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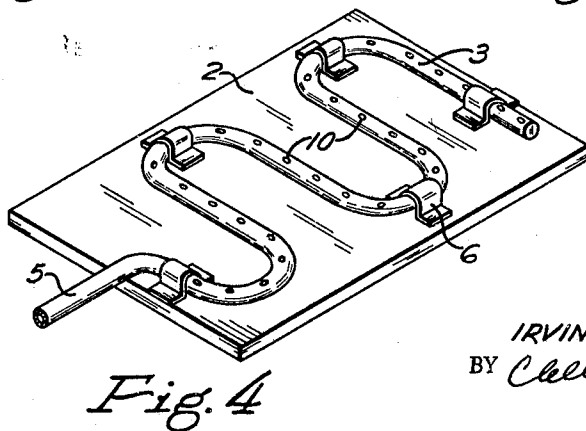
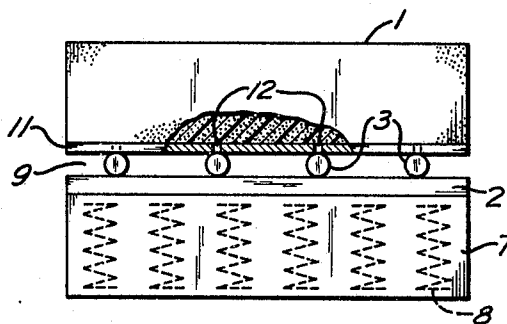
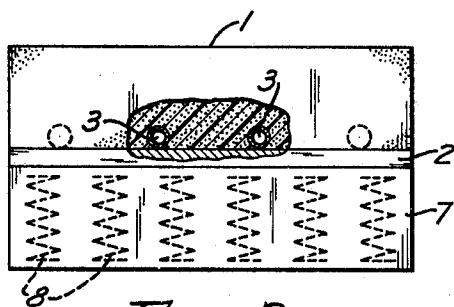
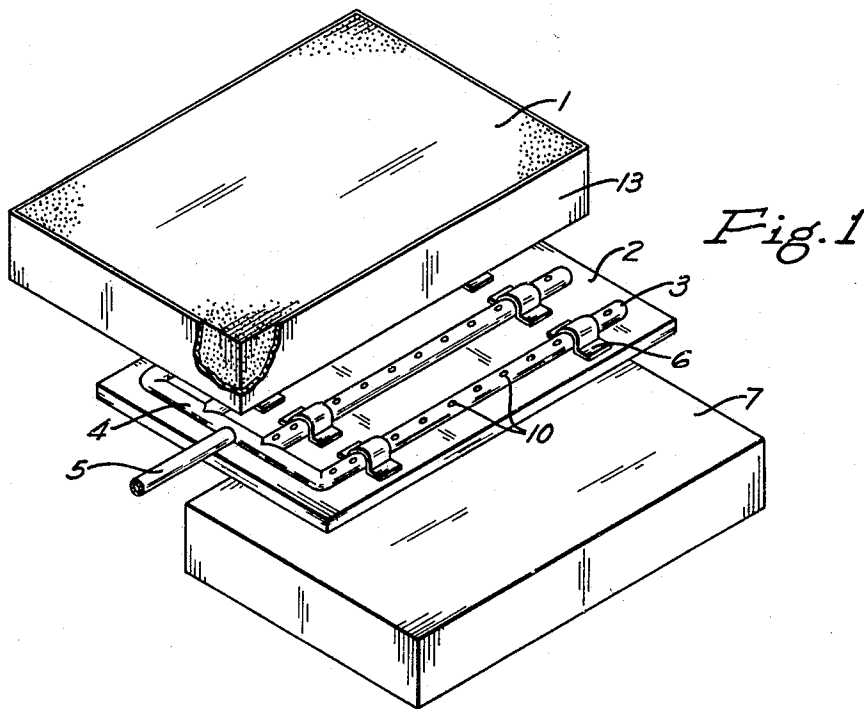
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3,486,177

CUSHIONS

Filed Sept. 20, 1966

2 Sheets-Sheet 1



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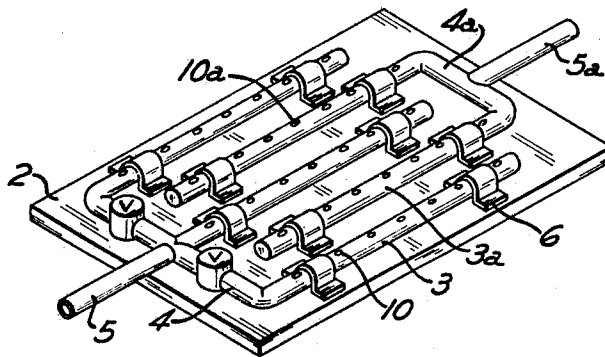


Fig. 5

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3,486,177
CUSHIONS

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9 Claims

ABSTRACT OF THE DISCLOSURE

A fluid pervious cellular pad adapted to support an occupant and circulate a fluid thereabout is provided by a flexible rubber-like cellular body or pad with a fluid pervious surface adapted to lie adjacent to and disperse a fluid atmosphere uniformly about an occupant wherein the body or pad has top and bottom surfaces which are fluid pervious and sidewalls which are fluid impervious.

This invention relates generally to cushions and more particularly to a fluid pervious rubber-like cellular pad especially adapted for use in combination with a mattress for supporting hospital patients.

It has been proposed heretofore to provide fluid pervious seat cushions or the like and one such device is disclosed in U.S. Patent 2,826,244. The seat cushion described in the patent is provided with a plurality of longitudinal bores which communicate with a pump or other means for building up air pressure. The air is then forced out through the open cellular structure of the seat cushion body to surround an occupant with cool air. However, a major disadvantage of such a construction is that the air passageways are more compressible than the surrounding cushion body so that when the cushion is supporting the weight of an occupant the passageways collapse, making it difficult to force air through them and into the open cellular structure of the cushion.

It is therefore an object of this invention to provide an improved cushioning means adapted to disperse fluids uniformly about an occupant which is devoid of the foregoing disadvantages.

It is a further object of this invention to provide a cushioning pad of a rubber-like material having an open cellular structure adapted to receive fluids under pressure and disperse them about an occupant without the build-up of excessive back pressure in the construction.

Still another object of the invention is to provide a fluid circulation assembly adapted to circulate a fluid substantially uniformly about any portion of an occupant adjacent to one surface thereof.

Still further, it is an object of the invention to provide a cellular thermoplastic material adapted to cooperate with a mattress to provide an environment for treating an occupant with a fluid atmosphere.

FIGURE 1 illustrates one embodiment of the invention in which a cushioning pad is combined with a mattress or other suitable supporting means;

FIGURE 2 is an end view of the combination of FIGURE 1, partially in section, in which the cushioning pad has passageways in it adapted to receive the tubes from which fluid is introduced;

FIGURE 3 is an illustration of another embodiment of the invention in which a rigid sheet or support is situated between the fluid introducing tubes and the cushioning pad;

FIGURE 4 illustrates an embodiment of a fluid barrier which may be used in the combination of FIGURE 1 to insure proper direction of fluid flow; and

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FIGURE 5 illustrates another embodiment of a fluid barrier which may be used in the combination of FIGURE 1.

The foregoing objects and others are accomplished in accordance with this invention, generally speaking, by providing a cushioning means having a flexible rubber-like cellular body or pad with a fluid pervious surface adapted to lie adjacent to and disperse a fluid atmosphere uniformly about an occupant. The cellular body or pad-like structure is made from an open-celled, flexible thermoplastic material and has top and bottom surfaces which are fluid pervious and fluid impervious sidewalls. The pervious surface of the pad opposite that which is to be adjacent to the occupant is covered with a fluid impervious sheet coextensive with at least part of the pervious surface to prevent substantial escape of fluid from that surface; between the sheet and the adjacent pervious surface of the pad are situated one or more perforated tubes or passageways which are less compressible than the foam and which are adapted to receive fluids under pressure. Fluid is directed from the passageways through the bottom pervious surface of the pad to the opposite previous surface via the communicating open cells of the pad, thus insuring uniform distribution of the fluids about the occupant.

The fluid circulation assembly provided by this invention is particularly well suited for use as a topper pad on a mattress to be used where it is desirable to provide an atmosphere of a particular fluid about an occupant. The mattress or any other suitable foundation or supporting structure with which the aforescribed fluid circulation assembly is to be used may be of any suitable construction as long as it adequately supports the assembly without substantial distortion or movement of the fluid impervious sheet lying adjacent the fluid pervious surface of the pad.

In this regard, the mattress or supporting structure and fluid circulation assembly may have any desired configuration and size and may be round, square, rectangular, elliptical, ovoid, triangular, hexagonal, pentagonal and the like. Thus any shape may be used and any and all shapes and sizes are contemplated. It is clear, then, that in addition to being used in mattress constructions, the expedient of this invention may be utilized in cushions and furniture as well as in automobiles and any other type of structure which will admit of the use of such a structure, although its main import resides in its adaptability to the treatment of patients in conjunction with a mattress or similar supporting structure. Further, in the preparation of the pads for the fluid circulating construction of this invention, although it is preferred that the two pervious surfaces be substantially parallel to one another, it is also contemplated within the scope of this invention that the pad have a triangular cross-section, or a waving configuration such as is found, for example, in air mattresses and the like. Thus any cross-sectional shape as well as any shape for the perimeter of the pad is contemplated, although a substantially rectangular configuration with substantially parallel fluid pervious surfaces is preferred for expediency and ease of handling with the assembly.

It is readily apparent that with the assembly of this invention, the only outlet for the fluid pumped into the cellular body upon which an occupant rests is the surface upon which the occupant is situated. Thus, depending on the force of fluid pressure pumped into the assembly and the size of the pores of the foam, the fluid may surround the occupant in great volumes or only in the smallest quantity, as desired. In this regard, a fluid pervious covering material may be used on the surface of the pad to

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diffuse the fluid even more finely than can be achieved by means of the pore structure of the pad alone if so desired, or it may be used solely for aesthetic purposes. Nevertheless it is clear that by means of the control of the pressure of the fluid into the structure and the pore structure of the pad itself as well as with the use of a covering material porous to the fluid being utilized, the patient, occupant or therapist or the like can control the flow of fluid about the occupant with the highest degree of precision. Even further in this regard, should it be so desired, the assembly can be used in an evacuating capacity by reversing the pumping mechanism to pull air or any other type of fluid into the assembly from the atmosphere surrounding the occupant. In this manner, a type of air conditioning of the occupant can be achieved with only the simplest and most economical of mechanisms.

The most desirable type of material from which the pad of the instant assembly can be made is a flexible, open-celled polyurethane foam, and any suitable open-celled polyurethane foam material prepared in accordance with any known method for making flexible foams such as, for example, by the process disclosed in U.S. Patent 2,948,691 and Re. 24,514 and the like patents may be used. For best results in the practice of the invention, it is most expedient to employ a polyurethane foam, although any other suitable flexible cellular material either natural or synthetic such as, for example, foam rubber, polystyrene, polycarbonate and the like, which will permit a substantially uniform dispersion of fluid in accordance with this invention may also be employed and all are contemplated.

The pad to be used in the fluid circulating structure of this invention may be of any desired thickness such as, for example, from about $\frac{1}{8}$ " or less up to several inches or more depending largely upon whether the pad is to support the weight of an occupant or just lie against him. The pad is preferably obtained by cutting it from a block of foam to the desired configuration so that the sides are initially pervious and then wrapping a thin sheet of any suitable resinous material, such as, for example, polyvinyl chloride or a copolymer of polyvinyl chloride and polyvinyl acetate around the edges of the block and fastening it thereto to provide a fluid impervious barrier. Any other suitable fluid impervious materials can be used as the fluid impervious material, such as, for example, rubber, treated cloth, polyethylene, polyurethane, polycarbonate, polyesters and the like, but a resinous sheet is most convenient. Even further, the foam from which the pad is cut may have the proper length and width measurements for the pad to be used in which case no pervious sheet need be used at the sides of the pad due to the impervious nature of the skin that forms about a foaming polyurethane structure. This may also be true for other types of cellular materials in which case no sheet need be applied to the sides of the pad to be used in the instant assembly.

A resinous sheet or other similarly fluid impervious material as aforescribed may also be used in the construction of the fluid impervious barrier which is coextensive with and adjacent to the side of the structure which lies adjacent to the tubes or passageways from which the fluid is introduced.

Any type of fluid material desired may be pumped through the construction of this invention in order to accomplish the purpose at hand. For example, in the treatment of a patient, it may be desirable to surround the patient with an atmosphere of dry air and it may further be desired to heat the air for the treatment. This can be achieved easily and economically by means of the structure described herein. Cool or cold air may be similarly circulated as well as liquids and vapors, such as, for example, of water. Further, any suitable fluids may be used including nitrogen, hydrogen, ethers, pain-killing fluids, therapeutic fluids and the like.

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Referring now to the drawing, one embodiment of the invention is illustrated in FIGURE 1. A flexible open celled block or pad of polyurethane foam 1 is covered around the edges with a vinyl sheet 13 having a thickness of about 0.05 inch. The underside of pad 1 is not covered and has open cells so that it is fluid pervious. A fluid barrier is prepared by fastening tubes 3 which are less compressible than the foam and made of polyvinyl chloride, for example, to a fluid pervious sheet or support 2 with fittings 6. The tubes have perforations 10 and join a common header or manifold 4. A tube 5 is sealed to manifold 4 at one end and communicates at the other end with a source of fluid under pressure such as, for example, an air pump. The tubes must be sufficiently rigid to withstand collapsing when cushion 1 is compressed thereabout because of the weight of an occupant on the exposed surface of pad 1, and may be fabricated of any suitable material which is less compressible than the foam when in a tubular form, including natural materials, such as, for example, rubber, or synthetic materials, such as, for example, polyvinyl chloride, polyurethane, polycarbonate and the like; metals such as, for example, iron, aluminum and the like, or any other suitable material, although polyvinyl chloride is preferred.

As shown in FIGURE 2, pad 1 is assembled with a mattress or mattress support 7 with the fluid impervious barrier tube construction lying therebetween. The underside of pad 1 can have longitudinal panels or passageways therein to receive any or all of the tubes 3, 4 and 5. The mattress support 7 illustrated in FIGURES 1 and 2 may be provided with springs 8 or any other reinforcing or constructional expedient.

As illustrated in FIGURE 3, in one embodiment of the invention the fluid circulation structure is provided with a fluid barrier 2 having tubes 3 mounted thereon and with a rigid sheet-like structure 11 lying against the underside of pad 1 and on top of the tubes 3. The rigid member 11 can be made from a rigid plastic material and has perforations 12 communicating with perforations 10 in tubes 3. The rigid member 11 protects the tubes 3 from collapsing when weight is applied to the surface of pad 1, thus strengthening the assembly and also providing extra support as desired for an occupant. The rigid member may also be fabricated with ridges or passageways in it adapted to receive the tubes 3 and rest substantially on sheet 2 if desired.

In another embodiment of the invention, the tube for the introduction of a fluid to the assembly may have a serpentine shape 3 and be secured by means of fastener 6 to the fluid barrier 2 illustrated in FIGURE 4. This embodiment precludes the necessity for a manifold and can be used in many instances, particularly where the pad is small.

Various modifications of the described fluid circulation assembly can be made in order to diversify its use and efficiency. In FIGURE 1, for example, only one or two of the tubes 3 may be connected to the manifold 4 and communicating tube 5 while the other tubes may be connected to a manifold on the opposite side of the construction which is connected to a pump by means of a tube similar to the communicating tube 5. An embodiment of this type having barrier 2 manifolds 4 and 4a communicating with tubes 3 and 3a having perforations 10 and 10a is illustrated in FIGURE 5. The fluid is fed into manifolds 4 and 4a through tubes 5 and 5a. Fluid flow can be controlled by the valves shown in the manifold. Both pumps can be put into operation in order to effect a whirlpool type of circulation of fluid about the patient for greater therapeutic effect. Even further, if so desired, more tubes may be added to the assembly or fewer may be used and they may be attached to the manifold 4 in a manner which permits their easy removal from the outlet and capping of the outlet for greater pressure or for reducing the quantity of fluid being pumped

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into the assembly and therefore, about the occupant. Thus, in FIGURE 4, several serpentine tubes may be disposed next to one another and may be attached to a pump through a manifold as well as having only a single tube for fluid introduction. Further, the several tubes may be attached to two or more manifolds as above described to result in the desired motion of the air about the occupant.

In another modification of the invention, valves may be included in the manifold system near the point of origin of each of the tubes such as tube 3 and/or they may be placed in strategic places in the header or manifold 4. The feed of the fluids could then be adjusted or the fluid flow could be diverted completely to and from whole areas of the circulation or distribution assembly by manipulating such mechanical valves. The valves may be controlled by an external remote valve or plurality of valves, as desired.

It is to be understood that although the invention has been described in considerable detail in the foregoing, such detail is solely for the purpose of illustration and variations can be made in the invention by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A cushion adapted to support an occupant and to circulate a fluid thereabout comprising an open-celled foam pad and a tubular system for circulating fluids under pressure, said pad having fluid impervious sidewalls and fluid pervious top and bottom surfaces communicating with its open cells, said tubular system having one or more perforated tubes which are less compressible than the pad and which communicate with the open cells, said tubular system being mounted on an impervious sheet which prevents substantial movement of fluid introduced into the said open cells in a direction away from said fluid pervious top, and means for introducing fluids under pressure into said tubular system.

2. The assembly of claim 1 wherein the tubes fastened to the impervious sheet communicate with a manifold, the impervious sheet being a resinous sheet.

3. The assembly of claim 2 in combination with a mattress lying adjacent to the resinous sheet.

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4. The assembly of claim 3 wherein the tubes extend in spaced relationship longitudinally along the adjacent pervious surface.

5. The assembly of claim 1 wherein a rigid structure lies against the bottom fluid pervious surface and the tubes, the rigid structure having perforations which communicate with the perforations in the tubes.

6. The assembly of claim 1 wherein the tube is serpentine.

7. The assembly of claim 1 wherein more than one tube is adapted to receive the fluids under pressure and one or more of the tubes are connected to a means for introducing fluid thereto from one direction while the remainder of the tubes are connected to a means for introducing fluid thereto from another direction.

8. The product of claim 1 wherein the foam pad is a rectangular polyurethane pad having substantially parallel top and bottom surfaces, the fluid impervious sheet is polyvinyl chloride or a copolymer of polyvinyl chloride and polyvinyl acetate, the perforated tubes are polyvinyl chloride and the fluid pervious surface is covered with a fluid pervious covering material to aid in the diffusion of the fluid.

9. The apparatus of claim 2 wherein valves are included in the manifold system to adjust the feed of fluids.

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