Oct. 12, 1971 M. GOTTFRIED 3,611,455

FLOTATION PAD

Filed April 29, 1969

FIG. 1

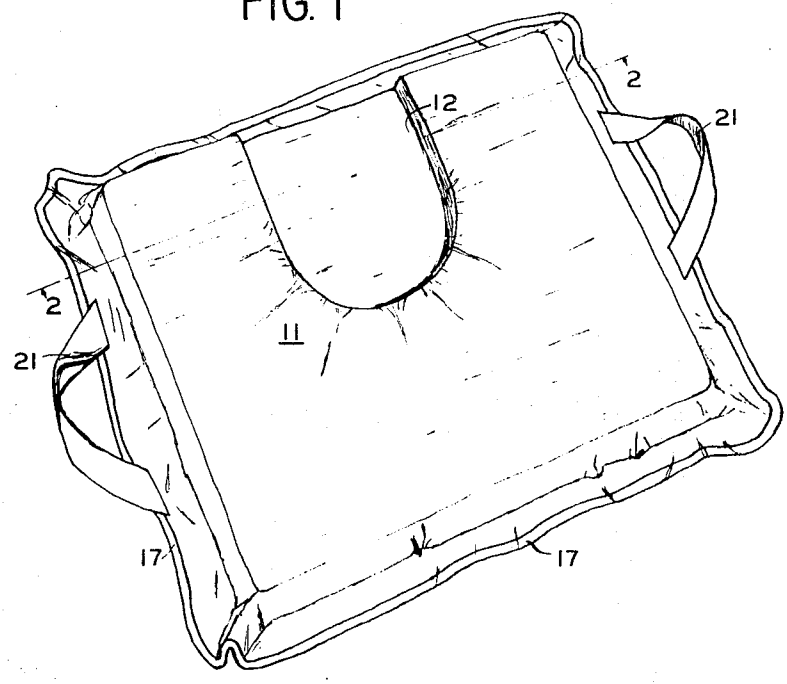


FIG. 2

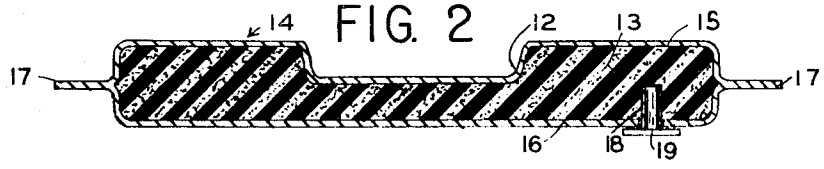


FIG. 3

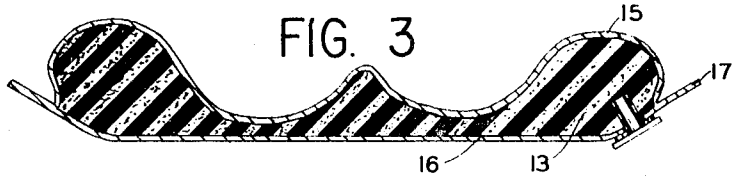
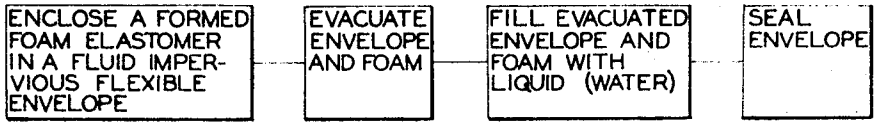


FIG. 4



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3,611,455

FLOTATION PAD

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U.S. Cl. 5—348 6 Claims

ABSTRACT OF THE DISCLOSURE

A cushion for the human body of a formed foam elastomer enclosed in a fluid impervious flexible envelope from which the air has been removed and at least in part replaced by a liquid such as water. The foam essentially is saturated with the liquid and the envelope loosely encloses the elastomer form so that the envelope conforms to a supported body, the liquid tends to equalize the supporting pressure across the surface of the body and the elastomer form tends to confine the body of liquid to the support area and provide a stable support.

CROSS-REFERENCE TO RELATED APPLICATIONS

Efforts to relieve regions of the human body subjected to high supporting pressures by supporting the body on a limited body of liquid to distribute the supporting force for the body to a nearby uniform pressure over all of the support surface have been successful to the extent that in some applications essentially pure flotation support has been achieved. In application Ser. No. 756,074 filed Aug. 28, 1968 for "Body Support Cushioning System" by Max Gottfried, Dennis G. Mosiniak and Ansis V. Tenteris, a flexible fluid impervious envelope having sides or wings constrained to define when filled with a liquid, a pool having a loosely covered upper surface has been employed in beds to support a prone patient in flotation and in chairs to provide a uniform distribution of supporting force over the supported surface of a seated patient. These cushioning systems have been found to be difficult to manipulate by patients who utilize wheel chairs to afford them a reasonable degree of mobility and independence, particularly where the wheel chair is folded by the invalid as when transferred to an automobile.

BACKGROUND OF THE INVENTION

The aforenoted body support cushioning system when applied to a wheel chair utilized both displacement of the liquid within the envelope, and the development of a hydrostatic head to support a seated patient. Thus some of the advantages of pure flotation are lost in the interest of a practical compromise with considerations of portability. The present invention seeks greater portability in a cushioning system by further reducing the amount of liquid in the system and by enhancing the controlled utilization of that liquid as a support. In particular, this invention combines a resilient cellular body with the liquid in a support cushion to reduce the maximum pressures imposed on a body supported on the cushion.

Support cushions have been made of airtight envelopes which contain a mass of compressible, resilient material to augment the support offered by the inflation of the envelope. Sylvester Pat. 1,332,933 of Mar. 9, 1920 for "Pneumatic Cushion" discloses one such structure. Morris

Pat. 2,997,100 of Aug. 22, 1961 for "Pneumatic Foam Structures" suggests a foam body of elastomer having an airtight skin and a means for inflating the foam to a controlled pressure to control the firmness of the body as a cushion. In these devices the support fluid is not displaced in any degree by the weight of the supporting body but rather the balancing support forces are the internal pneumatic pressure and resilience of the filler material where it assumes a portion of the load. This type of support maximizes the tension developed in the envelope surface contacting the supporting body and thereby tends to concentrate support pressures in the area of the body's boney prominences.

SUMMARY OF THE INVENTION

The present invention relates to body cushions and their methods of manufacture and more particularly to cushions utilizing a combination of liquid and resilient solid as the supporting medium.

In one embodiment of the invention a body of cellular elastomer such as a flexible polyether urethane foam or foamed rubber in the form of a block is enclosed in an envelope which is flexible and fluid impervious. A given amount of water or other suitable liquid is introduced into the envelope in a manner to fill the cells of the foam and the envelope is sealed. The envelope has a loose surface over the liquid filled, foam body to enable it to conform to the buttocks of a human seated thereon whereby some of the liquid and its confining cellular structure is displaced and rises around the buttocks to act as a flotation pool in which the buttocks is supported. The resilience of the cellular material in part supports the body. However, the cellular material also constrains and retards the flow of the liquid so that a gradual compliance and conformation to the supported buttocks is experienced.

Seat cushions of this type have been found to have many of the characteristics of cushions employing a gel filling such as the organosiloxane gels, and offer superior characteristics in certain areas. Cushions having liquid filled cellular material are far less expensive and more rugged than gel filled cushions.

The present invention's object is to improve body support cushions.

A second object is to utilize a combination of displacement and hydrostatic head forces to support a body with a uniform distribution of supporting pressure.

A third object is to facilitate manufacture of liquid filled, resilient cellular cushions.

DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective of the upper face of a seat cushion according to this invention;

FIG. 2 is a cross section of an elevation of the cushion of FIG. 1 taken along the line 2—2;

FIG. 3 is a cross section of the cushion as in FIG. 2 showing the effect of the loading of the cushion by the human buttocks; and

FIG. 4 is a functional flow diagram of one method of producing the cushion of the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

A contoured seat pad 11 as shown in FIG. 1 comprises a body in the general form of a rectangular parallelepiped having a cutout region 12. The illustrated pad is suitable for a wheel chair and has been used as a cushion for truck drivers' seats. Its form in the cutout region 12 is intended

to reduce pressure over the coccyx by reducing the thickness of the resilient padding to about half its thickness over the major surface portions.

The pad construction will be appreciated from FIG. 2. It comprises a body **13** of a foamed elastomer which when initially formed is of a nominal four inch thickness, a length of eighteen inches, and a width of sixteen inches. The cutout region **12** extends about seven inches across the cushion and a maximum of nine inches from the back of the cushion toward its front. Such a body **13** of a flexible polyether urethane foam having a degree of firmness such that a 4" by 4" by 15" specimen deflects 25% of its original thickness when the deflecting plate has an area of fifty square inches and is loaded to between 34 and 40 pounds, when incorporated in the finished cushion with water, is about three inches thick over the major surface areas and about an inch and a half thick in the cutout region **12**.

An envelope **14** which is impervious to fluids encloses the body **13**. A heavy duty nylon cloth having its inner face, that adjacent body **13**, coated with neoprene is durable yet thin enough to conform readily to the natural body curvature. The upper and lower panels **15** and **16** of envelope **14** are joined in overlying relationship as at **17** to form a sealed joint. The lower panel has a stem **18** sealed through its face for the purpose of removing air from the foamed body and envelope and admitting liquid thereto. A stem **18** of an elastomer which can be distended to insert a plug **19** and will constrict by virtue of its resilience to sealingly grasp the plug has been employed to maintain the stem sealed under load of a supported body.

Pad **11** as used for the exemplary seat cushion has handles **21** sewn to the overlying marginal portions **17** of the envelope panels at either side of the seat whereby the pad can be lifted conveniently.

The resilience of the body of elastomer is augmented by flotation support and hydrostatic pressure by water or another suitable liquid. In the example, the volume of approximately 736 cubic inches has twenty one pounds of water or approximately 80% of volume of water introduced through the stem **18** so that a load imposed on the upper panel **15** causes the supported body portion to sink into the loose upper surface of the cushion while drawing the bottom panel **16** taut in the general form shown in FIG. 3. In this condition, the liquid and resilient, cellular body containing it, is displaced to the sides of the supported body portion and by virtue of the confinement and constraint offered by the saturated elastomer body **13** and envelope **14** supports the body portion in part by flotation. Further, by virtue of the loose upper panel **15**, the supporting face of the cushion conforms to the supported body portion to distribute the support force over the body portion. This reduces pressure concentrations as over the coccyx and ischial to reduce the tendency to develop pressure sores and to reduce the discomfort imposed where an individual remains seated and relatively immobile for long periods.

As set forth in FIG. 4, one technique for fabricating this type cushion is to form the foamed elastomer body **13** to the desired shape and encase it loosely in an envelope **14** of flexible fluid impervious material. This envelope can be sealed by cementing or thermally bonding the marginal regions of superposed upper and lower panels **15** and **16**. Air is then expelled from the cellular body **13** and the envelope **14**, and a fluid is admitted so that the resilience of the body draws the fluid into its cell structure. An external pressure can be applied to remove the air. The envelope **14** can be evacuated as by coupling a vacuum pump to the interior through stem **18**. During this evacuation, the air within the cells of the foam is withdrawn and atmospheric pressure compresses the assembly from its original thickness in excess of four inches to less than an inch. When thus compressed, the inlet is coupled to a source of water and filled until the entire unit weighs twenty-three pounds. This requires about twenty-one pounds of water and results in the recovery of the foamed elastomer to a thickness of about three inches with the water primarily drawn into the cellular structure. The unit can then be sealed by inserting a plug **19** in the stem **18**.

It is desirable to avoid entrapping any air in the unit since the presence of air reduces the stability of the cushion. The removal of traces of entrapped air can be accomplished by orienting the unit with the stem **18** uppermost and drawing a vacuum until some water is withdrawn, then sealing the stem with plug **19**.

It is to be appreciated that the cushion disclosed lends itself to different configurations to enhance the relief of pressure at critical pressure areas by reducing the thickness of the foamed elastomer body in the region of support where higher pressures are experienced. The pad can be used in beds for localized relief by positioning it in a cavity in the supporting mattress as at the heals or buttocks. Cellular material of different degrees of firmness can be employed. The thickness of the cellular material, its density and the amount of fluid can all be varied.

The support afforded by the cushion is a combination of displacement of the liquid (a flotation support), the hydrostatic pressure of the liquid (a pressure balance), and the resilience of the cellular body. The greater the amount of liquid displaced, the closer to pure flotation support, the optimum support for reduction of pressure concentrations. However, flotation requires a weight of liquid and thus increases the weight of the cushion. A compromise must thus be maintained between weight (portability) and the degree of flotation support achieved.

Thus, where greater flotation support is desired, a less firm foam will permit the supported body to sink further into the cushion and thereby displace a greater volume of fluid. In reducing foam firmness, a point is reached where greater depths of liquid may be required to provide support, hence the foam will be thicker than illustrated and a greater volume of liquid employed. Further, variations can be made by greater reliance on the hydrostatic pressure by filling the envelope with liquid to a greater degree than illustrated. Accordingly, the above description is to be read as illustrative of the invention and not in a limiting sense.

What is claimed is:

1. A support cushion adapted to sustain an animal body portion against gravity while militating against pressure concentrations over the boney prominences of the animal body portion comprising a body of resilient, cellular elastomer of substantial thickness through a major portion of its animal body sustaining region, said region having a lateral extent exceeding the sustained animal body portion; a fluid imperivous envelope of flexible sheet material loosely enclosing said body, said envelope having major surfaces of greater lateral extent than said resilient body region sustaining the animal body portion; a liquid substantially filling the cells of said elastomer and displacing essentially all free gas within said envelope; and means sealing said envelope, said substantial thickness being sufficient to provide a yielding support beneath the boney prominences of the animal body region supported thereby when said elastomer is substantially filled with liquid.

2. A support cushion according to claim **1** wherein said body has regions of reduced thickness in areas adapted to be subjected to pressure concentrations.

3. A combination according to claim **1** wherein said body has a thickness when sealed in said envelope of the order of three-quarters of its unconstrained thickness in free air.

4. A combination according to claim **1** wherein said body has a thickness when sealed in said envelope which is substantially less than its unconstrained thickness in free air and wherein said envelope is of sufficient size to

receive said body in its unconstrained state without substantial constraint.

5. A combination according to claim 1 wherein said liquid is approximately 80% by volume of said cellular body.

6. A combination according to claim 1 wherein said body is a flexible polyether urethane foam having a degree of firmness such that a four inch thickness deflects 25% under a fifty square inch loading of 34 to 40 pounds, which in the unconstrained condition in air is about four inches by sixteen inches by eighteen inches, wherein said body has a volume of about 736 cubic inches in its water

filled form, and wherein said liquid is about twenty-one pounds of water contained primarily in the cellular structure of said body.

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PAUL R. GILLIAM, Primary Examiner

U.S. Cl. X.R.

5—338, 339