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R. H. BATES ET AL
PHYSICAL THERAPEUTIC APPARATUS

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Fig. 1

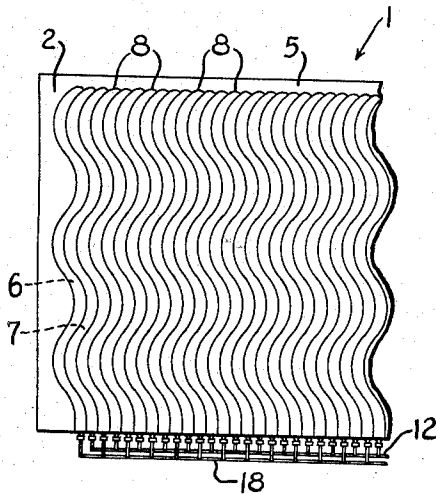


Fig. 2

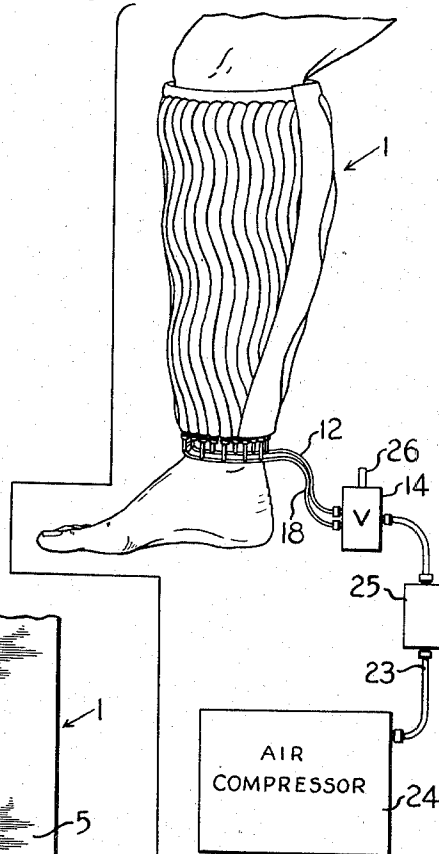


Fig. 3

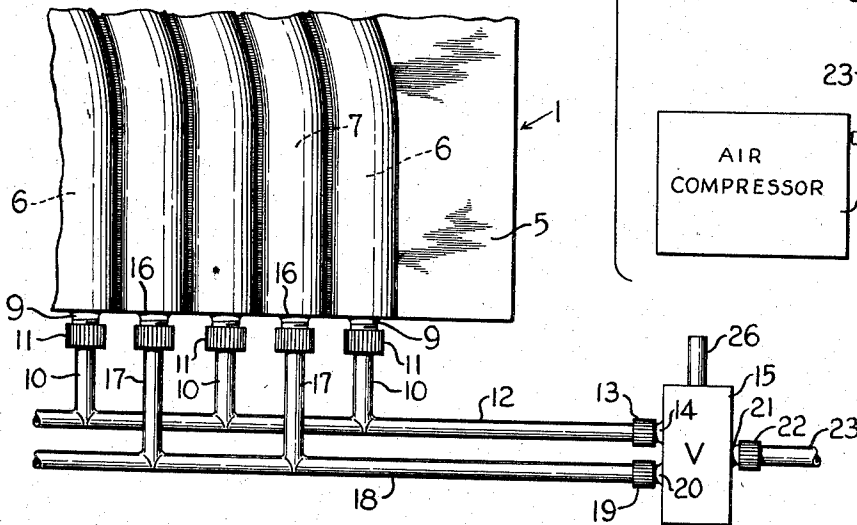
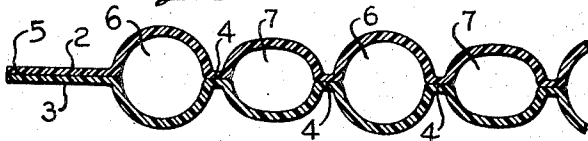


Fig. 4



INVENTOR.
ROLLAND H. BATES
CARL PANTERMOLLER
BY
Rudrus & Seales
Attorneys

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PHYSICAL THERAPEUTIC APPARATUS

Rolland H. Bates and Carl Pantermoller,
Milwaukee, Wis.

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4 Claims. (Cl. 128—60)

This invention relates to a physical therapeutic apparatus and more particularly to an apparatus in which fluid pressure is applied to spaced locations of the body in alternate sequence.

The physical therapeutic apparatus of the invention is designed for massaging or stimulating the circulation in a portion of the body to which the apparatus is applied. Fluid pressure is adapted to be alternately applied to adjacent areas of the body and this effects a pulsating or massaging action which stimulates the circulation of the blood in this area.

According to the invention, the apparatus comprises a rubber or plastic sheet composed of two separate layers which are sealed together at spaced locations to provide a series of generally curved passages which extend the length of the sheet. Alternate passages are connected to a source of pressure and the intermediate passages are separately connected to the source of pressure. With this construction, fluid pressure is alternately applied to each set of passages while the pressure in the intermediate passage is released. This pressurizing and de-pressurizing action results in a massage-like treatment and stimulates circulation in the area of the body to which the apparatus is applied.

In a small form the apparatus can be wrapped around a limb of the body, or in a larger form it can be used as a mattress. As a mattress, the device is particularly useful for persons confined to bed for extended periods, for the pulsating action alternately applies pressure to different portions of the body and thereby prevents bed sores which generally result from the constant pressure and abrasion of the bed against the skin.

Bed sores are aggravated by perspiration and constant pressure. For example, if the bed linen is wrinkled, the wrinkles exert an increased pressure on the body and bed sores are likely to occur if this pressure is maintained against the body for extended periods of time. With the use of the present invention as a mattress, the constant pressure on the body is eliminated, for a given area of the body is subjected to periods of pressure followed alternately with periods of non-pressure. During the non-pressure periods the mattress is actually out of contact with the body area and an air pocket is formed between the body area and the mattress which acts to prevent the formation of bed sores.

In the smaller form, the device may be applied to a limb or other portion of the body for the massage and relief of aching muscles, sprains or the treatment of polio-affected limbs. The present invention is particularly useful in the treatment of polio patients in which the activity of the limbs is affected and extensive periods of massage are required. In this situation, the apparatus can be conveniently secured to the affected limb and the massaging action is automatically applied for any desired period of time.

The drawing illustrates the best mode presently contemplated of carrying out the invention.

In the drawings:

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Figure 1 is a fragmentary top plan view of the invention; Fig. 2 is a diagrammatic representation of the invention as applied to a leg;

Fig. 3 is an enlarged fragmentary diagrammatic showing of the pressure connections; and

Fig. 4 is a transverse section taken along line 4—4 of Figure 1.

The drawings illustrate a flexible sheet 1 which is formed of two separate layers 2 and 3 of rubber, plastic or any other similar flexible material. The layers 2 and 3 are bonded together along their edge portions, as indicated by 5, and are bonded together at spaced intervals, as indicated by 4, to provide a series of passages 6 and 7 which extend substantially the length of the sheet 1. The layers 2 and 3 can be bonded at 4 and 5 by the application of heat and pressure, by the use of adhesives or by any other conventional bonding process commonly used with the material of the layers 2 and 3.

The ends of the passages 6 and 7 are closed off, as indicated by 8, by the bonded edge portion 5. The passages 6 and 7 have a generally curved configuration and, as shown in Figure 1, take the form of a sine curve. The passages 6 and 7 are disposed immediately adjacent to each other with just the necessary amount of material extending between the passages in order to provide the seal 4. The passages extend substantially the entire width of the sheet 1 with the number of passages being determined by the width of the sheet.

The curved shape of passages 6 and 7 provides an improved pressure distribution whereby pressure is applied to areas of the body through passages extending in a number of directions rather than a single direction as would be the case if the passages 6 and 7 were straight. This pressure applied along cross or transverse lines as well as longitudinal lines results in a more effective massaging action with a better "feel" to the patient.

The series of passages 6 are adapted to be pressurized alternately with respect to the passages 7. To supply pressure to the passages 6, a nipple 9 is secured to the outer open end with each of the passages 6 and a plastic or metal tube 10 is engaged with the nipple 9 by means of a coupling 11.

Each of the tubes 10 communicating with the corresponding passages 6 are connected to a manifold 12 and the manifold in turn is connected through a coupling 13 to the outlet 14 of a four-way valve 15.

In a similar manner, a nipple 16 is secured within the outer open end of each of the passages 7 and a tube 17 is threadedly engaged with the nipple 16. The tubes 17 are connected to a manifold 18, and the manifold is connected by means of a coupling 19 to an outlet 20 of valve 15.

The valve 15 is also provided with a pressure inlet 21 and the inlet is connected through a coupling 22 to a conduit 23. The conduit 23 provides communication with an air compressor which is shown diagrammatically, and indicated by 24. A suitable pressure regulator 25 may be disposed in conduit 23 to regulate the pressure of the air or other fluid.

The four-way valve 15 is also provided with an exhaust outlet 26 which opens to the atmosphere.

In operation of the apparatus, compressed air or other fluid is introduced from the compressor 24 through conduit 23 to the valve 15. The valve 15 is of conventional construction and can be operated either manually or by a suitable timing mechanism.

The air entering valve 15 is initially permitted to pass through outlet 14 to passages 6 while the flow of air through outlet 20 to the intermediate passages 7 is closed. Passages 6, being pressurized, expand to their greatest diameter and apply pressure to the corresponding portion of the body. This is best seen in Fig. 4, where the alter-

nate passages 6 are shown expanded to a generally circular shape and the intermediate passages 7 are in collapsed state and therefore the portions of layer 2 defining passages 7 are generally not in contact with the body.

After a given period of time, which may generally be a matter of minutes, the outlet 20 in valve 15 is opened to admit air under pressure to passages 7 and, at this time, both passages 6 and 7 are pressurized. After a short period of time, which may be a matter of seconds, valve 15 is actuated to connect the exhaust outlet 26 with the outlet 14 so that the air under pressure in passages 6 is exhausted to the atmosphere. This results in passages 6 being deflated and the portion of the sheet defining passages 6 moves out of contact with the body and therefore, the pressure is applied to the body only through the passages 7.

After a given period of time, pressure is again introduced into the passages 6 and subsequently released within passages 7. This alternate pressurizing and depressurizing within the passages is repeated throughout the treatment.

It is preferred that both sets of passages 6 and 7 be pressurized before the pressure in one set is released so that there will be continual support given to the body at all times. This feature is particularly important when the device is used as a mattress in order to prevent the body from raising and lowering with each change of pressure.

The apparatus, as shown in Figure 1, can be used as a mattress, or if made in smaller size can be applied to a limb or other area of the body. As shown in Fig. 2, the device is wrapped around the calf of a leg and may be held on the leg by strings, clamps, etc. which are not shown.

The device provides a pulsating action in which pressure is applied to alternate adjacent portions of the body. This feature of applying pressure to alternate portions of the body aids in stimulating blood circulation and effects a gentle massaging of the body.

The invention is relatively inexpensive to produce and may be readily put into operation with a minimum of handling and labor. In contrast to whirlpool baths and the like, the apparatus can be conveniently transported and stored in a small area.

While the above description is directed to the use of air pressure, any other form of fluid pressure may be employed, and similarly, while the passages 6 and 7 are shown as having a sinuous or undulating form, it is contemplated that the passages could be provided with any other desired type of directional deviation or geometrical pattern. Furthermore, it is contemplated that the tubes 10 and 17 and the manifolds 12 and 18 could be formed directly in the sheet 1 rather than being separate elements as shown in the drawings.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. A physical therapeutic apparatus adapted to be applied to a portion of the body comprising, a sheet of flexible material having a first series of closed internal passages formed therein and having a second series of closed internal passages alternately spaced with said first series, each of said passages having a sinuous configuration and being generally coextensive with adjacent passages, and means for alternately supplying fluid pressure to said first and second series of passages to alternately apply pressure to adjacent portions of the body.

2. A physical therapeutic apparatus adapted to be applied to an area of the body comprising, a first layer of flexible resilient material, a second layer of flexible resilient material bonded to said first layer at spaced intervals to provide a first series of closed internal passages and a second series of closed internal passages alternately spaced and parallel to said first series, each of said passages having an undulating configuration and being generally coextensive with adjacent passages, first conduit means communicating with each of said passages in said first series, second conduit means communicating with each of said passages in said second series, a source of fluid pressure, and valve means providing communication between said source of fluid pressure and said first and second conduit means and the atmosphere, said valve means disposed to alternately supply fluid pressure from said source to said first and second series of passages and to alternately release the fluid pressure in said first and second series of passages to the atmosphere to provide a pulsating action whereby fluid pressure is alternately applied to adjacent areas of the body.

3. A physical therapeutic apparatus adapted to be applied to an area of the body comprising, a generally rectangular layer of rubber-like material, a second generally rectangular layer of rubber-like material disposed on said first layer, a bond joining said first layer to said second layer along three complementary edge portions, a second series of bonds joining said first layer to said second layer at a series of generally parallel spaced intervals disposed normal to the unbonded edge portions of said layers to provide a series of passages between said layers, each of said passages having a curved longitudinal configuration and having an open end at said unbonded edge portions of said layers, means associated with the open end of each alternate passage in said series for introducing fluid pressure into the alternate passages and for releasing said pressure, and means associated with the open end of each intermediate passage in said series for introducing fluid pressure into the intermediate passages in out of phase relation with said alternate passages and for releasing said pressure whereby pressure is applied to the intermediate passages while maintaining the pressure in said alternate passages and pressure is released in the alternate passages when the maximum pressure in the intermediate passage is achieved to prevent the body from raising and lowering with the pulsating action.

4. In a physical therapeutic apparatus to be applied to an area of the body, a first layer of rubber-like material, a second layer of rubber-like material disposed on said first sheet and being substantially coextensive with said first sheet, a peripheral bond joining said layers together along the major portion of the periphery of said layers with the remaining portion of said periphery being free of said bond, and a second series of generally parallel bonds extending from said remaining portion of the periphery of said layers to said peripheral bond to provide a series of closely spaced passages between said layers, each of said passages having one end closed off by said peripheral bond and having the other end open and each of said passages being substantially parallel to adjacent passages and having a series of directional deviations throughout the length thereof.

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