should be introduced first, the quantity being about a pint. This should be retained from 20 to 30 seconds, and then passed out, and an equal quantity of cold water introduced. At first only one alternation should be made; but later, after the patient has become accustomed to the treatment, the number of alternations may be increased to five changes. Patients to whom the lavage is administered should also receive the alternate douche or cold epigastric douche daily.

When necessary to employ lavage for infants, a small-sized tube, as a No. 8 Nelaton catheter, is employed. The child is held in an upright position by the nurse, while the tube is introduced. A large glass funnel or fountain should be in readiness, with two or three pints of water at 100°, containing one-half teaspoonful each of salt and bicarbonate of soda to the quart. The rubber tube should be connected with the catheter, and the tube completely filled with the liquid to avoid introducing air.

After introducing from four to eight ounces, according to the size of the child, the tube is disconnected, and the liquid allowed to escape. The greater portion generally passes out around the tube, as the catheter is so small that it will not allow free exit for the hard and undigested curds of cow's milk which are often found present in these cases. The catheter should be held firmly in place, drawn to one side during vomiting, but kept in the stomach if possible.

Lavage for young children is perfectly safe, and is by no means so difficult as might be supposed. The younger the child, the more easily the maneuver is executed. The tube passes without difficulty, and the whole operation is over in a short time, to the great relief of all concerned. Clinical evidence is overwhelming that gastric dilatation and the retention of undigested food in the stomach, giving rise to the development of microbes and of ptomains resulting from their growth, is one of the chief causes of the gastric disorders of children which prevail so extensively in the summer-time. The use of unmodified cow's milk is without doubt chiefly responsible for the intestinal disorders of children, and these maladies will continue rife among them until a more natural and appropriate diet can be generally provided for young human beings.

Therapeutic Applications.— Gastric lavage is absolutely **1402** necessary as a means of cleansing the stomach in cases of *obstruction of the pylorus* from any cause, when the closure is complete or nearly so. In such cases it must be employed

systematically daily, or in some instances even twice a day. In *chronic dilatation* of the stomach, in which organic changes have taken place in the walls of the stomach, resulting in the formation of pouches or an extreme degree of motor insufficiency, the habitual use of the stomach-tube is sometimes required, although it is not always necessary that lavage should be administered daily. Complete emptying and cleansing of the stomach every other day or three times a week is generally sufficient to maintain a comfortable degree of asepsis.

In cases of *gastric catarrh* in which large quantities of mucus are present, the stomach-tube must be used; but it should be dispensed with as soon as possible. In cases of *hypopepsia*, in which there is little or no irritation of the mucous membrane, the use of the stomach-tube once or twice a week for a short time sometimes affords useful stimulation of both the muscular and the secreting structures. Occasionally the use of the tube may be advantageously resorted to in *gastric ulcer*, though generally it is contraindicated in this condition.

In *persistent vomiting*, especially when the vomited matters have a green color, or consist of bile, and even in fecal vomiting, gastric lavage not infrequently produces the most happy results.

The therapeutic indications for gastric lavage are, in the author's opinion, by no means so numerous as is generally supposed. It was at one time the author's custom, after making a bacteriological examination of the stomach fluid and finding many germs present in it, to order systematic washing of the stomach twice or thrice weekly; in occasional cases, lavage was applied daily. But more careful study of the subject, and larger clinical experience in the adaptation of dietetic remedies to these cases, has convinced him that lavage is necessary only in a very small proportion of cases, even when the stomach is thoroughly infected. A fruit diet will starve out all the microbes that can grow in the stomach, with the exception of yeasts and molds, and even these disappear when

a simple, rational dietary is adhered to for a reasonable length of time. Many persons have injured themselves greatly by the too frequent use of the stomach-tube. Even in gastric catarrh a properly adjusted dietary will accomplish all that can be done by means of lavage, and much more, except in cases in which large quantities of tough, tenacious mucus have accumulated in the stomach, and require removal as a foreign body, or when the stomach is enormously dilated from atony or pyloric obstruction. This measure is of immense utility in cases in which it is required, but it may be easily abused.

A very useful application of lavage is to abort a threatened attack of migraine. Repetition is sometimes necessary.

The introduction of two or three ounces of ice-water after a cleansing lavage is useful in increasing motility in cases of atony or motor insufficiency. This measure should not be employed when hyperpepsia or gastric catarrh is present. In *chronic gastritis*, water at a temperature of 105° to 120° should be employed in washing the stomach.

Gastric irrigation is recommended by Turck as a cardiac stimulant. It is certainly a powerful means of exciting the heart, but the inconvenience of its use leads the author to recommend as preferable the precordial compress (**1383**), the effects of which are decidedly marked, rendering it a most efficient remedy in cases of cardiac failure.

Lavage of the stomach may be successfully employed as a preliminary remedy in cases of *intestinal obstruction* in a large proportion of cases. The author has been able to relieve what seemed to be hopeless cases by this means. It may be said that, as a rule, whenever *fecal vomiting* occurs, gastric lavage may be properly administered, as the powerful peristaltic movement thus set up not infrequently restores the normal relations of the disturbed parts, and so relieves the obstruction.

Contraindications.—The habitual use of the stomach-tube is highly detrimental to the stomach, and should be prohibited except when made absolutely necessary by organic

disease. The habit many patients have of passing a stomach-tube and emptying the stomach whenever they feel a slight inconvenience in the gastric region or experience headache or other slightly unpleasant symptoms, is a most detrimental practice. In recent years, since the use of the stomach-tube has become so very common, the author has found himself under the necessity of prohibiting its use as frequently as he has been called upon to recommend its employment.

The use of the stomach-tube should be carefully avoided in cases of *ulceration* accompanied by *hemorrhage*, and in cases of *cirrhosis* of the *liver* in which there is reason to suspect an accompanying varicose condition of the gastric veins. In *hemorrhagic tubercular* cases, in *aneurism* of the aorta within the chest, in advanced cases of *arteriosclerosis*, and in cases in which *cerebral apoplexy* has occurred, the use of the stomach-tube must be either wholly interdicted, or undertaken with most extraordinary precaution.

THE WATER EMETIC.

1403 Copious drinking of water at a temperature of 95° to 100° is an excellent means of provoking emesis. A single glassful will not generally produce the effect desired, but three or four glasses are almost sure to do so. If any medicinal agent is employed, as mustard or other substance by means of which emesis may be provoked, a copious draught of water at the temperature named should be employed at the same time. If the desired effect is not produced after three or four glasses have been swallowed, another glassful to which a teaspoonful of common salt has been added, should be taken.

The emetic is by no means a certain means of emptying the stomach; even though there may be considerable quantities of liquid removed from the stomach by vomiting, it is impossible to say that there is not a considerable quantity still left; and in any case it is evident that the stomach can not be thoroughly cleansed by this method. The stomach-tube is in every way preferable to the emetic, the use of which is

necessary only in cases in which the stomach-tube can not be safely employed, or when the patient's fear of the stomach-tube is so great that its use is quite impossible. It is sometimes useful to suggest to an apprehensive patient contemplating the use of the stomach-tube with great horror and distress, that it is not necessary to swallow the whole tube, but only the tip end of it. As a rule, it is only the nervous fear of the patient which makes the use of the stomach-tube at all painful or even seriously inconvenient.

IRRIGATION OF THE COLON.—THE ENEMA.

1404 This very useful procedure consists of the introduction of a quantity of water into the colon. The author employs the enema in three forms: First, the *simple* enema, the method of using which is well known; second, the *graduated* enema, a method devised by him a few years ago for the purpose of enabling persons who had become accustomed to the daily use of the enema to dispense with this very inconvenient procedure; third, the *coloclyster*, termed by the French "enteroclyster," which consists in an enema taken in the right Sims's position or the knee-chest position, a long rectal tube being employed.

In the simple enema the water is commonly employed at about the temperature of the body, or 98°. Better results are obtained by employing water at 70° F. The water is introduced by the aid of a syringe of some sort. Various excellent forms of syringes have been devised, of which the accompanying cuts illustrate the most useful and typical forms (Figs. 222, 223, 224).

The temperature must also be adapted to the use for which the measure is employed. If for mere mechanical effects, a temperature near that of the body is proper. It is generally better to introduce the water gradually, so that the bowels may not be stimulated to contraction, causing the fluid introduced to be discharged before a sufficient quantity has been received.

While the water is being introduced, the patient lies upon his back, with the hips slightly elevated. If a strong desire is experienced to expel prematurely the liquid introduced, the difficulty may be overcome by asking the patient to resist the expulsive impulse strongly, if necessary by compressing the anus with a napkin for a short time, until the peristaltic movement has ceased.

In the employment of the enema only such an amount of water as is necessary should be used. Many persons have been damaged by distending the colon so as to compel it to receive three or four quarts of water at once, as advised by a well-known empiric of New York City. On the very day of this writing the author has been called upon by a patient who was seriously damaged by following the advice of the charlatan referred to. The colon had evidently been stretched and dilated to such an extent that it had never returned to its normal condition, although considerable progress had been made in overcoming the obstinate intestinal inactivity caused by the habitual mechanical emptying of the colon.

In the application of the enema great care must be taken to avoid the introduction of air into the bowels, as this may be a source of severe colic pain. It is also important that the quantity of water employed should be only sufficient to accomplish the purpose sought.

The enema may be usefully employed in the cases of feeble patients as a preparation for surgical operations. In such a case, the bowels should be first washed out, then two or three pints of water at 100° should be slowly introduced into the rectum, the purpose being to increase the volume of the blood by absorption.

The warm enema (98° to 100°) may be usefully employed as a means of introducing water into the system in cases in which for any reason the patient can not swallow liquids without injury, as after operations upon the stomach, in cases of *persistent vomiting* requiring complete gastric rest, in *hemorrhage* from the *stomach,* in *typhoid fever* with *gastric dila-*

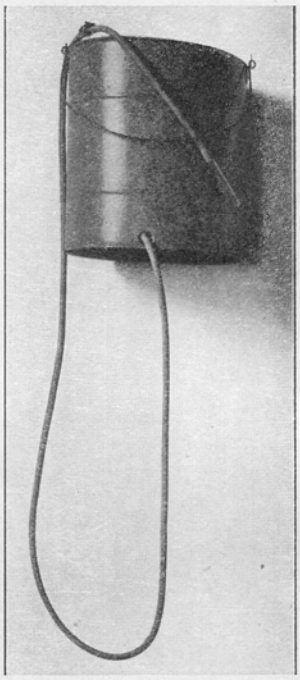


FIG. 222. ENEMA APPARATUS — Metal Fountain (p. 891).

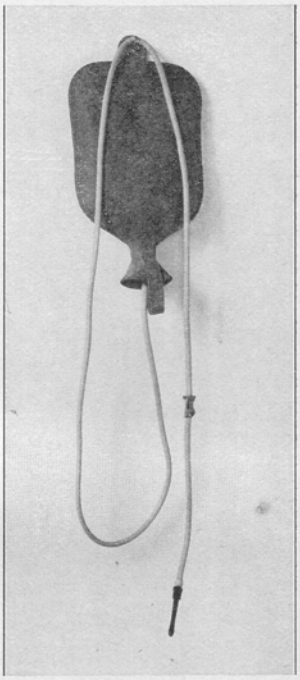


FIG. 223. ENEMA APPARATUS — Siphon Bag (p. 891).

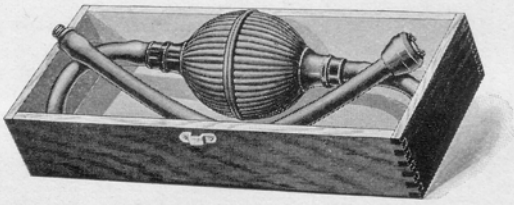


FIG. 224. BULB SYRINGE (p. 891).

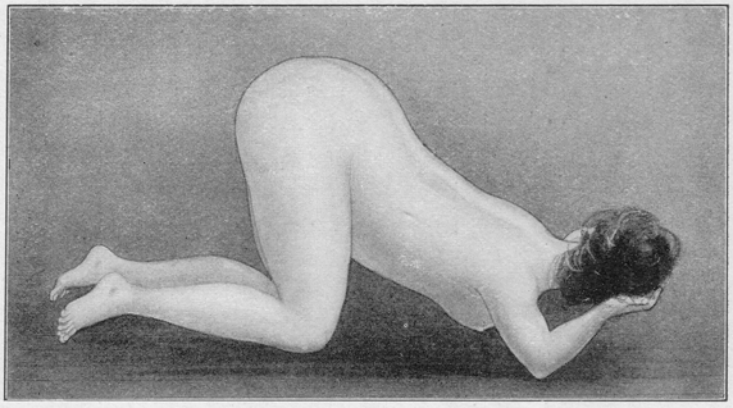


FIG. 225. KNEE-CHEST POSITION FOR COLOCLYSTER (p. 897).

tation, and similar cases. Absorption takes place from the intestine much more rapidly than from the stomach.

The enema is certainly most useful as a means of temporarily relieving chronic intestinal inactivity; but great care must be taken to avoid creating dependence upon it. However, it is far better to be a slave to the enema than to "after-dinner pills."

A small cold enema is usually preferable to a large warm one. A pint of cold water may be introduced into the rectum at night or before or after breakfast to be retained.

The warm enema soon loses its efficiency because of its relaxing effect upon the intestines. The tone of the muscular walls is gradually lessened from day to day, until the bowel may become enormously stretched. Large quantities of water should never be used, as they overstretch the bowel and produce atony. Three or four pints is the limit for a daily application. The colon will hold a considerable quantity more than this, but should not be stretched to its full capacity under the relaxing influence of the warm water. The introduction of cold water into the small intestine is entirely free from this objection. Half a pint or a pint of cold water may be employed daily without injury, for the reason that the cold water energizes the muscles and nerves of the intestine. In the ordinary use of the enema, the temperature should be (80° to 70°).

In cases of extreme atony of the colon the enema sometimes fails to produce evacuation, the water being in large part retained, in these cases contraction of the colon may be induced by applying a cold wet towel to the abdomen, lower back and perineum while the patient is at stool or by massage of the colon or by a small enema of very cold water.

Not the least valuable service rendered by this simple procedure is the post-operative management of cases of abdominal surgery. It is the author's custom to administer an enema immediately after the operation in all cases in which

adhesions have been broken up, for the purpose of "placing" the intestines, as a precaution against obstruction. The value of this procedure, in combination with other measures, pertaining chiefly to regimen and care, is attested by the fact that in dealing with more than seven hundred cases of abdominal surgery, nearly all ovariotomies or hysterectomies, the author has never once been compelled to reopen the abdomen to relieve obstruction, and has been able to record a mortality rate of less than three per cent, and a series of one hundred and sixty-five successive operations for the removal of uterine or ovarian tumors and diseased appendages, without a single death.

1405 **The Cold Enema.**— The enema is recognized as one of the most valuable means of reducing the temperature in febrile conditions, and not simply as an antithermic, but as a measure which aids in the removal of the causes of the abnormal temperature by exciting renal and cutaneous activity.

The cold enema was employed by the De Hahns in Germany in 1737 in the treatment of fevers. The same measure was also used by Dr. Benjamin Rush in the treatment of yellow fever in Philadelphia in 1794 with "good effects."

The enema renders invaluable service in typhoid fever, not only as a means of reducing the temperature, but of encouraging the action of the liver and kidneys, and especially in cleansing the alimentary canal. For twenty-five years it has been the custom of the author to begin the treatment of every case of typhoid fever with copious enemas.

A simple illustration will show the efficiency of the enema as a means of lowering the temperature: Suppose, for example, the quantity of water introduced to be five pounds (pints), and the temperature 70°, the patient's temperature 105°, and his weight 150 pounds. If on the withdrawal of the water, its temperature is found to be increased to 85°, there will have been absorbed by the water 75 pound Fahrenheit heat units ($5 \times 15 = 75$). This would be an equivalent of one half a heat unit to each pound of the body weight, or .5° fall in

temperature for the whole body. In other words, if there had been, in the meantime, no increase of heat production, the temperature of the body would be lowered .5°.

A very convenient method of administering the cooling enema is to supplement the ordinary tube of a fountain syringe by a shorter piece of tubing, two or three feet in length, connected to it in such a way that it can easily be disconnected. The short piece of tubing should be somewhat larger than the ordinary size, so that it will not be easily obstructed. After being slowly introduced, the water should be retained for 5, 10, or 15 minutes, if possible. Then by disconnecting the short tube, and without removing the rectal tube, the water may be allowed to escape into a suitable vessel, and another portion of cool or tepid water may be immediately introduced.

In a fever case under the author's care a number of years ago, the cold enema was employed in this manner continuously for two or three hours, with the result that the temperature of the patient, which was between 105° and 106°, and had proved refractory to every other measure, was reduced to 102° and was thereafter readily controlled by the repetition of the same procedure.

The lower the temperature of the water employed, the greater will be the effect. Ordinarily it is not necessary to employ water at a temperature lower than 70°, and excellent effects may be obtained by means of the enema at 80°, provided a large quantity is introduced and the measure repeated a number of times in immediate succession. To prevent premature expulsive efforts, it is well to begin at a temperature near that of the body, gradually but quite rapidly lowering it by adding cold water in sufficient quantity to produce the temperature desired. Suppose, for example, that it is desired to administer an enema of four pints of water and to obtain the effect of water at 70°; the enema is started with a pint of water at a temperature of 100°, and three pints rapidly added at a temperature of 60°.

Stolz, in experiments to determine the antithermic effect of the cold enema in cases of *typhoid fever*, found that by the administration, at intervals of 5 to 10 minutes, of the enema at a temperature of 46°, the pulse was slowed twenty to thirty beats, and the temperature as taken in the mouth was lowered 3.6°.

The cold enema has rendered great service in the treatment of jaundice, as first shown by Krull.* The author prefers the enema at 105° to 110°, followed by the cold enema (60°).

The cold enema is most effectual as a means of relieving *constipation* through its tonic effects upon the structures of the rectum and mucous membrane.

1406 **The Hot Enema.**— The hot enema, or hot irrigation of the colon, is a useful means of combating an inflammatory condition of the pelvic viscera. Hot water introduced into the rectum and colon is brought nearer to the ovaries and other pelvic viscera than is possible in any other way. For this purpose it may be administered three or four times a day, or if necessary once every three or four hours. The temperature should be 110° to 120°.

Reclus prefers very hot rectal irrigation (130°) to vaginal irrigation or injection, in *congestions* of the *pelvic viscera*. It is of great value in the treatment of *prostatic inflammation*, causing disappearance of the swelling and pain and difficulty in micturition, often in a few hours, and in the majority of cases securing a complete cure of acute prostatitis in three to four days.

The hot enema is one of the most valuable of all hydriatic measures for combating *threatened collapse* in typhoid fever as well as in cholera and other conditions in which the vital failure is due to toxemia. The hot enema may even be used in cases of typhoid complicated by intestinal hemorrhage, and with marked benefit, when there is reason to believe that

* Krull, *Berliner Klin. Woch.*, 1877.

the patient is suffering in consequence of absorption of toxins resulting from the decomposition of retained blood clots. An immediate change in the aspect of cases of this sort is often apparent after freeing the colon of the fetid clots with a simple hot enema. The application should not be made while the hemorrhage is in progress, as the increase in arterial tension would involve serious risk. But a day or two later the bowel may be washed out without apprehension. The coloclyster, or copious enema, is the most rational method of establishing intestinal asepsis, at least when combined with an aseptic dietary of farinaceous gruels, fruit juices, and systematic water drinking.

The hot enema (104° to 115°) may be used with great benefit for its relaxing effect upon involuntary muscular tissue, in cases of *hepatic* or *biliary colic*. It is found equally useful in quieting excessive *uterine pains* during *parturition*, and in combating *irregular contractions* of the uterus.

The large hot enema has for many years been employed by Cantani and Wonte in the treatment of colic and infantile diarrhea. These sagacious observers also recommend its use in intestinal occlusion and *pseudo-membranous* colitis.

The hot enema is one of the most helpful of all measures in surgical shock and other forms of *collapse*. It may be safely used in all cases of shock in which the skin is pale and the pulse weak. The temperature should be from 110° to 120°. It should be followed by cold friction.

THE COLOCLYSTER, OR ENTEROCLYSTER.

The purpose of this mode of applying the enema is to fill 1407
the entire colon, or at least to introduce the largest quantity of water possible without overdistending the colon. In the ordinary enema it is difficult to introduce more than a pint and a half to three pints of water; but by placing the patient in the right Sims's or knee-chest position (Fig. 225), the amount of liquid may be increased to four or even five or six pints, and in some cases even more, without inconvenience to

the patient. In the right Sims's position the water is passed upward through the sigmoid flexure, and then runs along the descending colon, and on reaching the transverse colon, follows down toward the ascending colon, in which it accumulates until the colon is gradually filled. In the knee-chest position the action of gravity is still more helpful in completely filling the colon. This filling of the colon is necessary in cases in which fecal accumulations are present in the cecum; in catarrh of the cecum, a condition often mistaken for appendicitis, and which is doubtless the precursor of appendicitis in the great majority of cases; also in cases in which the cecum is infested with threadworms; and in cases of pseudo-membranous colitis.

Physiological Effects.— The physiological effects of irrigation of the intestine have been carefully studied by Krull, Stadelmann, and Kemp. Krull held the cold enema to be a powerful hepatic stimulant, but Stadelmann concluded from his researches that its action is mechanical only, aiding the liver by removing from the intestine large quantities of decomposing stuffs, with swarming microbes and the ptomains and toxins produced by them. This result seems rather surprising when one considers the powerful influence upon the mesenteric circulation, of cold water introduced into the intestine. Very powerful fluxion of the liver must be excited by this measure, and the reaction following must certainly be attended by decided increase in the activity of the portal circulation.

The introduction of very hot water into the colon increases blood pressure, improves and accelerates the heart action, and produces a marked effect upon renal secretion. A temperature of 110° to 120° has been found much more effective in increasing renal secretion than a lower temperature. The author has often noted in cases of patients to whom the enema has been administered, the passage within a very short time of a large quantity of clear urine. This was observed and pointed out by the empirical hydropaths more than fifty years ago.

Cold water produces a movement of fluid toward the intestine by the reaction which follows the application. This fact renders the cold enema of value in the treatment of constipation due to excessive dryness of the fecal matters. When used for relief of an *acute inflammation*, as in *dysentery*, the application must be moderate, prolonged, and continuous.

The hot enema, on the other hand, stimulates absorption from the alimentary canal, and raises the blood pressure by filling the blood-vessels and by reflex stimulation of the heart.

For most pronounced effects upon the heart and kidneys, the temperature should be 110° to 120°. The author is confident that he has saved the lives of a number of persons suffering from renal suppression by the repeated employment of this simple measure during periods varying from one to three or four hours. He has used the hot enema for this purpose for more than twenty years. The effects obtained are much more prompt and in every way more satisfactory than those obtained from jaborandi or any other diuretic drug.

The ordinary hot enema at 100° to 104° produces little effect upon blood pressure, but has a marked diuretic effect.

Cerebral congestion may result from the use of the warm water enema, as shown by the experiments of Schüller.*

According to M. Von Genersch† it is possible by the employment of the coloclyster to introduce a liquid into the small intestine, through which it may be rejected by the mouth.

Therapeutic Applications.—The coloclyster affords marvel- **1408**
ous relief in a class of patients, unfortunately by no means small in number, who, suffering from *atony* and *dilatation* of the *colon*, are always carrying about with them an enormous accumulation of fecal matters. The patients are variously classified as *neurasthenics*, *hypochondriacs*, *simple dyspep-*

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* *Arch. für Klin. Med.*, 1874.

† Von Genersch, *Progrès Médical*, 1893, p. 162.

tics, etc., and are treated for *biliousness*, *insomnia*, *exhaustion*, and a multitude of ailments, all of which conditions are the simple result of *chronic autointoxication*, and are promptly relieved by a cleansing bath administered to the large intestine. The quantities of fecal matter removed in these cases is sometimes enormous; and not infrequently quantities of old putrefying fecal masses, semi-hardened by long retention, make their appearance after a free coloclyster has been thoroughly administered every day for a week or more, showing that a single irrigation of the colon, no matter how thoroughgoing, is not sufficient to establish the fact of its thorough cleansing. In this class of cases the coloclyster should be administered daily for two or three weeks if need be, or as long as the patient complains of gaseous distention of the bowels and fetid flatulence.

After the discharge of the warm water, the temperature of which should be 92° to 95°, a pint of water at 60° to 70° should be introduced and retained if possible, as a tonic bath for the colon. Care should be taken to avoid distending the colon with an excessive quantity of water at once. The amount need never exceed two quarts, and the quantity should be reduced from day to day after the colon has been thoroughly cleansed, until only a pint or a half pint of cold water is employed. Cold water stimulates and tones the bowel, whereas hot water is relaxing. The cold coloclyster may be used indefinitely without producing constipation, if the quantity of water employed is small. It acts as a sort of gymnastic trainer for the bowel, strengthening its muscular structures, and increasing the activity and energy of its controlling nerves and nerve centers.

The author's attention was early called to the observations of Krull, already referred to, and he has for more than twenty years made use of the enema in cases of *jaundice*, whether suspected to be due to *gall-stones*, or clearly due to infection of the liver and *catarrh* of the *bile ducts* in so-called "*infectious jaundice.*" The results have been almost uni-

formly excellent. Patients rarely fail to show marked improvement within a few days, and complete recovery has been secured in all cases of infectious jaundice. Careful regulation of the diet and other measures have been employed at the same time, but the coloclyster has been regarded as a measure of primary importance. The temperature for the clyster should be 90° to 100°, the purpose being to flush the portal circulation while at the same time cleansing the alimentary canal. A much larger quantity of water can be introduced by this method than when a lower temperature is employed, and may be retained for a much longer time. A small cold enema (70°, one pint) should be injected as soon as the warm water is discharged, to counteract the depressing and relaxing effect.

The coloclyster by means of the Sims's position is an exceedingly useful measure in fevers. By placing the patient in this position a much larger quantity of water may be introduced, and in certain cases this method is one of the most effective of all means of lowering the temperature.

That many cases of intestinal obstruction may be relieved by the coloclyster properly administered has been abundantly proved by Lesage, von Genersch, and others. Four to six quarts of fluid are often employed. The patient should take the knee-chest, or right Sims's position, or may be inverted, and the water should be introduced with a long rectal tube. The temperature should be 104°, and care should be taken to introduce the liquid slowly, the fountain being placed at an elevation of eight to twelve feet.

THE GRADUATED ENEMA.

This form of intestinal irrigation is administered in the **1409** same way as the ordinary enema or the coloclyster, and differs from it only in the fact that each day the amount of water is diminished and the temperature lowered. A very good plan to adopt is as follows: Beginning with three pints of water at a temperature about that of the body, the amount

of warm water introduced each day is diminished by half a pint, one-fourth pint of cold water being added, making the total amount of the fluid one-fourth pint less each day. At the end of the twelfth day the enema will consist of four ounces of cold water. In the majority of cases the decrease in temperature will compensate in stimulating effect for the diminished quantity; so that the bowel is thus brought to a more natural state, and weaned from the necessity of distension with warm water in order to provoke an evacuative movement. The graduated enema is exceedingly useful as a means of overcoming the enema habit.

RECTAL LAVAGE OR IRRIGATION.

1410 The author a number of years ago devised a hard-rubber instrument for this purpose, which has proved very convenient (Fig. 226). Numerous other forms of irrigators have been devised for the same purpose.

The temperature of the water used should be 100° to 125°, beginning with the lower temperature at first, and gradually increasing as tolerance is established. A normal saline solution, about a dram and a half to the quart, is more serviceable when the purpose is to relieve local irritation. When a cleansing effect is desired, as in catarrh of the bowels, a mixture consisting of equal parts of carbonate of soda and common salt (one dram and a half to the quart) may be used.

Hot irrigation of the rectum or the small hot enema frequently repeated is very useful in cases of *inflammation* of the *prostate*. Hot irrigation is also valuable as a means of relieving *leucorrhea*, *catarrh* of the *rectum*, *rectal irritation*, *spasm* of the *sphincter*, and *rectal ulcer*.

Cold rectal irrigation is useful as a means of allaying acute inflammation (60° to 40°, 5 to 10 min.). Repeat hourly. Fig. 227 shows an instrument for dry cooling.

Alternate irrigation (60°, 15 secs.; 110° to 120°, 15 secs., repeating) may be usefully employed in cases of constipation due to loss of normal nerve sensibility. Employed daily, or twice daily, at night and after breakfast.

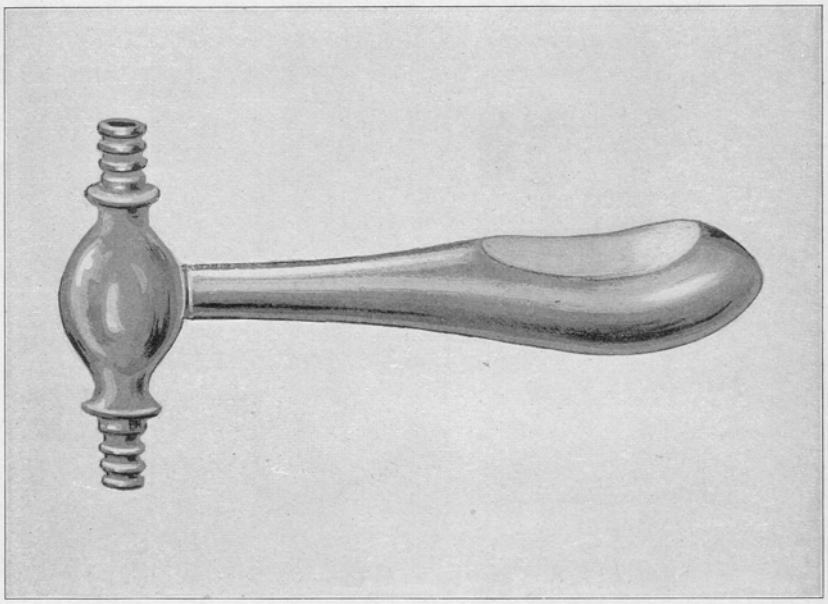


FIG. 227. INSTRUMENT FOR COOLING PROSTATE (p. 902).

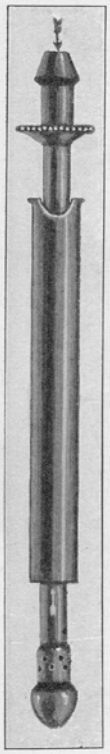


FIG. 226. RECTAL IRRIGATOR (p. 902). (Kellogg)

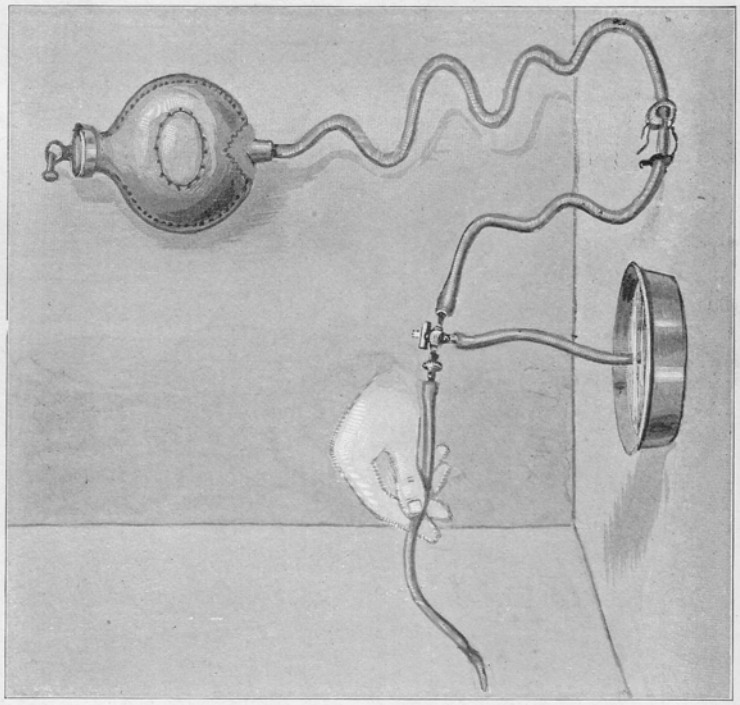


FIG. 228. INSTRUMENT FOR BLADDER IRRIGATION (p. 903).

IRRIGATION OF THE BLADDER.

1411 The instruments required for this procedure are a fountain syringe (Fig. 228) or a funnel with three or four feet of rubber tubing attached, and a smooth, soft-rubber catheter. Special forms of catheter are necessary in some cases of prostatic disease. The connection of the syringe with the catheter should be made by means of a "Y" connection piece to one arm of which a piece of tubing two or three feet in length is attached for the purpose of conveying the water into some proper receptacle. The patient should lie upon a couch or treatment table with the clothing conveniently adjusted. The fountain should be placed a foot and a half or two feet above the couch Both the supply and the waste tubes of the instrument should be furnished with convenient stop-cocks, so that the flow of water may be easily and perfectly controlled.

Great care should be taken in introducing the catheter to preserve strict asepsis. Not only should the catheter be thoroughly aseptic, but the genitals, and the hands of the physician or nurse, must be as carefully prepared as for a surgical operation. When these precautions are taken, the so-called "catheter-fever" will very rarely occur. The temperature of the water employed should be, for ordinary cleansing purposes, 100°. Water containing chloride of sodium, in the proportion of one and one-half drams to the quart, is less irritating than fresh water. The water should be boiled after the salt is added, so as to make sure that it is thoroughly sterile.

The bladder should first be emptied, then the water should be introduced in small quantities, from one to three ounces at a time. It should flow in with little force, and should be allowed to pass out immediately; but the bladder should not be pressed upon to hasten the discharge of the fluid, and a new quantity of fluid should be introduced before the bladder is completely emptied, so as to avoid the irritation produced by strong contraction of the bladder upon itself.

By the same apparatus employed in vesical irrigation, certain useful mechanical effects may be brought to bear upon the bladder. In cases in which the organ has become abnormally contracted, so that the patient is continually annoyed by distressing demands for micturition, the normal capacity of the organ may be restored by gradual distention by means of the hydrostatic pressure of the water column connected with the fountain. To accomplish this, the outflow tube is closed, the fountain is placed about one foot above the patient, and the bladder is allowed to fill as full as possible with this amount of pressure; then the fountain is slowly raised until the patient experiences a very strong desire to empty the bladder. The inflow is now shut off, the outlet opened, and the bladder allowed to empty itself; after a rest of three or four minutes, the operation is repeated. The bladder should thus be filled and emptied three to six times at each treatment, and the treatment should be repeated daily. The temperature of the water employed should be 104° to 106°.

We are indebted to Daggett, of Buffalo, for a method of irrigating either the bladder or the urethra, or both, which is exceedingly practical, and is superior to the hydrophore. A cut of the instrument employed is shown in Fig. 229. The irrigator is connected with a fountain syringe containing a solution of salt in the proportion of a dram to a quart, at a temperature of 115°. The instrument is introduced into the meatus far enough so that it can be grasped and held in place. The tube is then connected with the inlet, the end of the finger being held over the outlet. The fountain is placed two or three feet above the patient's head, so as to give moderate pressure. As the urethra is gradually distended, the fluid finds its way backward, and finally enters the bladder if permitted to do so. When the bladder is filled, it is only necessary to pinch the tube connecting the irrigator with the fountain, and allow the water to escape. By repeating the operation several times, the bladder may be thoroughly

cleansed, and without running the risk of injury, catheter fever, etc., which is so likely to occur even when great care is practiced, in the daily passage of an instrument into the bladder. Of course there are cases in which this simple device will not answer the purpose on account of obstruction at the bladder outlet; but it is practical in a very large proportion of cases, even in cases of enlarged prostate, and can be used by the patient himself after proper instruction.

Physiological Effects.—The mucous membrane of the bladder is exceedingly sensitive to temperatures either above or below the average temperature of the interior of the body. The healthy bladder expels with great force water at a temperature of 77°, even when the quantity is not more than two or three ounces (Mellez), and at a temperature of 41° so small a quantity as one or two drams will cause prompt and vigorous contraction. Very hot water likewise produces powerful contractions of the bladder.

Therapeutic Applications.—The bladder douche at a temperature near that of the body is a highly valuable measure in the treatment of vesical catarrh or chronic cystitis. This measure is in fact indispensable in dealing with that form of bladder catarrh which is met with in old men suffering from enlarged prostate, and who have lost the power to empty the bladder without mechanical assistance. In such cases it may be employed daily, twice a day, or every other day, as may be indicated by the conditions present. When mucus is formed rapidly and in large quantities, when the bladder is infected and decomposition takes place to such an extent that the urine is ammoniacal when withdrawn from the bladder, the irrigation should be sufficiently often to prevent accumulation of mucus and advanced decomposition.

In inoperable cases of calculus of the bladder, vesical irrigation renders valuable service as a palliative measure, the patient's suffering being greatly mitigated by its use. Irrigation is indicated in most cases of *atony* of the *bladder* and in cases of *paralysis* of the organ associated with *paraplegia*,

locomotor ataxia, and other affections of the nervous system. Vesical irrigation is usually required whenever the urine is ammoniacal, and when it is turbid when passed; when pus or blood is present; and when minute calculi, so-called gravel, are sometimes passed. In certain cases of *atony* in which there is no irritation, and in which no evidences of vesical catarrh are present, the powerful stimulus of cold water may be carefully tried. The first injection should consist of one or two ounces of water at 80°. If this produces no unpleasant effect, the temperature may be gradually lowered to 60°. Hot applications may likewise be employed with advantage in these cases, but the temperature should not exceed 115° to 120°. Alternate hot and cold irrigation of the bladder is the most powerful means of stimulating its muscular structures. The extreme temperatures should at first not exceed 110° and 85°, and the highest and lowest temperatures should be gradually approached.

In *hemorrhage* from the *bladder*, very hot irrigation (118° to 122°) may be employed. An ice-bag may be applied over the bladder at the same time, and a hot foot bath or a hot blanket pack to each leg separately may be employed with advantage.

Contraindications.—Irrigation of the bladder must generally be avoided in *acute cystitis* until after the extreme sensitiveness of the mucous membrane has to some degree subsided. Irrigation can generally be undertaken if special care is employed within two or three days after the onset of the disease. Most relief will be obtained in the early stages of cystitis by external applications, such as the hot pelvic or hip and leg pack or the very hot sitz (110° to 120°) for 5 or 10 minutes, followed by a very gentle affusion at 80°.

Special care must be taken to avoid the baneful effect of cold in cases of either *acute* or *chronic cystitis*. Chilling of the patient during the treatment may produce an acute exacerbation of the inflammation, and greatly aggravate all the symptoms. To counteract any tendency in this direction, it

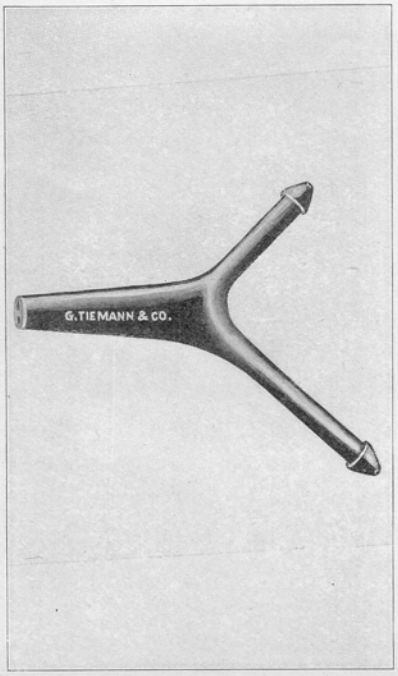


FIG. 229. IRRIGATOR FOR URETHRA AND BLADDER (p. 904).

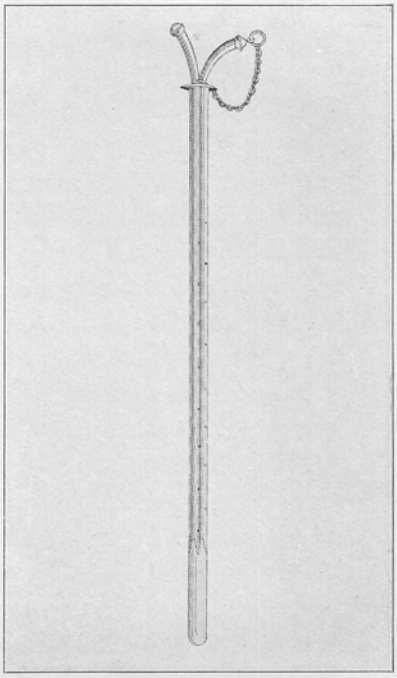


FIG. 230. URETHRAL IRRIGATOR, YDROPHORE OF SCHUTZ (p. 907).

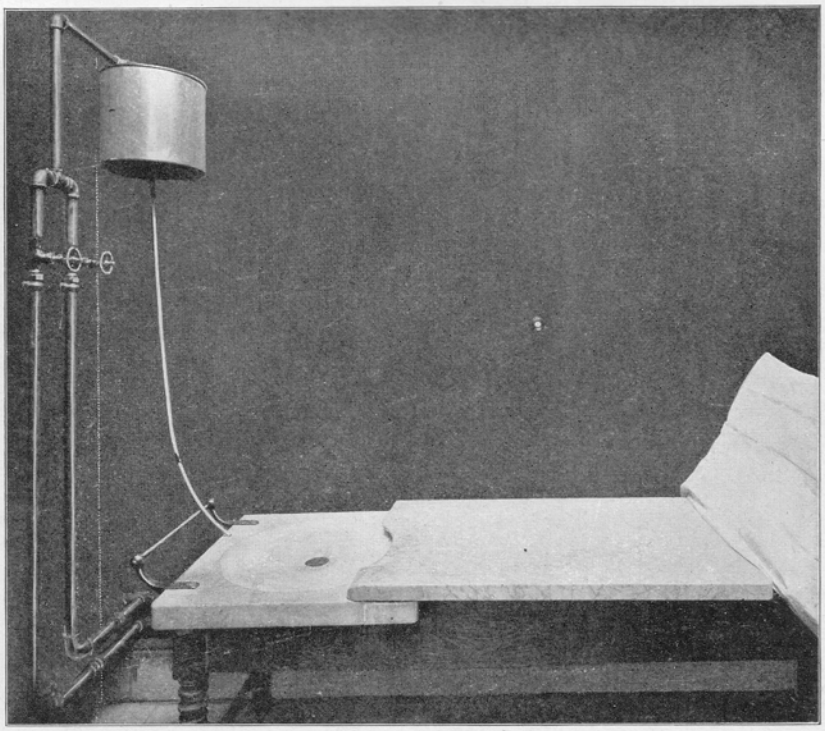


FIG. 231. MARBLE-COVERED COUCH FOR VAGINAL IRRIGATION (p. 909).

is well to administer a hot or warm sitz bath immediately after irrigation of the bladder, in cases in which the patient is able to sit erect. Special care must be taken to keep the feet warm during the application, and there should be as little exposure as possible. The limbs should be wrapped in flannel blankets, and the patient should on no account be allowed to feel the slightest sensation of chilliness.

Irrigation of the bladder must be avoided in cases of *acute urethritis*, in consequence of the danger of conveying the infection backward into the bladder and other of the deep passages.

IRRIGATION OF THE URETHRA.

Numerous instruments are employed for the application of 1412
liquids to the urethra. One of the best of these is the hydrophore of Shutz (Fig. 230), which consists of a fluted tube, with small openings in the sides. As this instrument is introduced, the water flows backward toward the meatus, cleansing the canal as the tube advances, thus preventing the conveyance of infection to the deeper parts of the urethra. The instrument should be introduced until it passes beyond the sensitive area, but should be checked at this point. Daggett's instrument (Fig. 229) may also be used. When it is desired to treat the urethra exclusively, as in gonorrhea, for example, the urethra should be shut off from the bladder by pressure upon the perineum with the finger. It is sometimes important to distend the urethra, so as to spread out the folds of the mucous membrane, and thus secure complete cleansing of the surfaces. To accomplish this, it is only necessary to compress the parts at the meatus about the catheter with sufficient firmness to prevent the escape of liquid, while also compressing the urethra at the perineum.

Ordinarily, the temperature of the water employed for irrigating the urethra should be about 100°. Curtis reported many years ago (1833) remarkable results in the treatment of *chronic urethritis* by very hot water. He employed simply a fountain syringe, consisting of a tin pail with a rubber tube

attached, and a No. 8 English catheter. An alcohol lamp was adjusted under the pail, so as gradually to elevate the temperature of the water during treatment. The temperature was allowed to rise very slowly, by which means a tolerance was established to such a remarkable degree that a temperature of more than 180° was sometimes employed. This was probably the temperature in the fountain, the temperature of the water actually in contact with the mucous membrane naturally becoming considerably lowered by cooling while passing through the tube. The catheter was introduced into the urethra to within about an inch of the prostate, and the fountain hung high enough to give sufficient force to the stream to carry it backward through the urethra, but not into the bladder. Curtis claimed for his method that it cut short the disease very promptly; that it gave almost immediate relief from pain and swelling; and that it was equally successful in acute and chronic cases. The author has found the very hot urethral douche a very effective procedure.

The employment of hot urethral irrigation (110° to 130°) in gonorrhea secures the early absorption of exudates, and thus prevents deformity, cicatrization, and stricture. This is also the best remedy for *chordee*. The quantity of water employed should usually be several quarts, or until the pain is relieved. A short hot sitz bath (110° to 118° for 5 or 10 min.) is a valuable measure to be used in combination with hot urethral irrigation. In chronic cases, with exudates, employ alternate hot and cold irrigation.

VAGINAL IRRIGATION.

1413 This procedure, more commonly but incorrectly termed the vaginal douche, consists of the injection into the vaginal canal, with little or no pressure, of a stream of water, either hot, cold, or of intermediate temperature. This procedure has rendered immense service in the treatment of uterine, ovarian, and other pelvic disorders in women, but a lack of understanding its physiological effects and therapeutic application

at various temperatures has resulted in numerous failures and disappointments.

Following the example of Peasley and Emmett, who were among the first to champion the vaginal douche as a therapeutic measure in gynecological practice in this country, most American practitioners make habitual use of vaginal irrigation at as high a temperature as the patient can comfortably bear, or from 105° to 122° F. Fortunately, vaginal irrigation at this temperature is applicable to a large proportion of cases; but other temperatures, higher or lower, may often be employed to much better advantage. The application is best made with a fountain syringe, which consists of a reservoir containing water placed at a height of two to three feet above the patient. By means of a rubber tube of suitable size (the size ordinarily employed is too small) and a glass or hard rubber vaginal nozzle, the water is conducted to the vaginal canal. The patient lies upon her back with the hips elevated, a proper receptacle being arranged to catch the water as it flows out from the vagina.

Fig. 231 shows a douche table devised by the author, which has borne the test of many years' use. The top consists of a marble slab, hollowed somewhat to fit the form of the body, and provided with an opening and channels to conduct the water rapidly away. The arrangements for asepsis are perfect, and the patient's clothing never becomes wet or soiled.

In introducing the vaginal tube, care should be taken to direct it backward behind the cervix uteri, to the very farthest limit of the *cul de sac*, so as to avoid any possible danger of forcing the water into the uterine cavity. As the water enters from the fountain, it flows about the neck of the uterus, and circulates through the vagina, bringing every part of it under the thermic influence of the application, thus affecting not only the mucous membrane with which the water comes in actual contact, but through reflex influence the circulation of all the pelvic viscera.

414 Many years ago Max Runge made an exhaustive study of the effects of vaginal irrigation upon the circulation and muscular excitability of the uterus, applying a gentle stream of water at different temperatures to the exposed uterus in living rabbits. As a result of these interesting studies, he found that the application of water at 41° F. produced at first strong tetanic contractions, lasting for a full minute, which were followed by rhythmical contractions and relaxations, continuing for some time. When the cold application was continued for 10 to 15 minutes, the contractions slowly ceased, the pale color of the uterus induced by the primary contraction of the uterus under the influence of the cold, giving rise to a pronounced red colorization, showing active movement of blood through the organ. After the close of the experiment, the parts returned to their normal state at the end of a half hour. That the cessation of the contraction was not due to the exhaustion of the uterine muscle, was shown by the fact that subsequent applications of heat or electricity gave rise to violent contractions.

Applications of hot water at a temperature of 122° produced, on the other hand, rhythmical contractions of the uterus, but less vigorous than after applications of cold, and without any tendency to tetanic contraction, as after the cold application. When the hot application was continued for 10 minutes, the contractions finally ceased, leaving the uterus as before, and of a bluish color, but incapable of contracting, as shown by applications of cold, electricity, strychnia, and other excitants. No effect whatever was produced, showing that the uterine muscle was, temporarily at least, completely paralyzed. After the lapse of half an hour the uterus acquired its normal condition. Further investigation showed that the passively congested and paralytic state of the uterus, as described, was produced only by temperatures above 104° or very hot applications.

It is interesting to note the similarity, with marked differences, however, between the applications of heat and cold to

the uterus. Stronger and more prolonged contractions were produced by the cold than by the heat. Muscular excitability was not diminished, but was palpably increased by the cold application, whereas in ten minutes it was completely obliterated by the hot irrigation.

From these facts it will readily appear that both hot and cold applications may be employed for relieving hemorrhage due to uterine congestion, but that the cold application is a more powerful hemostatic agent than heat. Hot applications, on the other hand, possess remarkable power to lessen and even completely to annul uterine excitability and contractility of the uterine muscle, which is decidedly increased by cold irrigation. But the tendency of cold irrigation to produce painful uterine contraction and to provoke an exacerbation of neuralgic and other pains to which the pelvic viscera are so particularly subject, accounts for the almost universal preference for hot irrigation in the treatment of pelvic disorders of women. The author has found not a few cases in which temperatures above 104° were badly tolerated, a fact which was doubtless due to the paralytic congestion produced by high temperatures. The douche at 90° is found highly useful in relieving pelvic congestions, which are extremely productive of discomfort. The author has never found it expedient to employ as low a temperature as 41°, but vaginal irrigation at 75° to 80° has often produced excellent antiphlogistic results in cases in which hot irrigation could not be tolerated.

Hot irrigation is indicated when the effect desired is to relieve pain, to promote the absorption of exudates, and to stimulate vascular activity in cases of salpingitis or so-called cellulitis; also in cases of chronic metritis, ovaritis, and so-called endometritis.

Very hot irrigation, as shown by Emmett and proved by the experience of nearly every other gynecologist, is of high value as a means of checking hemorrhage. For this purpose the application must be made at as high a temperature as can be borne, a temperature of 125° to 130° being desirable.

If hot irrigation fails, employ cold, boiled water (65° to 55°). If cold irrigation produces pain, employ simultaneously a hot sitz bath or hot hip or leg pack. Hot irrigation is sometimes better tolerated in connection with the cool or tepid sitz bath (75° to 85°). Rub the surface well to promote reaction.

In relation to vaginal irrigation during pregnancy, it may be remarked that careful vaginal irrigation, even at a temperature of 115° to 118°, may be made at any time during gestation before labor has begun, without the slightest danger of producing uterine contractions or any tendency to miscarriage. After the beginning of labor, however, very hot irrigation produces prompt dilatation of the cervix.

The ordinary effects of vaginal irrigation will be increased by employing an intermittent jet obtained by attaching an ordinary bulb syringe to the fountain douche apparatus. Alternate irrigation is sometimes useful in relaxed conditions and in promoting absorption of exudates when pain and congestion are not present. Two fountains with tube attachments may be employed, one containing cold (60° to 80°), the other hot (104° to 120°), water; or two fountains may be joined to a single tube by a suitable connection.

The percussion vaginal douche is an effective means of cleansing irrigation, and also powerfully stimulates the pelvic circulation. It is administered by means of a modification of the ordinary fountain douche in which the fountain is closed and the air pumped in by a rubber compressor bulb, a small amount of air being mingled with the water so that there is an alternate discharge of water and air expelled with considerable force.

1415 **Intra-Uterine Irrigation.**—The application of water to the interior of the uterus requires a special instrument for the purpose, so constructed as to allow a ready outflow of the liquid introduced, known as a double current or irrigating sound. In uterine irrigation only distilled or well-boiled water should be employed. If no other medicament is used, it is

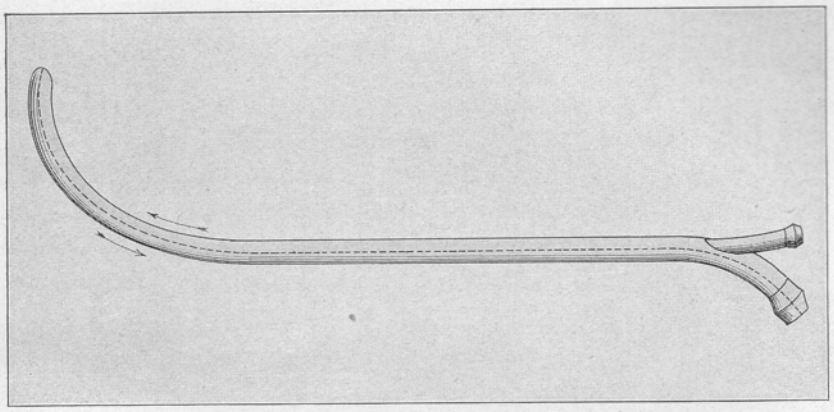


FIG. 232. PSYCHROPHORE (p. 913). (Winternitz)

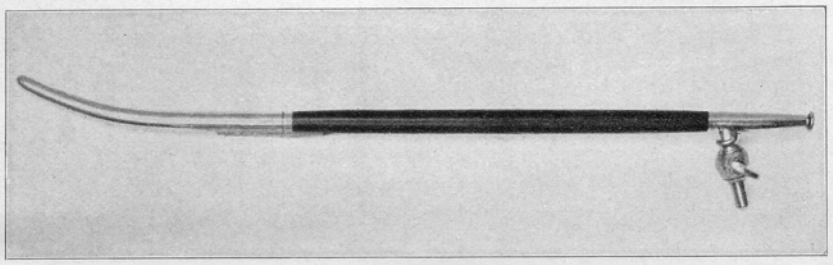


FIG. 233. HOLLOW SOUND FOR MAKING THERMIC APPLICATIONS TO UTERUS (p. 914). (Kellogg)

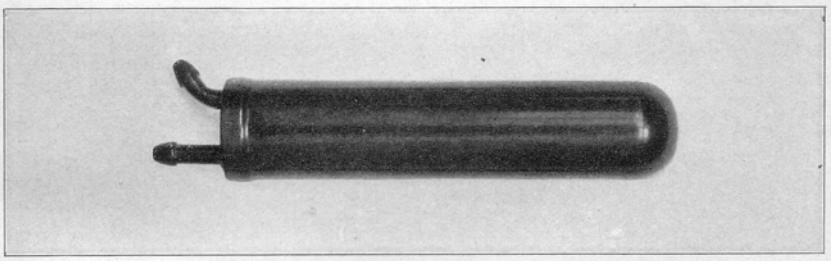


FIG. 234. HOLLOW CYLINDER FOR MAKING THERMIC APPLICATIONS TO VAGINA (p. 914). (Kellogg)

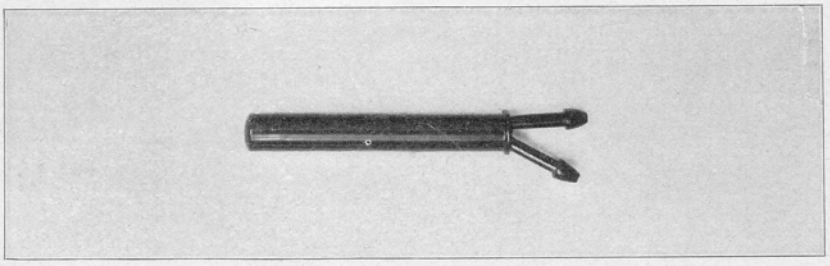


FIG. 235. HOLLOW CYLINDER FOR MAKING THERMIC APPLICATIONS TO RECTUM (p. 914). (Kellogg)

well to add to the water common salt, one gram to 100, or 10 grams to the gallon. The application should be made with all antiseptic precautions after curettement or other operations upon the interior of the uterus, and in obstetrical cases in which blood clots or membranes are retained, from which the patient is liable to infection through absorption of septic matter from the uterine cavity.

MEANS OF MAKING HOT, COLD, AND ALTERNATE APPLICATIONS TO THE MUCOUS PASSAGES.

Fig. 232 illustrates an instrument devised by Professor **1416** Winternitz, known as the *psychrophore*, and intended for making applications to the urethra when hot or cold applications are desirable. The author has found this measure serviceable in the treatment of certain cases of extreme hyperesthesia of the urethra. Both prolonged cold applications and short hot applications may be used with success. In some of these cases alternate hot and cold applications are most effective. This is especially true in cases in which the tone of the parts is lowered or passive congestion exists.

Alternate cool or tepid and very cold applications may sometimes be made with advantage, the warm at 78° to 80° for 5 minutes, then an application at 50° to 57° for 5 minutes.

The bladder should be emptied just before the use of the psychrophore, and should not be emptied again for a couple of hours after the treatment.

The psychrophore likewise renders valuable service in the curative treatment of *nocturnal enuresis*.

The author a number of years ago devised a series of hollow applicators shown in the accompanying cuts (Figs. 233–235), which have proved very successful for the several purposes for which they were designed. By means of a hollow uterine sound (Fig. 233) either hot, cold, or alternate applications may be made to the interior of the uterus with great convenience. By compressing the outflow tube, the rate at which the water passes through the instrument may be regu-

lated, and by the same means also the temperature. If the water at the outlet is made to fall upon a thermometer, the temperature of the water may be observed at every moment, and may be made to rise or fall by adjustment of the gauge. The author has frequently made applications to the body of the uterus at 160° with excellent effect, although this temperature is somewhat painful. A temperature of 140° is usually sufficiently high to accomplish the desired results. The instrument also proves useful in cases of subinvolution, vegetations, catarrh of the cervix, and flexion or relaxed uterine walls and arrested development.

1417 In Fig. 234 is shown a hard-rubber instrument which has been found very useful as a means of applying heat to the pelvic viscera through the vagina, in cases in which the bed-pan or douche apparatus can not be used without injurious disturbance to the patient. The instrument is simply introduced into the vagina, and a current of hot water passed through it. The patient may lie in any position, and thus is in nowise inconvenienced by the application; the relief experienced from this procedure is often very remarkable. The effect of moist heat is easily obtainable by simply covering the instrument with a mass of absorbent cotton and saturating with water.

1418 Fig. 235 shows an instrument constructed on the same plan as the preceding, but smaller in size, and designed for *thermic applications to the rectum.* Either hot or cold applications or alternate hot and cold applications may be made as desired. This measure is of great value in the treatment of rectal irritation, and constipation due to lack of tone in the structures of the rectum, as well as in cases of enlarged or irritable prostate, etc. Short cold applications or alternate hot and cold applications are employed in cases in which excitant effects are desired, as in relaxed conditions in which there is loss of muscular tone, in hemorrhoids, and in some cases of chronic ulcer requiring stimulation. The extremes of heat and cold should in such cases be made as great as possible, or

as great as the patient will bear. Very hot applications are useful in cases of *internal hemorrhoids*, *rectal catarrh*, *rectal ulcer* and *fissure*, *enlarged prostate*, and *spasm* of the *sphincter*.

The analogous instrument for the vagina the author has used with great satisfaction in relieving the pain which is often most distressingly persistent after a *laparotomy* involving the pelvic viscera. The instrument may be applied with water at any temperature desired. Most excellent analgesic effects may be obtained with cold water in *local inflammatory processes*.

Arzberger, to whom the credit of having first employed instruments of this sort is ascribed, employs a temperature of 70° to 60°. The temperature at first may be higher (80° to 85°), and may be gradually lowered. Numerous modifications of these instruments, possessing varying degrees of merit, have been constructed by various instrument-makers.

STEAM INHALATION.

The inhalation of air saturated with moisture and warmed **1419**
by mixture with steam, improperly called steam inhalation, is a very old-fashioned but an extremely valuable remedy for both acute and chronic inflammations of the air-passages. The so-called "croup-kettle," though a crude affair, has been the means of saving many lives, and alleviating the sufferings of hundreds of little ones. When it is desirable that the patient should breathe the vapor continually, very effective means may be conveniently arranged by aid of the portable oil-stoves and gas-stoves now in use. The stove should be placed by the bedside of the patient, with a teakettle, or in the absence of anything better, a basin in which water may be continuously and vigorously boiled. By means of a yard of wire mosquito netting, rolled into the proper shape, and covered with oil-cloth, rubber cloth, or newspapers, it is possible to construct a cone whereby the vapor may be brought to the face of the patient lying close to the edge of the bed; or

for a small sum a tinner may be employed to make a more convenient and durable arrangement for conducting the steam from the boiler to the patient. It is not necessary nor desirable that all air should be excluded except that which comes through the apparatus. It is only important that the patient should breathe the air as moist and at as high a temperature as possible.

In cases of *croup* and *diphtheria*, the moist, hot inhalation aids greatly in maintaining the resistance of the tissues, and facilitates the separation of the false membranes. It must be remembered, however, that complete saturation of the air with moisture seriously interferes with the absorption of oxygen by the lungs; so that if marked cyanosis is present, the inhaling apparatus must be removed, or the inhalation of pure oxygen gas may be employed in connection with it.

1420 By far the most important use for steam inhalation is in the treatment of *acute* or *chronic catarrhal affections* of the nose and throat. The simplest form of inhaler consists simply of a tin cup with a loosely fitting cover, through which a tube passes, by which the patient is enabled to draw from the interior of the cup, warm sautrated air, which finds its way in about the edge of the cover. More than twenty years ago the author devised a convenient inhaler which is illustrated in the accompanying cut (Fig. 236). This construction permits the addition of some medicament to the water when desirable, and provides an extra water compartment outside the inhaling cup, by which the heat of the latter is retained for a long time. In *acute inflammations* of the *pharynx*, the *post-nasal region*, the *larynx*, and even in *acute bronchitis*, the faithful employment of the steam inhaler aids greatly in securing early recovery. The inhaler should be used many times a day in order to secure the best results. Ten or fifteen minutes in each hour is the usual prescription. In acute conditions, in which the parts are very sensitive and painful, the temperature of the inhalation should be moderate. The effect of the application should be soothing. In chronic con-

ditions, especially when there is thickening of the mucous membrane and hypertrophy of the glandular structures, as in cases of large or *elongated uvula*, *enlarged tonsils*, *follicular hypertrophy* of the *tonsils*, or *adenoids*, the temperature of the inhalation should be as high as can be borne. A tolerance for heat is quite readily established by the mucous membrane, so that after a few minutes a higher temperature can be employed than at first. It is not necessary to change the temperature of the water on this account, however. At the beginning of the inhalation the patient makes short, quick drafts through the inhaler; then, as tolerance is established, he draws longer and deeper breaths, especially if the bronchial mucous membrane is involved. It is easily possible to manage the inhalation so as to confine the effect almost wholly to the naso-pharynx.

The effect of the hot vapor upon the mucous membrane is precisely that of circumscribed applications of heat to the cutaneous surface. The tissues are excited to increased activity, the movement of blood through congested parts is encouraged, and the improved circulation aids the reparative processes, assists the absorption of exudates, and promotes the resistance of the tissues against invasion by parasitic microbes, to which the chronicity of catarrhal affections of the naso-pharynx is chiefly due.

Another method of administering steam inhalation, de- 1421
vised by the author, has been shown by experience, to be possessed of so much merit that it is entitled to brief mention here. It consists of the inhalation of steam from a receptacle to which it is conducted by a pipe communicating with a powerful generator or with the steam-heating system of the building. The receptacle is of such shape that the entire head in front of the ears may be pushed into it, thus exposing the skin of the face to contact with hot steam, at the same time that the heated moist air is drawn in through the nose or the nose and mouth. By this means the entire mucous surfaces and a large part of the cutaneous surface, associated

directly and reflexly with the diseased parts, are brought under the influence of the hot application. Thus while the vasomotor stimulating influence of the heat is acting upon the mucous membrane of the nose and throat, this direct action is greatly assisted by the strong hyperemia of the skin produced, and consequent draining of collaterally associated vessels of the mucous membrane. Patients experience from this treatment a degree of immediate relief such as is afforded by no other measure with which the author is acquainted. Obstructed nostrils are opened up, viscid and inspissated masses of secretion are loosened and discharged, pain and pressure are removed, hoarseness is relieved, and the patient recognizes so thoroughly the benefit received that it is not necessary to urge him to persevere in the employment of the measure until permanent results can be obtained. The treatment should be administered three times a day, 15 minutes each time. At the conclusion of the treatment, a towel wet in ice-water is applied to the face for half a minute. The latter procedure restores tone to the relaxed cutaneous vessels, while at the same time securing continued activity and a lasting hyperemia, thus prolonging the effect of the treatment.

In cases in which there is great loss of tone of the vessels of the naso-pharynx, exposures to the hot steam may be alternated with ice-water applications, the steam being employed one minute and the ice compress 15 seconds. The alternations should be repeated ten or twelve times.

In the apparatus shown in the accompanying cut (Fig. 237), devised by the author, a strong draft of cold air is produced by the aid of an electric fan. The patient controls the fan with a button, and exposes his face alternately to the action of the hot steam and the cold air. By this means a powerful alterative effect is brought to bear upon the naso-pharyngeal membrane with most excellent results. The treatment is, of course, associated with the inhalation of antiseptic vapors and the application of antiseptic sprays to the affected membranes, for the purpose of maintaining an aseptic condi-

tion until the parts have become sufficiently restored to resist successfully the attacks of their microbic enemies.

Adopting the suggestion of Brown-Sequard, the author has also utilized the cold draft as a means of training sensitive patients in such a way as to establish immunity against slight exposures to cold air or drafts, allowing the breeze from the electric fan to fall upon the back of the neck or other sensitive parts, while they are at the same time submitted to a vigorous rubbing to encourage their ability to react. As the training advances, the application of the breeze is made longer and stronger, while the force of the rubbing is diminished until the skin becomes capable of taking care of itself without either protection or the mechanical aid of rubbing. This condition being one which must be reached by every person who desires to become free from catarrhal affections, any system of treatment which does not accomplish it, or which confines itself to the treatment of the diseased mucous surfaces, will certainly fall short of the object sought.

The whole skin must be made so healthy and vigorous that it will be proof against the circulatory disturbances which give rise to colds. A relaxed skin which is bathed in perspiration by slight exercise renders the person very liable to colds. By cold bathing the skin becomes accustomed to contracting its blood-vessels firmly, so that the loss of heat which gives rise to chill and the accompanying internal congestion, does not occur. This condition can be secured only by long training by means of daily cold applications.

THE STEAM JET.

The steam or vapor jet is so called only by the license of **1422** common usage, as steam proper can not be brought in contact with the living tissues without destructive effects, although a Russian physician (Snegirjow) a few years ago called attention to the value of this agent at 212° for controlling hemorrhage, and Pincus Kiliani, who continued the experiments and observations, has clearly shown that steam has powerful

styptic properties, and that it might be used advantageously in operations upon the liver, kidneys, lungs, and other parenchymatous organs. Bleeding from quite large arteries is readily controlled by it. Under the influence of the steam jet, the parts shrivel, and acquire a cooked appearance. This action of steam does not, however, appear to interfere with immediate union of the cut surfaces to which the application has been made. The steam jet has also been advantageously used in morbid conditions of the uterus, accompanied by bleeding, especially in malignant disorders.

The steam jet is applied by means of an ordinary steam generator such as was formerly used for surgical operations by Lister's spray method. The steam is conducted to the part to which the application is to be made by rubber tubing, as short as possible without inconvenience, provided at the end with a suitable holder. The author has devised a special nozzle for applying the steam jet, which prevents the ejection of the water of condensation which, having a greater specific gravity than steam, is likely to fall where not desired. The nozzle is so arranged as to combine handle and nozzle in one piece, and provides for the safe disposal of the water of condensation (Fig. 238). The value of the steam jet for the purpose suggested has yet to be determined by the test of further clinical experience. It may prove to be an exceedingly useful measure in certain classes of surgical cases.

WATER DRINKING.

423 Water drinking as a therapeutic measure is of very ancient origin. Hippocrates prescribed it as a remedy in fevers, and the drinking of cold water has been practiced among the Egyptians from the most ancient time in the treatment of fevers. Cold water drinking was used by Hahn in the treatment of fevers in Germany in the first half of the eighteenth century, fully sixty years before Priessnitz prescribed the internal use of water in such prodigious quantities at Graefenberg.

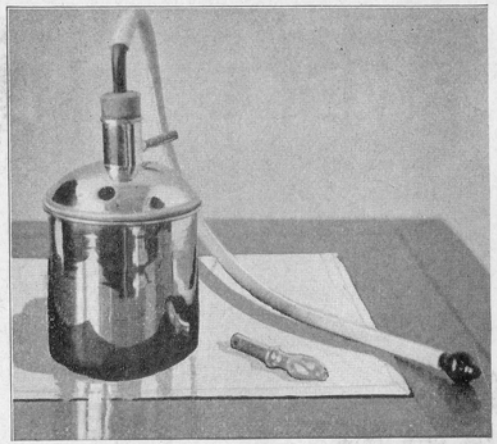


FIG. 236. STEAM INHALER (p. 916).

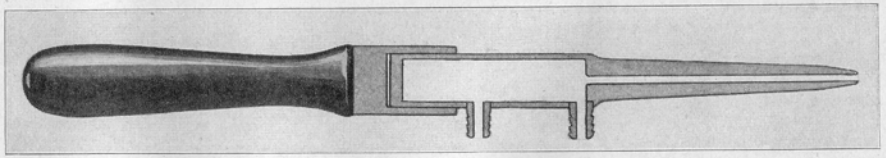


FIG. 238. STEAM-JET AND NOZZLE FOR HEMOSTASIS — DIAGRAM (p. 920). (Kellogg)

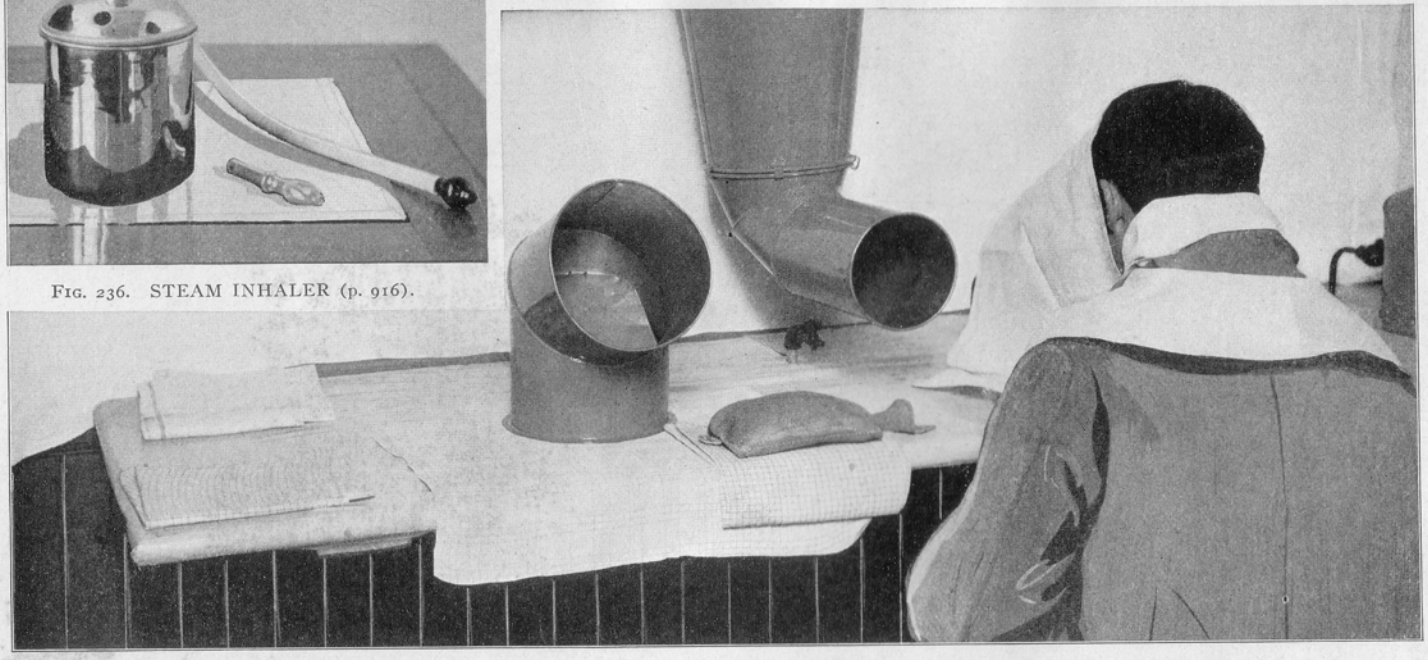


FIG. 237. STEAM FACE BATH ALTERNATING WITH COLD BLAST (p. 918).

Todano, an Italian contemporary of Hahn, made his fever patients drink five pints of ice water every three hours. The patient was placed in a hammock without covering, and the treatment was continued until perspiration occurred. If he became comatose, ice was placed over the heart. This extraordinarily vigorous refrigerative treatment must have sometimes produced most undesirable results, and it is these excesses in the use of an efficient and valuable remedy which are doubtless to a great degree responsible for the slowness with which the merit of water drinking as a systematic procedure has acquired recognition and appreciation.

Sir John Chardin, a French traveler in Persia, relates how that in May, 1674, he was treated by a native Persian physician for a very grave intermittent or "fever of Bender." One of the most important measures to which he was subjected was the drinking of large quantities of water cooled with snow.

Currie also recommended water drinking in the treatment of fever, as follows: "While the different modes of applying water to the surface are employed, it ought also to be poured into the stomach in large quantities when the patient's heat will permit it, and the presence of nausea and vomiting are no objection to this practice."

The importance of water to the vital economy must be recognized when we remember that the living organisms which compose the human body, as well as those of all other animals, are submerged in water.

Bernard, the great French physiologist, sagaciously remarked concerning the aquatic life of man, "Life exists only in a liquid medium. It is only by certain artifices of construction that the organisms of man as those of other animals, can live in the air; but all the active cells upon which their functions depend, live, without exception, like the infusoria, in an interior liquid medium." *

*"Études Physiologiques sur Quelques Poisons Américains." Cl. Bernard, Paris, 1864.

Water drinking is an internal bath; it dilutes the fluids of the body in which the cells and fibers are bathed; it purifies the body by diluting the medium in which it lives. By the free use of water the movement of the mass of liquid in which the living elements of the human body perform their work is quickened, and the stream of life runs clear and pure. It has been shown that water is absorbed from the stomach very slowly. This takes place chiefly in the intestine. Absorption is stimulated, however, by the presence of CO_2. Distilled water charged with CO_2 is the best of all drinks as a beverage for use in connection with hydrotherapy. It is soothing to the stomach, and is rapidly absorbed; hence more readily quenches thirst. The presence of mineral salts of any kind lessens the rate of absorption.

1424 Schultz has shown that copious water drinking increases the proportion of water in the blood nearly six percent; but Böcker has shown that this increase lasts only a short time, not more than fifteen to twenty minutes. Half an hour later the blood is thicker than before, and contains a smaller proportion of water than when water has been wholly withheld for twenty-four hours. Another effect upon the blood noted by Böcker was that blood clots formed after copious water drinking contain a smaller number of damaged corpuscles, which indicate their incapacity to absorb oxygen by not turning red when exposed to the air,—an evidence of the great value of water drinking as a means of improving the quality of the blood through bettering its constituents as well as by elimination of waste matters through assisting their solution.

To the great thinning of the blood which follows copious water drinking is due the remarkably increased activity of the kidneys, skin, and bowels which it produces. Examination of the urine shows not only that the quantity is increased by water drinking, but that the urea and other solid constituents are also increased. Fleming,* in experiments for the purpose of determining the physiological effects of the Turkish

* "Physiology of the Turkish Bath," Glasgow.

bath, showed that the perspiration produced in profuse sweating after copious water drinking contains a larger per cent of the chloride of sodium than does the urine. An increase in the amount of urea and other nitrogenous principles (1.55 per cent) was also noted.

Baron Liebig showed long ago (and his observations have been many times confirmed) that water drinking powerfully influences metabolism, increasing both assimilation and disintegration, but especially the former.

Water is the medium by which nutritive material is conveyed to the tissues and waste matters conveyed out of the body. Thus it is evident that by increasing the amount of water introduced into the body, the movement of the vital fluids, the blood and lymph, may be accelerated almost at will. By the increase in the volume of blood, the blood pressure is raised, the heart movements become more energetic, and the functions of the glands and other forms of activity are increased. This is true of the secreting glands as well as of the kidneys and other excreting glandular organs. Increased movement of blood through the lungs secures greater absorption of oxygen by which the various metabolic and catabolic processes are facilitated; retrograde metamorphosis is more completely accomplished; uric acid, urates, oxalates, and other products of imperfect oxidation are diminished or made to disappear entirely; in short, the patient lives a more highly vitalized and functionally active life.

Therapeutic Applications.—The effect upon the blood of **1425** copious water drinking suggests it as a valuable measure in cases of *dropsy*, whether general or local in character, especially the latter. The increase in the specific gravity of the blood due to the rapid withdrawal of water by the kidneys and the skin, even to the extent of impoverishing the blood, prepares the way for the absorption of the dropsical fluid; and by a repetition of this measure from day to day most remarkable therapeutic results may sometimes be obtained. Distilled water charged with carbonic acid gas should be em-

ployed, without the addition of sugar or any substance, unless it be fruit-juices of some sort. The dose should be from one to two pints, and should be taken preferably before breakfast or an hour or so before dinner. The author well remembers a case with which he became acquainted while in Bellevue Hospital nearly twenty-five years ago, under the late Dr. Austin Flint. A patient under treatment for general dropsy from organic disease of the heart, which had proved so refractory to all measures which had been employed, including diuretics of all sorts, was finally given up as a hopeless one, and the patient was permitted to drink copiously of water, which had previously been denied or allowed only in very stinted quantities. She drank in the course of the day two or three quarts of water. As a result, profuse diuresis occurred, the dropsy disappeared, and the patient made, for the time being at least, a very good recovery, and was soon able to leave the hospital.

Profiting by this experience, the author has made use of this measure in many cases of dropsy with most gratifying results, and has never found it necessary to require dropsical patients to refrain from drinking water freely. It should be taken *in large quantity and rapidly.* When practiced for the purpose of carrying off the dropsical effusion, the water drinking should be confined to two periods daily, morning and evening, no fluid whatever being taken between these hours.

When it is desired to increase the volume of the blood and to introduce permanently a larger proportion of water, the water drinking should be managed in quite a different manner. A small quantity should be taken at frequent intervals, and the amount in the course of a day may sum up to several pints; but the quantity taken at any one time should not exceed four to six ounces. This quantity may be taken every hour or hour and a half with advantage.

When the amount of water supplied to the body is insufficient, the condition of the body becomes in some degree comparable to that of a stagnant pool; while an abundant

supply of liquid so encourages its activities that it may not inaptly be compared to the flowing mountain stream.

Cold Water Drinking.—Priessnitz required his patients to **1426** drink large quantities of water, many patients taking as high as twenty to forty glasses a day. It is curious to note that at the time when this empiric was requiring his patients to swallow such prodigious quantities of water, he had a rival, an old schoolmate, by the name of Schrott, living in a little village four miles from Graefenberg, who required his patients to abstain wholly from water for five to eight days at a time.

Water is not a mere mechanical conveyor of poisons out and of foods in; it is a powerful vital stimulant, a divinely appointed agent which the *vis medicatrix naturæ* can use in her healing work. Dietl, the famous pupil of a world-renowned master, Rokitansky, writing so long ago as 1845, uttered the following wise and philosophical words, which every physician who undertakes to rely upon the virtues of water and other physiological agents in dealing with human maladies should accept as a confession of faith:—

"Nature alone can cure; this is the highest law of practical medicine, and the one to which we must adhere. . . . Nature creates and maintains; she must therefore be able to cure."

The deluging practice of Priessnitz is still recommended by the German water-cure empirics and by some scientific hydrotherapists, but cases are certainly very rare in which such quantities of cold water can be swallowed with advantage. As a measure of treatment, water drinking may be practiced to the extent of six or eight or even ten glasses a day with advantage, when required, but not infrequently three or four glasses are sufficient, and there are cases in which it is more important to interdict the use of liquids by the stomach than to commend their use. In such cases water may be introduced by the enema in small quantity, to be retained.

Cold water drinking is especially indicated in all the

cachexias and diatheses. In rheumatism it is useful as a means of diluting the blood so that it can dissolve and carry out of the body a larger amount of uric acid and allied substances; and as a means for encouraging activity of the skin and kidneys, it is always useful in this disease.

In *obesity*, water drinking is essential as a means of dissolving and carrying out of the body the large amount of broken-down material which results from the increase in tissue destruction set up by exercise, hot and cold baths, and other means employed to reduce weight. To forbid the free use of water in obesity is a grave error.

In *diabetes* the free use of water is not injurious, but advantageous. The blood contains an excess of sugar. All the sugar that is not oxidized must be removed from the body by the kidneys and skin, chiefly by the former. The specific gravity of the urine in these cases is always high, indicating a similarly high specific gravity of the blood. It is evident, then, that water is needed in cases of this sort for the purpose of maintaining a proper degree of fluidity of the blood and for facilitating the removal of the unused sugar, the presence of which interferes more or less seriously with the various vital functions. While the free use of water in diabetes will of course have the effect to increase the quantity of urine daily discharged, the amount of sugar, which is a matter of most serious importance in this disease, is not increased. Indeed, the amount of sugar has appeared to be somewhat decreased, doubtless as the result of the increased oxidation which takes place within the body under the influence of free water drinking.

In *fevers* water drinking is essential as a means of aiding the kidneys and the skin in the elimination of the toxins to which the rise of temperature is due, in aiding the liver in its work of destroying the fever poisons, oxidizing leucomains, and promoting the reduction of temperature by securing an increased evaporation from the skin.

Winternitz and numerous other observers have shown that

when water is taken in sufficient quantities, the temperature of the body may be lowered by the absorption of heat from the water. Suppose, for example, a patient having a temperature of 102° should swallow three pints of water at 60°. In acquiring the temperature of the body the water swallowed will absorb 126 heat units. In the case of a patient weighing 120 pounds this would induce a fall of temperature of more than 1°, provided, of course, that the heat production and heat elimination continued at a uniform rate.

A general fall in the temperature of the body of .4° C., sometimes more, was observed after drinking water at a temperature of 60° to 65°. Water taken at a lower temperature and in larger quantity has been shown by Winternitz to be capable of reducing the pulse twenty beats and the temperature .8° C. (1.4° F.). The temperature of the urine was found to be .7° C. (1.3° F.) below the normal.

Winternitz, by means of a thermometer introduced into the stomach itself, made interesting observations upon the effect of water drinking upon the local temperature. A half hour after drinking a pint of cold water the temperature of the stomach was found to be .6° C. (1.08° F.) below its normal temperature. The rectal temperature was found to be still lower, sinking gradually from the time the water was taken for nearly half an hour, when the maximum reduction of more than 1° C. (1.8° F.) was found. The axillary temperature at first rose slightly, then fell, the temperature remaining below normal for more than an hour. The pulse was decreased ten beats. This curious fact was noted,—that the temperature reduction was greater in the rectum than in the stomach. On reversing the experiment and introducing the water into the rectum, it was found that the temperature in the stomach was reduced more than was that of the rectum, falling to .9° below the normal.

A decided fall of the surface temperature at the epigastrium may be observed after cold water drinking, as well as general reduction of temperature, indicated by thermometers

placed in the axilla and rectum (Exp. 73). This fact was first observed by my assistants, Drs. Otis and Edwards, while conducting a series of observations (1898) to determine the effect on temperature reduction of water taken at different temperatures.

In cases of *chronic inactivity* of the *skin*, cold water drinking is an exceedingly valuable measure, but it must be employed with discretion, as inactivity of the skin usually means an inactive mucous membrane, so that liquids are absorbed with difficulty. In cases of chronic dilatation of the stomach, water drinking, while indicated as a means of relieving the general condition, may be inadmissible on account of the state of the stomach. In these cases water may be introduced by enema.

Copious water drinking is one of the most effective means of relieving a common cold, by aiding in the elimination of tissue poisons, the accumulation of which gives rise to the difficulty known as "a cold."

One or two glasses of cold water taken half an hour or an hour before breakfast prove in many cases an almost perfect panacea for *chronic inactivity* of the *bowels*. Hundreds of patients have been cured by the use of this simple remedy alone. At a meeting of the New York Academy of Medicine attended by the author more than twenty years ago, a leading physician of New York City stated that he had successfully treated more than one hundred cases of constipation by this simple means.

Chronic biliousness, which is nothing more or less than *chronic toxemia* resulting from the putrefaction of animal food substances in the alimentary canal, requires the free use of water. Eight or ten glasses a day would be none too much in cases of this sort.

In cases of *gall-stones* and *infectious jaundice*, water drinking is certainly indicated. The amount taken should be ten or twelve glasses a day, if possible, so that the liver will be thoroughly flushed and the bile so diluted that it will be able

to dissolve and remove any concretions which may be present. In *cirrhosis* of the *liver* arising from either indigestion or alcohol, water drinking is essential as a means of aiding the liver and the kidneys to perform the work required of them in the removal of a large quantity of alimentary poisons in addition to the toxins naturally produced within the body by the physiological processes of tissue change.

In the treatment of the opium, alcohol, tobacco, and other drug habits, water drinking renders important service by hastening the elimination of the drug and in aiding liver work and general oxidation.

The *temperature* of the water drunk should ordinarily be about 70° F. In special cases water at 60° and even 50° may be employed. Very cold water is indicated only in fevers, in constipation, and in small quantities in hypopepsia.

The *quantity of water* taken must depend on the effect **1427** desired. In fevers, a good rule is to take a glass of water every hour. In hypopepsia, one third or one half a glassful of cold water may be taken half an hour before eating. For inactivity of the bowels, one or two glasses of cold water should be taken on retiring at night, and as much more on arising in the morning. A thirst for water is almost always an indication that it may be taken with advantage, no matter whether such use is in harmony with the established canons of hygiene or not. It is safer to trust to the natural instincts than to pin one's faith to a theory. Almost the only decided contraindication is in connection with meals when free water drinking prevents proper insalivation of the food.

The Best Water.— The purest water is universally the **1428** best. Whatever beneficial effects are obtained from water drinking must be attributed to the water itself, and not to any ingredients which it contains. Mineral waters are simply diluted drugs. The ingredients may be obtained at any drug-store, and if diluted to the same extent as that in which they are found in the so-called natural waters, the effects obtained from their use would be the same. Medical experience has

shown that the best of the so-called mineral waters are those which contain the least mineral ingredients. The very best water is distilled water which has been well aërated. Water obtained from natural sources is generally more or less contaminated, that from lakes, streams, and rivers being necessarily defiled by the fish and other creatures which live in natural bodies of water, and by surface drainage, which, after every rain, washes out quantities of filth.

Water obtained from public supplies should always be boiled; indeed, this precaution is a wise one under nearly all circumstances.

Hard water should always be boiled for a long time to eliminate, so far as possible, the lime which it contains; but even when boiled it is by no means free from this injurious ingredient. The larger the amount of saline ingredients, the more slowly the water is absorbed. The presence of acids encourages absorption. Carbonated distilled water and diluted fruit juices without sugar are the best drinks.

HOT WATER DRINKING.

1429 Hot water drinking has of late years been enormously overdone. In the United States, and doubtless in other countries, many persons have been injured by deluging their stomachs with quantities of hot water several times daily. The author has met a number of patients who were taking three or four glasses at once in this way at a temperature which would seem positively incredible. In one instance a gentleman was found sipping a glass of water at a temperature of 160°. The free use of hot water has been largely encouraged by physicians who recommend an exclusive meat dietary, experience having taught them that the free use of meat must be accompanied by copious water drinking as a means of ridding the system of the ptomains, toxins, and various other poisonous substances which are always to be found in the body of a dead animal. Water drinking in these cases is doubtless a means of saving the patient's life

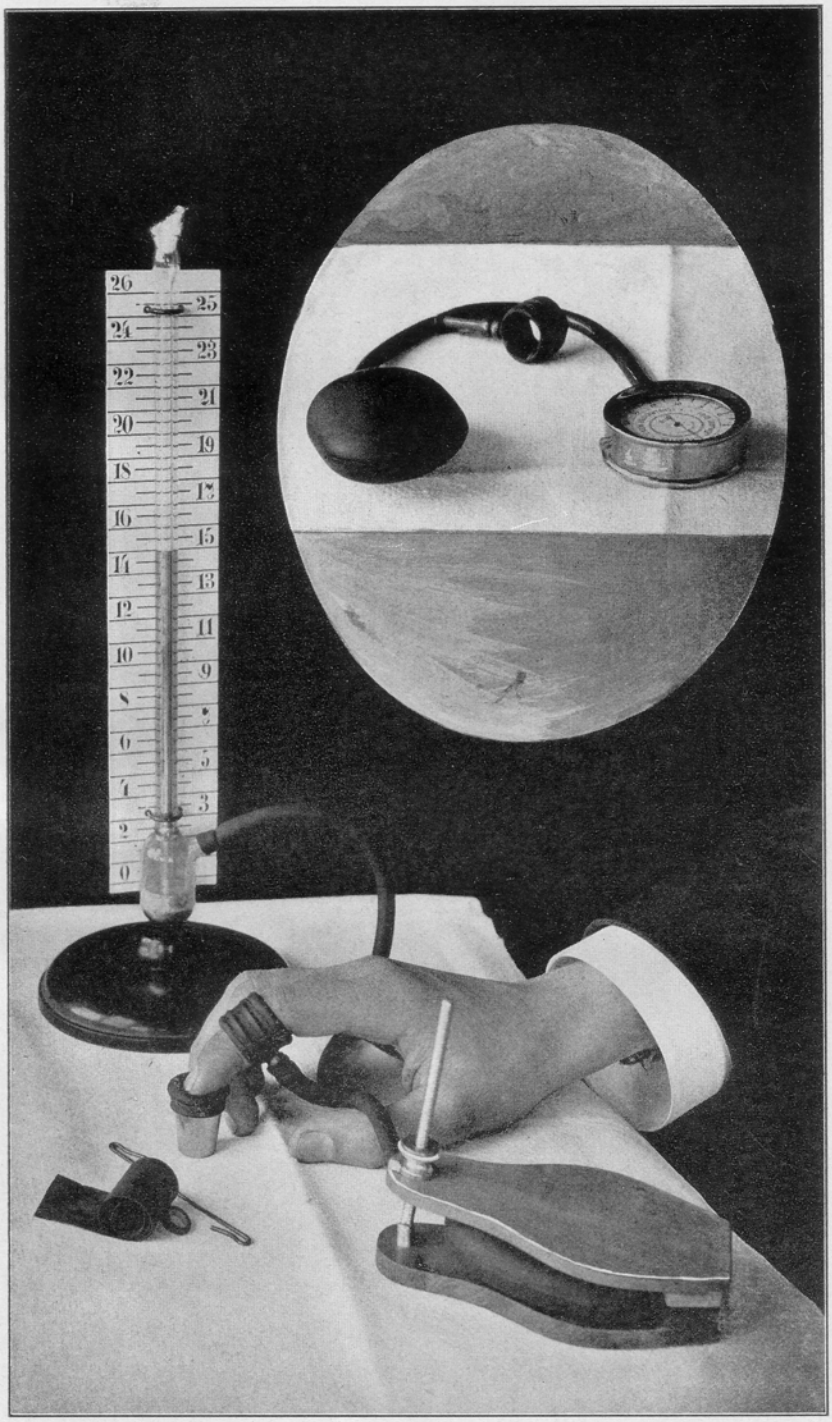


FIG. 240. GÆRTNER'S TONOMETER.

FIG. 239 GÆRTNER'S TONOMETER (p. 931).

under conditions which would otherwise lead to speedy exhaustion of the defenses of the body, and thus precipitate some acute and perhaps fatal malady, as Bright's disease, organic changes in the liver, arteriosclerosis, etc.

The fact that hot water has proved serviceable in some cases has led to its excessive use by a large number of persons who have suffered serious consequences from the practice. The general effect of hot water drinking is to debilitate the digestive system, while cold water acts as a tonic. Heat and cold, when brought in contact with the mucous membranes, produce effects entirely analogous to those resulting from their application to the skin. When heat is applied, the result is first a stimulation, quickly followed by a tonic reaction lasting for a considerable length of time. In this condition the blood-vessels of the stomach are contracted, the circulation is less active, and the activity of the peptic glands, if not entirely suspended, is greatly diminished, so that the quantity of hydrochloric acid produced is smaller than under ordinary conditions. When cold is applied, the opposite effect is produced. The blood-vessels are first contracted, but later, tonic reaction occurs, the movement of blood in the vessels is accelerated, the glands become more active, and the functions of the stomach are quickened.

From these facts it is apparent that hot water drinking is a measure likely to prove of great service in *hyperpepsia*, and likewise in gastrorrhea, as in these conditions there is an excessive production of hydrochloric acid. In order to be beneficial in cases of this sort, the water swallowed must be very hot, the temperature being 130° to 140°; and should be swallowed rapidly, so that it may be cooled as little as possible before coming in contact with the stomach.

The tonometer of Gærtner, an instrument by means of which the level pressure may be quickly and exactly determined, may be advantageously employed in connection with water-drinking. The two forms of this instrument are shown in Figs. 239 and 240.

Hot water drinking is very useful in *gastralgia*, especially when accompanied by vomiting. Slowly sipping hot water will sometimes relieve vomiting not only in gastralgia, but in other conditions. Hot water drinking also affords relief in the colic pains frequently the result of the habitual use of milk from a neglected nursing-bottle or some similar cause. It is an invaluable remedy in chronic gastritis, or gastric catarrh.

In cases of *hypopepsia* and *apepsia*, a few ounces of cold water should be rapidly swallowed half or three quarters of an hour before the meal, the purpose being to produce a vigorous reaction in the mucous membrane of the stomach. The result is an improved appetite and increased digestive power.

1430 *When Free Water Drinking Should Be Avoided.*— In *extreme dilatation* of the *stomach*, water drinking must be avoided for the reason that a dilated stomach does not readily absorb, and from lack of muscular tone it can not readily relieve itself of its contents by transferring the water to the small intestine. Very little absorption takes place in the stomach, the intestine being the great absorbent organ of the body. Thus when water is swallowed freely in cases of this sort, the stomach is simply filled up, and the thirst is not relieved until the stomach is completely filled, so that it runs over into the small intestine.

The effect of this overburdening of the stomach with liquids which are not readily disposed of, is to increase the dilatation or prolapsus of the already disabled organ.

In colic, cold water drinking should be entirely avoided, though hot water often affords relief if taken in ample quantity. At the same time that the hot water is taken into the stomach, the hot enema should be employed.

Dr. Lawson Tait laid down a law that liquids of all sorts should be avoided for two days after an *abdominal section*. His idea was that by withholding liquids in this way, the intestine would be compelled to absorb the stagnant fluids

from the abdominal cavity. This method is quite a hardship to patients who are subjected to it, many suffering more from thirst than from the pain of the operation. It is certain, however, that as Mr. Tait has pointed out, patients do better under this regimen. The withholding of fluid from the stomach is certainly a useful means of combating the nausea and vomiting which so commonly follow operations of this kind, and the author is inclined to think that this latter is the most important advantage obtained by withholding fluids in cases of this sort. No harm has seemed to result from the use of the tepid enema as a means of affording the necessary amount of liquid.

Drinking very freely of cold water must be strictly avoided when a person is both fatigued and sweating profusely. It is generally better not to drink freely of cold water when perspiring freely, even though one may not be seriously fatigued; as when the body is actively perspiring, the elimination of heat is very great, several times the normal amount, and the additional loss of heat occasioned by the cold water is sometimes sufficient to produce a chill, with internal congestion and serious results. If very cold water be taken when a person is perspiring freely, it should be in very small amount, and should be very slowly sipped.

Feeble patients should avoid the free drinking of cold water except when walking, when just setting out for a vigorous walk in the open air, or when about to engage in some other exercise. Water drinking is also entirely safe just before and during a hot bath. Avoiding the free use of water at meals is a very important hygienic rule. The cold water interferes with the digestion of starch, delays peptic digestion, and is the cause of many other mischiefs.

ELECTRICITY AS A COMPLEMENT TO HYDROTHERAPY IN THE TREATMENT OF CHRONIC DISEASE.

1431 The efforts of some enthusiasts to find in electricity a panacea for all human ailments, and the subsequent failure of this agent to accomplish in the hands of others all that was claimed for it, has been a fruitful cause of prejudice against its use as a substitute for the empirical, irrational, and artificial methods which have come down to us as a legacy from the infantile days of our beneficent art, or which were engrafted upon it during the ages when all the arts and sciences were stifled by the universal prevalence of superstition and intellectual darkness,— methods which still cling to us like the barnacles upon the bottom of an ocean steamer, and hinder our advancement toward the goal of all scientific progress in medicine; viz., the attainment of a system of dealing with the sick in which every measure employed and every application shall have for its basis a thoroughly rational and physiological foundation. No medical practice can properly claim to be strictly rational which is not at the same time physiological. Those measures which accomplish so-called therapeutic results by means of toxic effects are pathological rather than physiological agents; and with the onward march of laboratory research, clinical observation, and physiological and pathological knowledge, they must in time be wholly eliminated from our therapeutic armamentarium.

The author has for more than twenty-five years given special and earnest study to the practical application of physiological agents of all sorts in the treatment of disease. Water, gymnastics, massage, manual and mechanical exercise, heat, sunlight, diet, and other agents, as well as

electricity in its various forms, have all been carefully studied and utilized in the treatment of the various forms of acute and chronic disorders. Relying upon none of the agents as a cure-all, the effort has been made so to combine them all as to secure for each the greatest possible efficiency, utilizing each one for those things to which it is best adapted, and applying two or more in succession or simultaneously in such a way as to enable the effects of each one to supplement or complement the effects of each other one. Special attention has been given to the utilization of water and electricity, for the reason that these two agents have been the object of more exact scientific study and research than any others employed in physiological therapeutics.

The chronic invalid rarely has a fair chance unless he can have brought to bear upon his case simultaneously all the various physiological agents which are indicated. To undertake to cure a chronic dyspeptic by diet alone, by water alone, or by electricity or exercise alone, or by any other single agent, is very much like trying to raise a great building with one jack-screw. All the lifting agencies possible must be set at work to get these chronic sufferers out of their pathological ruts.

It requires but a very superficial study of the subject to show the remarkable similarity between the methods of hydrotherapy and electricity in effecting results. The most important results of each are attained through their influence upon the nervous system, as the therapeutic effects of both agents are based upon their physiological effects.

The researches of Schüller, Vinaj, Winternitz, and others have shown that prolonged moderately cold applications to the surface produce prolonged contraction and decongestion of internal vascular areas reflexly connected with the cutaneous area acted upon. Local cold applications in this respect differ from general cold applications, which cause dilatation of the visceral and cerebral vessels through contraction of the surface vessels.

Warm applications, that is, a temperature of 92° to 98°, on the other hand, cause immediate contraction of the vessels of the interior of the body, corresponding with dilatation of the cutaneous vessels.

Every portion of the cutaneous surface is reflexly associated with some internal vascular area, the conditions of which may be controlled by the application to the associated cutaneous area of thermic or other agents capable of producing vascular changes; for example, any agent which causes contraction of the cutaneous vessels will cause a corresponding action of the associated visceral vascular area, this being also true respecting vasodilatation.

From clinical observations and from the study of practical electrotherapy in connection with hydriatry or rational hydrotherapy, the author is fully convinced that many of the effects of percutaneous applications of electricity are produced by the same means through which most hydriatic effects are obtained; viz., through nervous impressions propagated from the skin to the spinal cord through the sensory nerves, and sent out from the spine as motor influences, then carried outward by the non-medullated vasoconstricting fibers of the sympathetic and the medullated inhibitory fibers which pass directly from the vasomotor centers of the cord to their distribution in the vessels. In other words, the condition of anelectrotonus and catelectrotonus, as the case may be, established in the cutaneous vessels, is propagated through a reflex arc to the associated internal vascular area. It seems to the author that this view alone affords a rational explanation of the influence of percutaneous applications of galvanism upon the internal organs.

1432 A galvanic current of twenty to forty milliamperes applied, the anode electrode over the hypogastric region, the cathode over the lumbar region, produces decided effects in relieving uterine and ovarian congestion. Yet the location of these organs is such as to bring them practically at the neutral point between the two poles, and hence outside the sphere of

influence of either the cathode or the anode. It is true that by increasing the strength of the current, the neutral point may be moved nearer to the cathode; while decreasing the current moves the neutral point nearer the anode, thus bringing in either case a larger area under the influence of the opposite pole. Knowing this fact, and taking advantage of it, we may bring under the influence of either pole desired, structures not too far removed from the surface; but in the case of organs located approximately in the center of the body or far beneath the surface, as the uterus, the ovaries, the abdominal viscera in general, and the spinal cord, it is evident that we are powerless to produce in them an electrotonic condition of any considerable degree of intensity.

1433 In the case of the pelvic organs, and likewise with the stomach, we are able to produce either anelectrotonus or catelectrotonus, as we may desire, by means of suitable electrodes; but in the case of the spinal cord, the sympathetic ganglia, and most of the abdominal viscera, and indeed, nearly all the deep-seated structures of the body, we are unable to produce electrotonic states, for the reason that the action of electrical currents, when applied to the body, is practically confined to the immediate vicinity of the electrodes. As the current leaves the electrodes, it spreads out, utilizing the whole body as a conductor instead of passing from one electrode to the other, as might be supposed by one not familiar with the laws of electrophysics.

These and other considerations show us that in explaining the effects of percutaneous applications of electricity we must keep in mind the interesting anatomical and physiological relationships which form the basis of a large share of the applications of water in rational hydrotherapy.

1434 The researches of Brown-Sequard, Charcot, Winternitz, Beni-Barde, Fleury, and other hydriatrists, have established a distinct reflex relationship between the principal internal organs and particular cutaneous areas, as elsewhere designated (**372–382**).

In general, the skin overlying an internal organ is reflexly associated with it. This is the reason why percutaneous applications of electricity made over an organ usually affect it, and not altogether because the electrical current is passed through the organ.

1435 For nearly twenty years, the author has made use of this principle in the application of electricity, especially in the treatment of genito-urinary diseases, and has seen excellent results from the application. For example, in applications intended to influence the genital glands and associated organs,— the uterus, ovaries, and tubes in women, and the testicles and prostate in men,— it has been found distinctly advantageous to make applications to the inner surface of the thighs and perineum, as well as to the epigastric and lumbar regions. The anatomical relations of the nerve supply of these regions suggested the method before the reflex relationships between cutaneous and visceral vascular areas was so thoroughly understood as at present. The author has also for many years utilized anodic applications of the galvanic current to the face as a means of relieving coryza, and has often seen a patient relieved of headache, presumably congestive in character, by applications of the galvanic current to the abdominal and cervical sympathetic.

It requires but a cursory review of the physiological effects of water and electricity to note the remarkable parallelism between the effects of hydriatic applications and those of electricity. With equal readiness it may be seen how, by simultaneous or successive use of electricity and water, if applied with scientific precision, these two potent agents may render mutual aid in a great variety of conditions.

1436 Special note may be made of the following points:—

Water moistens the skin, and thus increases electrical conductivity.

Hot applications cause immediate dilatation of the blood-vessels, increasing the vascularity of the skin, and thus also increasing its electrical conductivity; while cold water causes

first a contraction of the small vessels, lessening the blood supply of the skin, and diminishing its conductivity for both heat and electricity. In the reaction which follows, however, the amount of blood in the skin is greatly increased, thereby lessening its resistance.

Both very cold and very hot applications to the skin diminish the sensibility of the nerves, and thereby lessen their susceptibility to electrical effects. Anemia of the skin, on the other hand, increases sensibility, while saturation of the skin with moisture diminishes irritability and nerve sensibility. Steiner has shown that temperatures below 59° and above 77° lessen the velocity with which nerve impulses are conducted, while Hermann has shown that the application of cold diminishes notably the phenomena of electrotonus.

Heat, being relaxing, produces effects analogous to the cathode; while cold, produces contraction or anodal effects.

Neutral applications are likewise sedative, thus resembling the anode in their effects. Short cold applications, because of the reactionary excitation produced, give rise to effects resembling the cathodic influence of the galvanic current or the excitation of the faradic; while the atonic reaction which follows prolonged hot application results in sedative effects similar to those of the anode.

Granting the truth of those statements respecting the mode of action of percutaneous applications of electricity upon the visceral circulation, it needs no lengthy argument to show the great advantage of combining electrical and hydriatic applications in a great variety of morbid conditions.

According to the author's personal experience, two general **1437**
rules may be established for applications of this sort: *First*, increased movement of blood and accelerated functional activity of an internal organ may be induced by short, vigorous, cold applications in combination with cathodic applications of galvanism. The electrical application may be either simultaneous or may immediately follow the cold application. Bipolar, faradic, or sinusoidal currents may also be applied

with advantage, but the effect is less distinct than that of the galvanic current. The electrical application should, in general, be as strong as the patient can bear without pain.

Secondly, congestion and undue functional activity of an internal organ may be diminished by a prolonged, moderately cold application (60° to 70° continuing from thirty minutes to several hours), combined with the simultaneous anodic application of the galvanic current of moderate strength.

By the application of these principles, results which appear really marvelous to one not familiar with applications of this sort, may be obtained in cases of congestion of the brain, lungs, liver, uterus, ovaries, likewise in atonic conditions of the stomach and bowels, and in amenorrhea and hypopepsia.

1438 In applications for the relief of pain, in which electricity so often renders most valuable service, the association of heat with the electrical application is an exceedingly valuable measure. When the pain is neuralgic in character, the strong application of the sinusoidal or faradic current, combined with a fomentation at a temperature high enough to produce slight pain when first applied, continued for 15 or 20 minutes, gives very positive and gratifying results. The current should be as strong as the patient will bear. When the pain is due to congestion or inflammation, an anodic application of the galvanic current should be employed instead of an induction current. The application should be prolonged, and not so strong as to produce decided sensation.

1439 Anodal galvanic applications may likewise be associated with cold as an analgesic measure. In cases of cardiac insufficiency in which the application of electricity may be thought to be a necessary or useful measure, advantage may be gained by the application, two or three times daily, of a cold compress for 40 to 60 minutes, over the anterior surface of the chest. Slowing of the pulse and an increase in arterial tension, as indicated by a sphygmographic tracing, indicate at once the therapeutic power of this simple application.

1440 In cases of atony of the bladder, and inactivity of the bowels due to dilatation of the colon, the cold douche to the feet and over the lumbar, umbilical, and hypogastric regions, in combination with faradic and sinusoidal applications to the rectum and abdominal walls, achieve prompt success in many most obstinate cases which have failed to yield to other measures. Cold douches applied to the parts named may also be used to advantage in combination with the galvanic current applied percutaneously to the abdominal and lumbar surfaces. The strength of the current should be 60 to 80 milliamperes.

1441 In cases of apepsia and hypopepsia, in which hydrochloric acid is absent or greatly deficient in quantity, most excellent results may be obtained by the application of the cathodic galvanic or the sinusoidal current applied to the epigastrium in combination with the ice-bag, for half an hour before each meal. Painful congestion is relieved by very hot fomentations half an hour after a meal in combination with a faradic or sinusoidal current of moderate strength.

1442 Very short, very hot applications over the liver (130° to 140°, for 5 to 8 min.), combined with a prolonged anodic galvanic application, act powerfully in relieving hepatic congestion.

1443 Very hot fomentations over the lumbar regions, combined with an anodic galvanic application to the same parts and to the lower third of the sternum, are indicated in renal congestion.

1444 The hemostatic effects obtainable by hydriatric applications in connection with the galvanic current have been proved of invaluable service in hemorrhage due to ovarian congestion, intra-uterine vegetations, and intra-uterine and submucous and interstitial fibroids of the uterus. In cases in which persistent hemorrhage follows the employment of electrolysis, the cold pelvic pack and the hot vaginal douche in many cases render continuation of the treatment possible when otherwise its interruption would be necessary.

445 In amenorrhea, the effects of cathodic, faradic, or sinusoidal applications to the uterus are greatly increased by short cold applications to the lumbar regions, the inner surface of the thighs, and the feet.

446 In applications of electricity to paralyzed and paretic muscles, the effects of the electrical application may be greatly increased by the previous application of cold water in the form of the ordinary cold douche, the percussion douche, the Scotch douche or cold friction, or the heating compress. The marked increase of muscular irritability produced by hydriatric applications of this sort increases the susceptibility of the muscle to the influence of the electrical current, whether the galvanic, faradic, or sinusoidal current be employed.

447 For relief of pain in neuralgic joints, hot applications followed by the sinusoidal or galvanic current, are a most useful measure in cases in which joints are not painful nor stiffened or thickened by inflammatory products. The alternate hot and cold douche and other exciting hydriatric measures may with much advantage be employed in connection with cataphoresis. The author has found this combination exceedingly useful in treating many cases of this sort.

448 In chronic congestion of the pelvic and abdominal viscera, the good effects obtained from local electrical applications, either internal or percutaneous, may be continued and intensified by the use of the heating compress, consisting of a towel wrung dry out of very cold water, placed over the parts and covered with several thicknesses of flannel sufficient to maintain the heat produced by reaction, but not an excessive accumulation.

449 Faradic, sinusoidal, and cathodic galvanic applications may be employed in connection with the revulsive douche and other revulsive applications in all cases in which pain is not a marked feature, but in which the purpose is to produce strong circulatory reaction. When pain is present, the faradic or sinusoidal current should not be employed; the galvanic current should be used instead of the cathode.

The form of revulsive applications referred to consists of a prolonged hot application followed by an exceedingly short cold application. The respective times of the applications may be hot, 5 to 15 minutes, cold, 15 to 30 seconds, if compresses are employed; or 3 to 5 minutes for the hot douche, followed by a cold douche of 4 to 10 seconds.

1450 For general hypnotic effects, applicable to nearly all cases of insomnia, a neutral bath — that is, a bath at a temperature of 92° to 96° for 30 to 40 minutes, or a douche with little pressure at the same temperature, with a duration of 1 to 5 minutes — succeeds in securing sound sleep without the use of hypnotic drugs of any sort, especially when combined with the static insulation and breeze to the head and spine, or a galvanic application to the inferior cervical sympathetic and solar plexus, the anode being placed at the neck.

1451 The neutral full bath, combined with the galvanic, faradic, or sinusoidal current, is perhaps the most powerful of all hypnotic measures. The author has employed this bath with success for nearly twenty-five years; and it has rendered valuable service not only in relieving insomnia, but in helping patients through the trying time which immediately follows the withdrawal of opium, cocaine, and other drugs, in the treatment of various forms of drug addiction.

1452 The faradic, sinusoidal, static, and high frequency currents are all tonic in character, stimulating metabolism, arousing the nerve centers, and directly exciting the brain and all portions of the central nervous system. Short applications of cold water, especially when accompanied by strong mechanical effects, as in the cold douche, constitute the most powerful of all known tonics. By combination of the cold douche with the faradic and sinusoidal electrical currents, the tonic effects of each measure are intensified. The electrical application should be made soon after the douche, when reaction is well established, the nerve and muscle tone elevated, and the nervous reflexes in full swing.

1453 The refrigerant effects of the cold bath may be greatly increased by the simultaneous application of a slowly alternating sinusoidal current in such a manner as to secure vigorous contraction of the large muscular masses. Three sets of electrodes should be employed: one for the arms, another for the legs, and another for the back and the abdomen. The contractions should be at the rate of four to six per minute. The temperature should be 78° to 75°. The duration of the bath should be 10 to 15 minutes. The patient should be rubbed during the bath so as to maintain an active cutaneous circulation.

1454 The analgesic effects of water may be most advantageously employed in connection with the electrolytic treatment of uterine fibroids for the relief of the pelvic pains which are not infrequently awakened when currents of large quantity are employed. It has always been the author's custom to administer a very hot vaginal douche just before and just after the electrical treatment. A very hot sitz, 115° to 120°, for 3 to 5 minutes, followed immediately by a dash of cold water over the hips, prevents pain and hemorrhage.

1455 In applications for the relief of headache due to cerebral congestion, in which the cold applications do not produce favorable results, applications of galvanism may be made to the head in the usual manner in connection with very hot applications to the cervical region. Excellent and almost immediate results may thus be frequently obtained in cases which are rebellious to other measures.

1456 Dana, in his masterly work, "The Clinical Study of Neuralgias," fixes the location of a considerable number of areas which are the seat of transferred pain in neuralgias, and which have by clinical observation been definitely associated with internal pathological conditions.

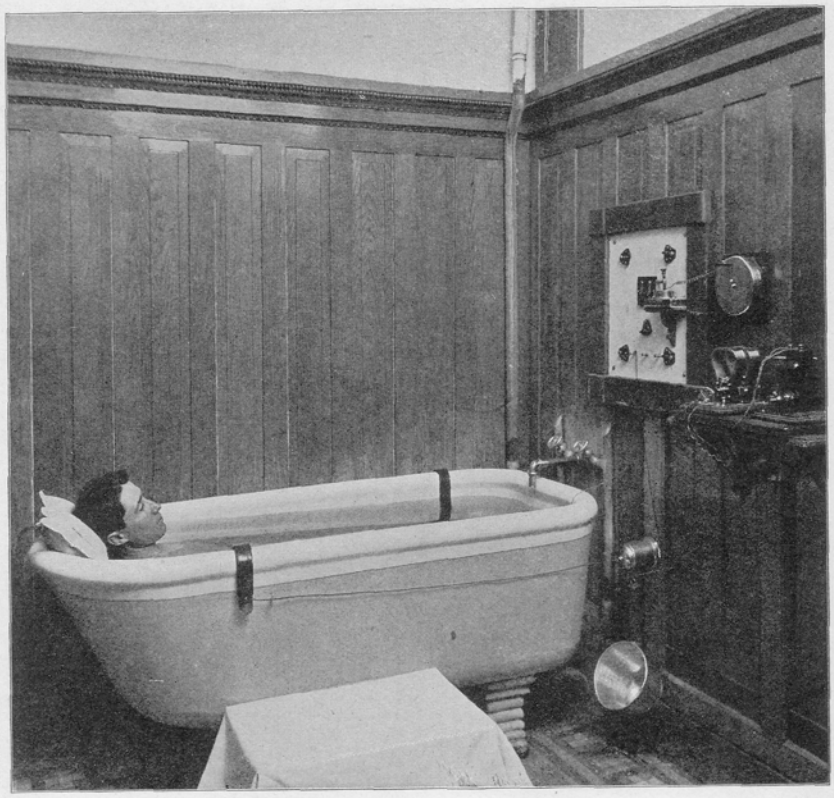


FIG. 241. ELECTROHYDRIC BATH (p. 946).

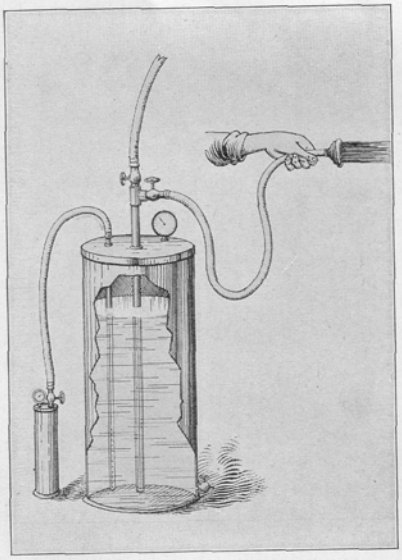


FIG. 242. CARBONIC ACID DOUCHE (p. 957).

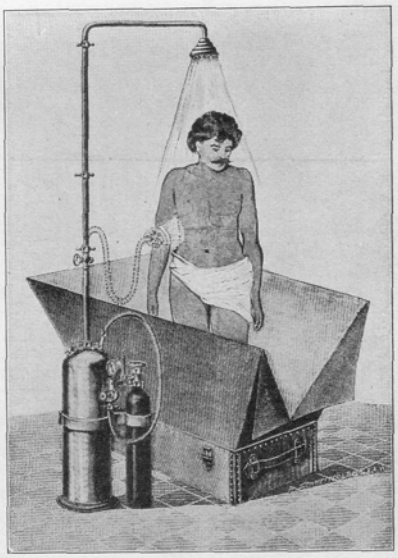


FIG. 243. OMBROPHORE (p. 958.)
(Winternitz)

By the combined application of fomentations, revulsive compresses, or other analgesic hydriatic procedures with the sinusoidal, faradic, or static electrical currents, most excellent results may be obtained, such as could not be looked for by other means than by the combination of water and electricity,— the two most powerful known agencies in influencing the nervous system. These several areas as located by Dana may be enumerated as follows: —

1. Vertex (anemia, endometritis, bladder).
2. Frontal region (constipation, hypopepsia, error of eye refraction, caries of incisors).
3. Occiptal region (pharyngitis, diseases of the ear and teeth).
4. Sternal region (gastric irritability, hypopepsia).
5. Mammary region (uterine disease).
6. Dorsal area below right shoulder-blade (liver).
7. Dorsal area below left shoulder-blade (spleen).
8. Central dorsal region of the spine (gastric disease).
9. Wrists (ovaries).
10. Thumbs (uterus).
11. Fingers (bladder).
12. Area between crest of the ilium and ribs (dyspepsia and constipation).
13. Sacral region (uterus).
14. Outer surfaces of hips (broad ligaments and ovaries).
15. Groins (spasm of ureter).
16. Inner aspect of knee-joint (the hip-joint).
17. Heels (neurasthenia, disease of the ovaries, rheumatic diathesis).

The location of these areas may be clearly seen by reference to Figs. 122, 123, for which the author is indebted to Dana's work previously mentioned.

THE ELECTRO-HYDRIC, OR ELECTRIC-THERMAL, BATH.

This bath is simply a water bath with the addition of 1457
electricity. The author employs the faradic, galvanic, or

sinusoidal electrical currents in this way. The electricity is communicated to the patient in a porcelain tub by means of a stationary head plate and sliding metallic electrodes on either side (Fig. 241). The electrical apparatus may be placed at the head of the tub or in any other convenient place within easy reach of the operator. The temperature of the bath depends upon the effects desired. The temperature most commonly employed is from 92° to 98°.

When tonic effects are desired, the faradic current is generally found preferable. The temperature of the bath may be from 92° to 95°, for 5 to 6 minutes, and at the last end cooled to 80°, the patient being rubbed in the meantime to prevent chilling. The strength of the current should be such as to produce distinct tingling in the various parts of the body to which it is directed, but not sufficiently strong to cause contraction of the muscles.

When sedative effects are desired, the temperature of the bath should be 92° to 97° (ordinarily about 95°), and the galvanic or sinusoidal current should be employed. The bath should be continued for 12 to 15 minutes. The direction of the current should be from head to foot; that is, the positive pole should be connected with the head of the bath, the negative with the foot.

The neutral electro-hydric bath is an excellent application for the relief of insomnia. It is, in fact, adapted to all classes of cases in which the nervous system is abnormally irritable. The sinusoidal current is especially useful in cases in which neuralgic pains are a prominent feature of the nervous irritability.

In administering the electro-thermal bath the current should be entirely turned off before the patient enters the bath, and then turned on very gradually until the current is just sufficient to produce decided sensations of tingling and prickling. Great care should be taken to avoid giving the patient a shock of any kind by the sudden interruption of the current. This is of special importance in the case of the

galvanic bath. If the bath is supplied with electricity from a street-current of high tension, as a 500-volt or 1,000-volt current, great care must be taken to avoid the possibility of a sudden afflux of current, which might be in the highest degree dangerous to life. On this account, it is better to supply the galvanic bath with a current from a cell battery of such size that the total amount furnished by it will not be capable of producing more than temporary inconvenience.

Electro-Vapor Bath.— This bath consists of a cabinet 1458
arranged as for an ordinary vapor bath. In addition, stationary electrodes are placed upon the foot rest, the seat, and the back rest, and several movable electrodes are provided suitable for application to the abdomen, or chest, or to be held in the hand. These electrodes are connected with a switch board placed upon the outside of the cabinet. An ordinary faradic battery is connected with the switch board in such a way that the current may be directed through the body in various directions by connecting the different electrodes through the switch board.

It is possible that certain therapeutic advantages may be gained by the combination of electricity with the vapor bath. The skin when moistened by vapor is certainly rendered a better conductor, and the entrance of the electric current into the body is thus facilitated. The tonic influence of electricity will, to a certain extent, counteract the sedative and depressant effects of the heat of the bath, and thus, the patient may possibly be enabled to endure a longer application when prolonged sweating is required for eliminative purposes. It can not be clearly shown, however, that equally good effects may not be obtained by the application of electricity after the bath; and it is probable that the tonic effects obtained from the electrical current are so much less intense than those derived from the cold application which should always follow the vapor bath, that the advantages gained by the combination of electricity with this procedure are hardly worth considering.

1459 **Thermo-Electric Bath.**— In this bath, an application of electricity is combined with a hot-air bath (**1233**). The physiological effects are essentially the same as have been elsewhere indicated in the description of the hot-air bath (**1234**). The mechanical arrangements are essentially the same as those described above for the electro-vapor bath; the only difference is that provision is made for heating the air without adding moisture to it. The cabinet may be so arranged that it may be used for either the vapor or the thermo-electric bath. The remarks made above respecting the therapeutic value of the electro-vapor bath apply equally to this procedure, and need not be repeated.

1460 **Electro-Chemical Bath.**— This bath is simply an electro-hydric bath in which a solution of some chemical substance is employed instead of plain water. Various compounds have been used for this purpose. The addition of chloride of sodium increases the conductivity of the water, and is a measure which may be usefully employed to increase the intensity of the bath when the electrical current is too feeble to obtain the effects desired. For this purpose two to ten pounds of salt may be added to the water of the bath.

The bath may be rendered alkaline, if desired, by the addition of sal soda in quantity of two to four pounds. This combination is thought by some to be especially desirable in cases of rheumatism in which the perspiration is strongly acid. If the bath is administered at a temperature of 90° or less, it is possible that there may be some slight absorption of alkali into the system; but the amount thus taken in is, as has been experimentally shown, exceedingly minute, and scarcely worth considering.

Certain observers claim special tonic effects from the employment of an acid solution, the water of the bath being acidulated by the addition of an ounce or two of sulphuric acid. It is doubtful whether any special advantage is gained by this means.

In cases of cardiac and renal disease in which the efferves-

cent bath is indicated, an electrical current may sometimes be advantageously added, thus enhancing the tonic effects of the bath, and rendering it possible to repeat it at more frequent intervals and to prolong the duration of the application, thus producing a more intense degree of cutaneous stimulation, the special object aimed at in the employment of this procedure.

Some attempts have been made to combine applications of static electricity with hydriatic procedures, but without very appreciable results. It is possible that this current might be substituted for that obtained from the induction coil, but it is doubtful whether any material advantage would be gained thereby. Possibly future experimentation may develop something of interest in this direction. The writer has long made use of the static current obtained from a very powerful influence machine in connection, but not in combination, with hydriatic procedures, and has found it a valuable aid, especially as a hypnotic, particularly in cases of insomnia and as an analgesic in cases of chronic articular rheumatism and neuralgia of the joints.

MASSAGE WITH HYDROTHERAPY.

In addition to the remarks made elsewhere (**1221-1230**), **1461** there remain to be discussed a few points in relation to the combined use of massage and hydriatic measures. The value of massage as a measure associated with hydriatic procedures depends chiefly upon the following characteristic physiological effects: —

1. Increase of circulatory activity.

2. Stimulation of all the functions of the skin and promotion of reaction.

3. The promotion of nutritive changes in the muscles.

Massage may be advantageously associated with hydriatic procedures not only as an accompaniment of the hydriatic process entering into the technique of the application but it

may be employed either as a preparatory or a supplementar measure.

All the procedures of massage may be associated wit hydrotherapy. Friction, percussion, and deep massage ar especially of service.

Friction.— Friction, as elsewhere explained (**1225**), i almost universally employed as an essential means of prc moting reaction after general cold baths. It has other use of almost equal importance, of which the following may serv simply as illustrative examples:—

1. Friction of the skin at intervals of 15 to 30 minutes i connection with the cold compress, to prevent benumbing c the skin and obliteration of the reflexes upon which the effi ciency of the compress depends. This measure is especiall of use in connection with the cold precordial compres (**1383**), the cold chest compress in pneumonia (**1374**), ice bag to the back of the neck (**1314**), the ice-cap (**1314**), an the spinal ice-bag (**619, 670**). Friction should be avoide when the purpose of the cold application is to allay super ficial inflammation. The hot fomentation (**1328**) should b employed instead of friction in cases in which deep-seate pain exists, which is aggravated by the friction, and in case in which the superficial parts are tender. The friction shoul be applied with sufficient vigor and duration to redden an warm the parts.

2. Friction may often be employed advantageously befor an application to accelerate the surface circulation, and pre pare the parts to react quickly after a cold application i made. This method is of special value in connection wit the wet girdle (**1347**), the abdominal compress (**1351**), an the chest pack (**1373**). It may also be usefully employed a a general measure before cold applications when there is tendency to gooseflesh or the patient complains of sligh chilliness, or when reaction is difficult, especially when th application of heat as a preparation for the cold procedur can not be conveniently utilized.

3. Vigorous friction may be advantageously used after either hot or cold localized applications which are employed for derivative effects, such as the cold running bath (**1296**), the standing shallow (**1174**), Scotch douche to the feet and legs (**1037**), and the revulsive compress (**1341**). It is only contraindicated in connection with these measures when pain or cutaneous hyperesthesias or eruptions are present.

Percussion may be employed in the same manner as friction and for the same purposes, either by itself or in connection with friction, but is a less useful procedure, its specific effects being less frequently indicated.

1. Percussion is especially indicated in cases in which very powerful circulatory reaction is required, and in which pain is not a marked symptom and the superficial parts not at all sensitive. When percussion is employed, it should be continued until the surface is well reddened. The special purpose of percussion is to produce a very intense and prolonged circulatory reaction.

2. Percussion as well as friction may be employed after the Scotch douche (**1037**) to the legs for relief of asthma or cerebral, pulmonary, or spinal congestion. It may likewise follow the leg pack (**1393**) or the leg bath (**1299**).

3. Percussion as well as vigorous friction must be avoided in cases in which inflammation is present, as in peritonitis and all acute inflammation of the pulmonary or abdominal cavities, in pelvic inflammations, and in most cutaneous eruptions and hyperesthesias of the skin.

General Massage.— General massage, including massaging of the muscles, so-called petrissage, or deep massage, may be administered with special advantage after general cold applications for the reason that the application of cold to the skin produces a marked effect upon the muscles, rendering them susceptible to the circulatory and nervous impressions made by the manipulations of massage.

1. The application of massage after the cold bath is especially useful after prolonged cold procedures such as are

appropriately employed in obesity and fat diabetics, as the plunge (**1108**), the shallow (**1174**), the prolonged cold douche (**1010**), and the dripping sheet (**1216**). Massage following the cold bath is indispensable in cases of obesity in which the patient is too weak to secure good reaction by vigorous exercise after the cold bath.

2. Very vigorous massage may be applied with advantage after the cold bath in cases of rheumatism, especially in cases in which the patient is so crippled that vigorous or prolonged exercise is impossible, either on account of general weakness or of a crippled condition of the limbs.

3. Gentle massage may be administered with very great advantage after moderate general cold applications in Bright's disease. These measures are not applicable to cases of advanced Bright's disease, but are especially useful in cases in which the patient has been gradually trained to the employment of cold water at a moderate temperature. Massage should not be employed in cases in which active inflammation is present as shown by elevation of temperature.

General and thorough massage may be advantageously employed to promote sweating in connection with the Turkish or the Russian bath, or the hot immersion bath. It is especially indicated in cases in which the skin is dry and inactive so that perspiration begins with great difficulty. It should be employed during the first fifteen minutes of the Turkish bath and the first two or three minutes of the Russian bath. It may be discontinued as soon as perspiration begins.

5. Massage may sometimes be administered with special advantage in connection with the hot immersion bath, the bath having the effect to relax the tissues and to lessen their sensibility. In this way, manipulation for the purpose of reducing joint dislocations may be made to succeed. Taxis for returning the prolapsed bowel into the abdominal cavity in case of hernia often succeeds with the patient in a hot bath after most persistent efforts of other means have failed.

Abdominal massage for replacement of prolapsed viscera

is, in some cases, only possible when the patient lies in a warm immersion bath because of the abnormal rigidity of the abdominal muscles. The hot immersion bath also facilitates manipulation of the abdominal and pelvic viscera in certain cases, thus rendering valuable aid in diagnosis.

6. Massage may by employed with great advantage after various localized applications, as the cold abdominal douche (**1081**), the cold plantar douche (**1083**), cold muscle douche (**1101**), in cases of degeneration of the muscles from neuritis, spinal cord disease, or other disorders of the central nervous system. These combined procedures are indicated in a general way in all cases of localized paralysis.

7. General massage may sometimes be employed after the general hot bath as a means of promoting vigorous perspiration, especially in cases of chronic rheumatism. This measure is also useful for the removal of exudates such as are found about joints after the subsidence of acute inflammatory processes; in the muscular shortening and rigidity which follow muscular rheumatism; in cases of sciatica after the employment of the Scotch douche (**1037**), and in cases of old, badly united fractures in which pain is a prominent symptom.

MISCELLANEOUS BATHS.

Hydrotherapy, strictly speaking, relates solely to the employment of water-baths applied in such a way as to produce thermic impressions by communicating heat to the body, or abstracting heat from it. It may not be out of place, however, to make brief mention of a few special forms of baths in which other substances are employed, either alone or in connection with water.

1462 **Emollient Baths.**— In certain forms of cutaneous irritation great relief is afforded by the employment of an emollient bath, which consists of an ordinary full or immersion bath at a temperature of 93° to 96° to which some emollient substance has been added. Either one of the following may be employed, the quantity of each substance named being calculated for 30 gallons of water; 4 to 6 pounds of bran previously softened by soaking for fifteen minutes in a sufficient quantity of water to completely saturate and cover the bran; or, 1 pound of corn-starch previously made into a thin smooth paste, with 1 or 2 gallons of water; or, 1 to 2 pounds of isinglass dissolved in 1 gallon of water. Of the above, corn-starch or gelatin are to be preferred.

1463 **Alkaline Baths.**— The fame of many mineral springs, as Vichy, Ems, and various American mineral spring resorts is wholly due to the agreeable effects of the alkaline ingredients of the water upon the skin. All the beneficial effects of these waters may be obtained by adding to the water of an ordinary full-bath, carbonate of soda or potash in proportion of 4 to 12 ounces of the carbonate to 30 gallons of water. The water should have a neutral temperature,— 92° to 96°. This bath is useful in many forms of skin diseases and also as a means of relieving the intense itching of jaundice and urticaria.

Alkaline solutions may be employed in various partial applications, particularly the hot sponge bath for relief of urticaria, and the evaporating compress in certain forms of

eczema. Carbonate of soda or potash should be employed in proportion of ½ ounce to the quart of water.

Saline Baths.— The typical saline bath is the sea-water bath. The water of the sea contains in solution from ¼ to ⅓ pound of solids to the gallon of water. The principal ingredients are common salt, magnesium chloride, and magnesium sulphate. These substances have a decided stimulating effect upon the skin and thus encourage reaction. This enables the patient to tolerate the bath at a temperature two or three degrees lower than when fresh water is employed, thus increasing both the tonic and the derivative effects of the bath. For an artificial sea-water bath employ 8 pounds of sea-salt, for 30 gallons of water, or the following mixture: Chloride of sodium, or common salt, 7 pounds; magnesium chloride 1 pound; magnesium sulphate ½ pound; water, 30 gallons. Practically identical effects may be obtained by the employment of ordinary salt in the proportion of 5 to 8 pounds of salt to 30 gallons of water. Cutaneous stimulation will be increased by the addition of half a pound to 1 pound of chloride of calcium (do not make the mistake of employing the substance commonly known as chloride of lime, the proper chemical name for which is calcium hypochlorite). The stimulating effects of various par tial applications may be increased by the addition of common salt, in the proportion of 4 ounces to the quart of water. This solution may be used in place of common fresh water in connection with cold friction (**1201, 1209, 1213, 1216**). **1464**

The Pine-Needle Bath.— To an ordinary full-bath add pine-needle extract. The amount required is small, but should be sufficient to cause reddening of the skin of the whole body. The temperature of the bath should be adapted to the patient's condition. The temperature may be somewhat lower than when ordinary water is employed. This bath produces powerful cutaneous stimulation. It is useful in chronic renal and cardiac disease, at a temperature of 92° to 94° and may be used in the place of effervescing baths. **1465**

1466 **The Mustard Bath.**— Add to the water of an ordinary full bath 2 ounces of freshly ground mustard which has previously been steeped for ten minutes in a quart of hot water. The mustard should be thoroughly stirred into the bath before the patient enters it; the effect is much the same as that of the pine-needle bath.

For a hot *mustard sponge*, add to the water employed ground mustard in proportion of 1 ounce to the quart and proceed as in an ordinary hot sponge bath,

For a hot *mustard fomentation*, wring a towel or a cheese-cloth compress out of hot water to which ground mustard has been added in proportion of ½ ounce to the quart. Spread this upon the part to which the application is to be made, then apply the fomentation over it.

Alcohol Sponge Bath.— To 3 parts of water at the tem-
1467 perature desired, add 1 part of proof spirit. The alcohol sponge is useful in relieving the night-sweats of phthisis. The efficiency of the evaporating sponge bath as a cooling measure is also increased by the addition of alcohol to the water. Vinegar may be employed in the place of alcohol, and in the same proportions.

The Sulphur Bath.— In certain forms of skin disease the
1468 sulphur bath is sometimes employed, although the writer has never found it necessary to resort to it. It may be easily administered by simply burning a small quantity of sulphur in connection with the hot-air or vapor bath. One-half ounce of sulphur may be burned in an iron basin placed over an alcohol flame in the hot-air or vapor bath cabinet. Great care must be taken to protect the patient from the sulphur fumes by tightly closing all the openings in the cabinet. Special care must be exercised during the removal of the patient from the bath. An excellent plan is to connect the bath with a ventilating shaft, so that by suitable arrangements the sulphur fumes may be removed before the cabinet is opened.

1469 **The Carbon Dioxide Bath.**— The carbon dioxide bath has for many years been used in some parts of Continental Europe

in two forms: simply immersing the body in an atmosphere of carbon dioxide gas, the head being of course excluded, and in the form of the carbon dioxide gas douche. The effect of these procedures has been said to be a marked stimulation of the skin. The writer, however, feels exceedingly doubtful whether the application of pure carbon dioxide gas in this manner is capable of producing any very decided physiological effect. It seems more probable that whatever effect may have been observed, was due rather to the systemic disturbance induced by the incidental inhalation of the gas during the administration of the treatment. The gas, carbon dioxide, (CO_2) is an inert substance; but when this gas is concentrated in water, it is capable of producing decided effects if brought in intimate contact with either the cutaneous or the mucous surfaces.*

Observation of the effects of the effervescent bath (**1139**) led the writer to devise a method for a carbon dioxide bath. This bath consists simply in the application of water artificially impregnated with carbon dioxide. The saturation of the water with the gas is effected by means of the apparatus ordinarily employed for charging so-called "carbonated" or "aërated" drinks and mineral waters (see Fig. 242). The water thus charged may be used for immersion baths, the full bath, the foot bath, or other partial immersions, or in the form of the general or localized douche. This bath is of the greatest service in the form of the douche. It must be administered at a low temperature in order to secure its characteristic effects. At a high temperature, the gas is rapidly dissipated. The stimulating effects of the bath encourage reaction, and thus permit the employment of a lower temperature than when ordinary water is used; by this means both circulatory and thermic reaction are encouraged to an unusual degree. When the jet douche alone is employed, any desired degree of pressure may be obtained by opening the valve and connecting

* Verrier, Précis d'Hydrothérapie Scientifique.

with it a cylinder containing liquid carbon dioxide gas. For localizing this douche, an ordinary siphon bottle with a connecting rubber tube and nozzle may be utilized in the absence of any better apparatus.

Professors Winternitz and Gaertner, of Vienna, have recently devised an apparatus for administering a cold shower bath, which they have named the "Ombrophor" (Fig. 243). This apparatus, which through the courtesy of Prof. Winternitz the writer has been permitted to add to his collection of hydriatic devices, consists essentially of the following parts: First, the water cylinder, with which is connected a small cylinder containing liquid carbon dioxide. With the water cylinder connect pipes, valves, and nozzles suitable for a shower and a spray bath. By means of an ingenious valve either the spray or the shower may be employed separately or together as may be desired. While the application is being made, the patient stands in a metal-lined box which also serves as a case in which to pack the instrument for transportation when desired. The whole apparatus is exceedingly ingenious, practical, and convenient. In their description of the apparatus the inventors do not mention that they expect to derive any special effects from the carbon dioxide gas in connection with the apparatus, but by taking pains to agitate the water cylinder after admitting the gas, or by filling the cylinder with water and bringing the gas in contact with it some hours in advance of the bath, the water may be well impregnated with carbon dioxide gas, and the apparatus may thus become an efficient means of administering the carbon dioxide bath.

The carbon dioxide bath is especially indicated in cases in which it is desired to obtain good circulatory reaction with as little thermic or mechanical irritation as possible. It is most advantageous in connection with the short cold douche. It is valuable as a remedy for insomnia when due to cerebral hyperemia, and when there is no considerable irritability of the cerebral cell. It may likewise be used with advantage in

chronic cardiac and renal cases, but in cases of this sort its use must be managed with a high degree of discretion, and it must be employed only when a proper preparation of the patient has been made, so that injury may not be done by the induction of too powerful retrostasis.

The Air Bath.— The effect of cold air when brought in **1470** contact with the surface of the body is essentially the same as that of cold water, though less intense. The powerful tonic effects of cold air are well illustrated by the refreshing influence of a current of air when one is greatly oppressed by heat. The fan, so much in vogue with ladies of all countries, owes its existence and popularity to this fact. The remarkably refreshing effect of a gentle breeze on a hot day, even though the temperature of the air may remain the same, is another common illustration of the physiological influence of air when applied to the surface of the body.

Air, as well as water, may be applied to the body in either a quiescent or an active state; that is, the body may be simply surrounded by air of a given temperature,— what might be called an immersion air bath corresponding to the full or immersion water bath; or the surface of the body may be exposed to a current of air having any desired temperature and rate of movement, which I have named the fan bath or air douche. Benjamin Franklin was one of the first to call attention to the value of the air bath, and it was the custom of this great philosopher to administer such a bath to himself just before retiring at night by removing his clothing, and walking about in his apartment. He declared that he derived great benefit from thus exposing the surface of the body to contact with the air.

There can be no doubt that the constant protection of the body from air and light by clothing, which is rendered necessary by the artificial customs and conditions imposed by civilization, in no small degree interferes with the normal functions of the skin by overheating this organ, retaining noxious secretions in contact with it, and depriving it of the normal stimu-

lating effect of the actinic rays of the sun and the important gymnastic exercise of the vasomotor nerves and centers and the contractile tissues of the small vessels and capillaries resulting from the never-ceasing storm of thermic impressions made upon the unprotected skin by contact with the ever-changing atmosphere.

The writer has for more than twenty-five years made use of the air bath in connection with various hydriatic procedures in the systematic treatment of chronic invalids, and has employed it in various forms, the principal of which may be briefly described as follows: —

1. The Outdoor Bath.— This bath is best administered by means of the outdoor gymnasium: A high-walled enclosure provided with dressing rooms and all necessary conveniences for out-of-door exercise at all seasons of the year. An outdoor gymnasium arranged under the writer's direction, consists of the following: A wide walking or running track extending around the outside of the enclosure, just 1-10 of a mile in length; a swimming tank 75 feet long, 30 feet in width, 4 feet in depth at one end and 8 feet at the other, with an arrangement for an abundant supply of water so as to keep the contents of the tank always fresh and clear and at the proper temperature (from 65° to 70°); a supply of woodsaws, axes, and plenty of material in the shape of logs of different sizes, from 3 inches to 3 feet in diameter, a large pile of fine white beach sand for those who wish to indulge in the sand bath, swinging rings, horizontal ladders, a May-pole, appliances for lawn-tennis, pitching quoits, and various gymnastic games (Figs. 244, 245).

On entering the outdoor gymnasium the patient removes all his ordinary clothing, and dons a thin bathing-suit or a pair of trunks; shoes, stockings, and hat are discarded, for he desires to bring himself as nearly as possible into a state of simple savagery, and to throw off all the unwholesome restraints of conventionalism. A pair of sandals may be worn if desired, but it is better to expose the soles of the feet to

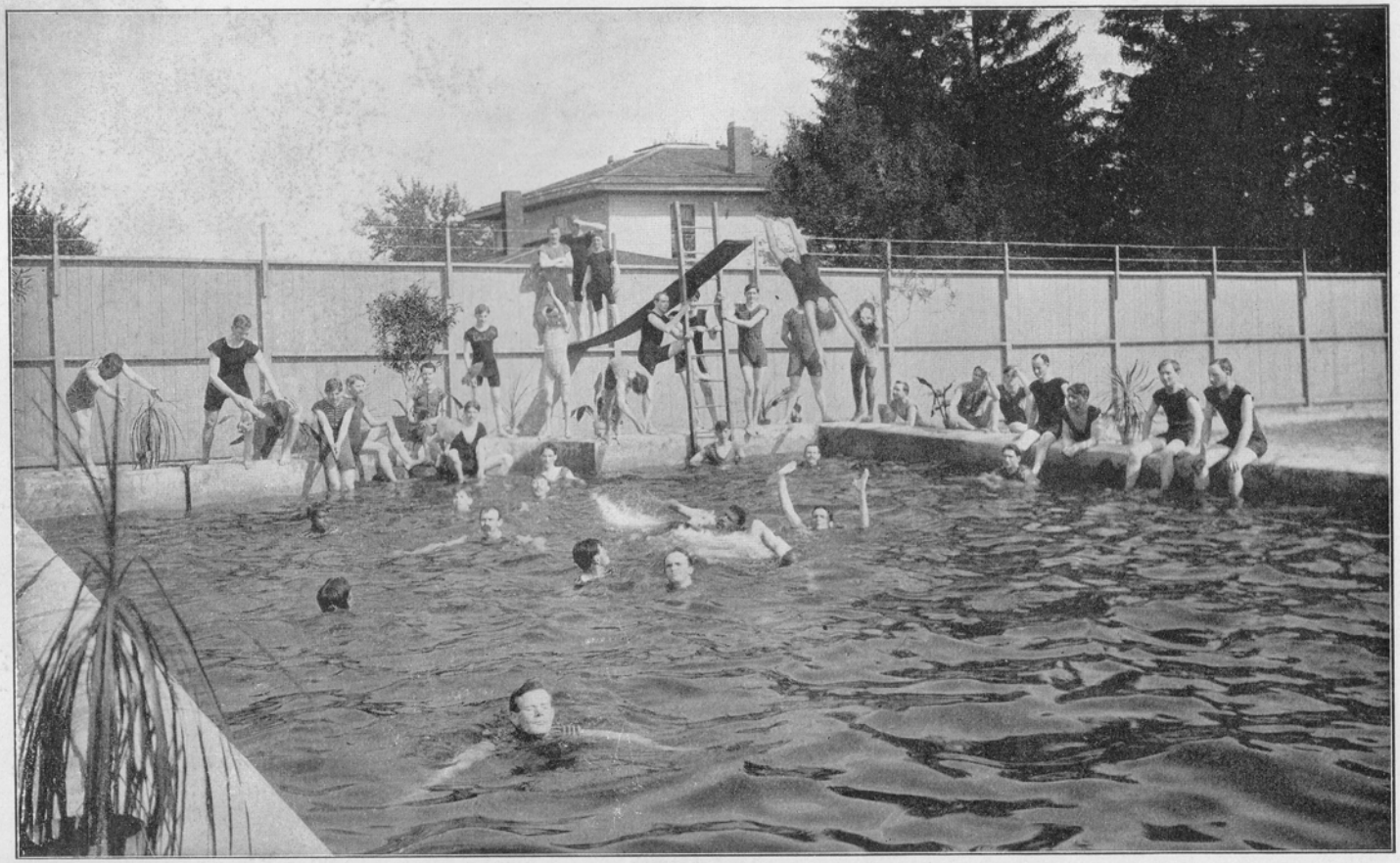


FIG. 244. OUTDOOR GYMNASIUM — Swimming Bath (p. 960).

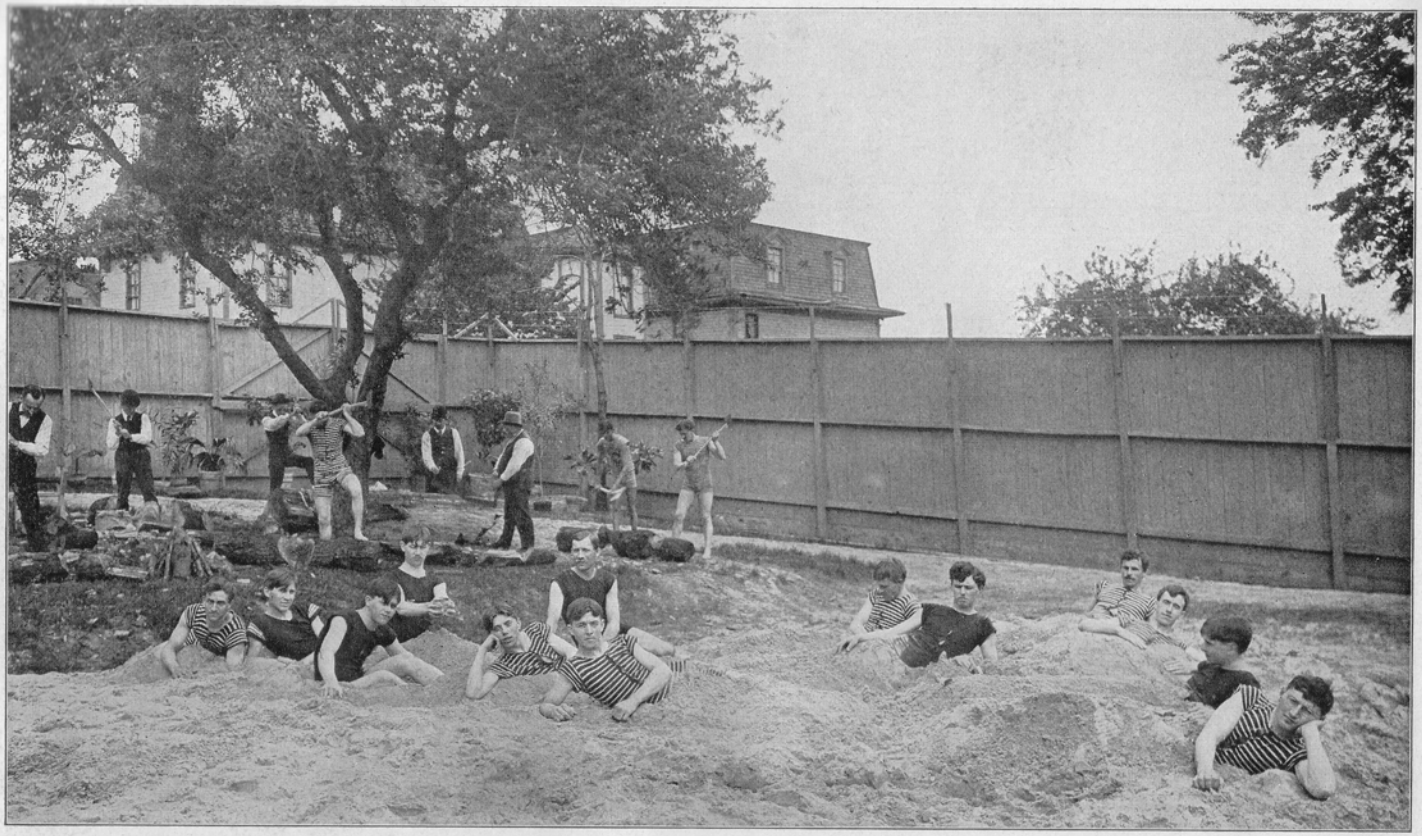


FIG. 245. OUTDOOR GYMNASIUM.—WOOD CHOPPING (p. 960).

contact with the earth and the grass. He imagines himself a boy again, frolicking in the freedom of unrestrained activity,—he walks, runs, leaps, rolls about on the grass, buries himself in the sand, chops or saws wood, laughs, shouts, whistles, and fairly runs wild with exhilaration as he feels the impulses of new life and vigor thrilling through his nerves and bounding in his veins, and finally plunges into the pool for a swim, which cools and tones the skin. As he returns again to the prison house of conventional clothing in which civilized human beings are compelled to live, he wishes heartily that civilization and nature had not drifted so far apart.

The outdoor gymnasium is a marvelously potent means for developing the restorative and healing powers of the body, and is the natural complement of the various thermic procedures of the hydriatic method. No sanitarium can be considered as scientifically complete without a well-equipped outdoor gymnasium.

More or less of the benefits of the outdoor gymnasium may be obtained by such out-of-door exercises as cycling, horseback riding, walking, boating, surf-bathing, swimming, mountain-climbing, golfing, and various other out-of-door sports, to which may well be added horticulture, floriculture, and light gardening. The outdoor gymnasium has the advantage, however, that it may be employed at all seasons of the year, that the exercises may be accurately regulated and under the constant supervision of a competent director, and that the seclusion of the gymnasium affords opportunity for a more thorough exposure of the body to the influence of light and air than ordinary out-of-door exercise.

For feebler patients, carriage riding provides a partial sort of air bath, which may be advantageously utilized while strength for more vigorous exercise or a more considerable degree of exposure is being accumulated. Very feeble patients may be allowed to lie out on the verandas or in sheltered places on cots or reclining chairs. This measure the writer has employed extensively for more than a score of years, and with

most excellent results. The patient is as lightly covered as is consistent with comfort, and the wraps should consist of white woolen blankets in cold weather, and white fabrics at all seasons, so that as much light as possible may penetrate to the skin. The writer's general instruction to his patients is to spend as much time as possible in the open air. Simply lying in the cool fresh air promotes appetite and normal metabolism and greatly adds to the beneficial effects derived from other therapeutic measures.

2. **The Sand Bath.**— The sand pile, with which every outdoor gymnasium should be provided, affords an excellent opportunity for the sand bath. Under the influence of the summer sun the sand becomes intensely heated and when heaped about the body is a most effective means of calorification. The head should be protected as in the hot water bath by a cold napkin, and should be shielded from the direct rays of the sun. Perspiration is quickly induced. By regulating the duration of the bath any desired eliminative effect may be obtained. The bath is followed by a cold shower or a plunge into the swimming pool. This bath is especially serviceable in cases of chronic rheumatism and inactive skin, which is so commonly associated with dyspepsia, diabetes and in certain forms of autointoxication.

Local applications of the sand bath may be made at any season of the year by heating the sand in an oven and heaping it about the part.

3. **The Indoor Air Bath.**— This bath may be administered in different ways: The patient may simply remove his clothing, and walk about the room, or sit, or lie, as his strength or inclination may indicate. The best effects are obtained by active exercise with the clothing wholly removed, rubbing and chafing the surface with the hands, and executing free-hand gymnastics or resistive movements. Feeble patients may be assisted by an attendant. Chilling is prevented even when the temperature of the air is quite low, by vigorous rubbing of the surface and the employment of active and passive move-

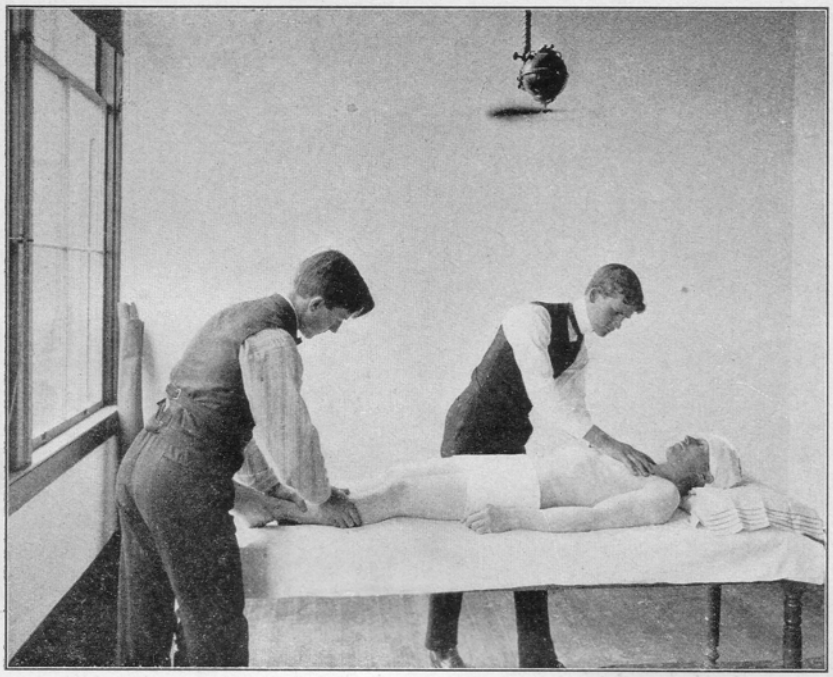


FIG. 246. AIR BATH (p. 963).

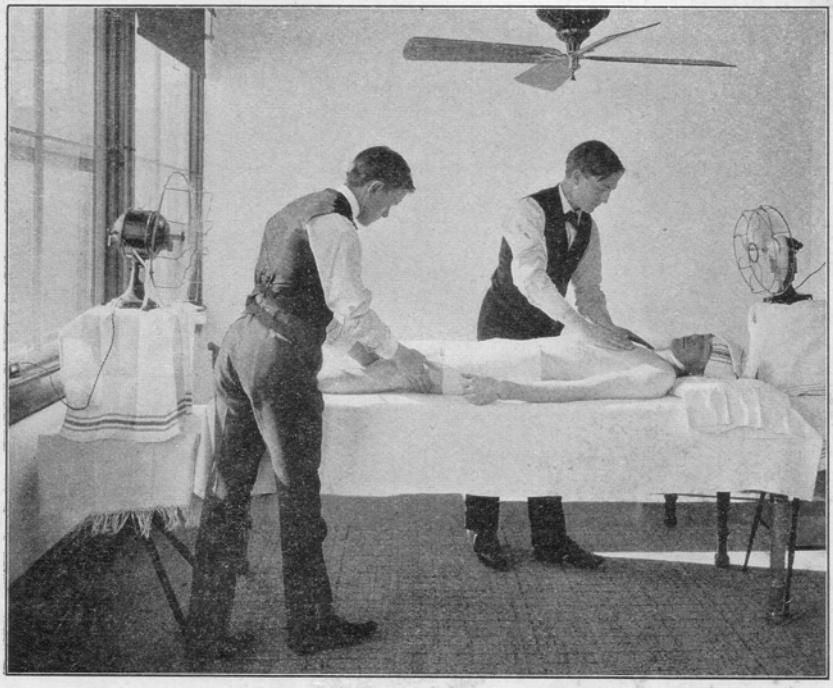


FIG. 247. AIR BATH (p. 963).

ments. Systematic massage may be administered advantageously in many cases. The temperature of the air should be as cool as it can be secured without artificial means during the summer, spring, and autumn months. During the winter months the temperature may range from 50° to 60°. A lower temperature may be tolerated for a short time, but for very feeble patients it is not advisable when the whole surface of the body is exposed. A much lower temperature may be employed, however, by affording the body the protection of a white woolen blanket, exposing only the head and a single arm or leg or some other circumscribed portion of the body where friction is being applied to maintain an active cutaneous circulation. For best effects, the indoor air bath should be combined with the sun bath.

4. **The Air Douche or Fan Bath.**— This bath consists of exposure of the whole body, or a circumscribed portion of the surface, to the influence of a current of air set in motion by an electric or blast fan. The writer first made use of this method in the year 1883, when he had constructed for the purpose an apparatus by means of which air artificially heated or cooled, might be applied to any desired portion of the body. The bath may be employed as a general tonic measure or as an antipyretic procedure. Cold air only is utilized for this bath. The hot fan-bath has a very limited range of usefulness.

When employed for general tonic effects, the patient is exposed to a strong blast of cold air while being at the same time vigorously rubbed by two attendants, so that strong cutaneous circulation is constantly maintained. By this means powerful thermic impressions may be made upon the skin without wetting it. Very satisfactory effects may be obtained by the employment of ceiling fans or any of the several forms of movable electric fans, which may now be readily obtained (Figs. 246 and 247).

For the most intense effects, as when it is desired to reduce the temperature of the body, the surface may be moistened by sprinkling or by covering it with a wet sheet.