Jan. 5, 1971 R. W. WIELE 3,552,044

CONFORMABLE PAD FILLED WITH ELASTOMERIC PARTICLES

Filed Dec. 30, 1968 2 Sheets-Sheet 1

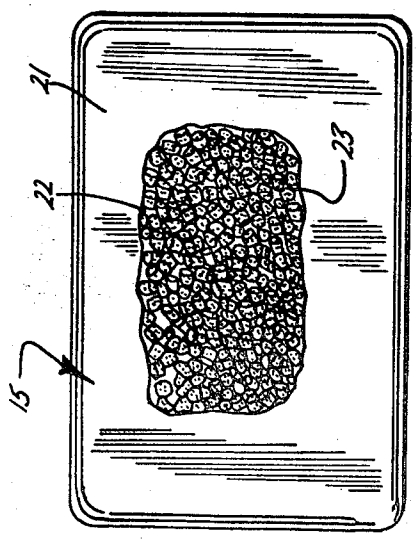
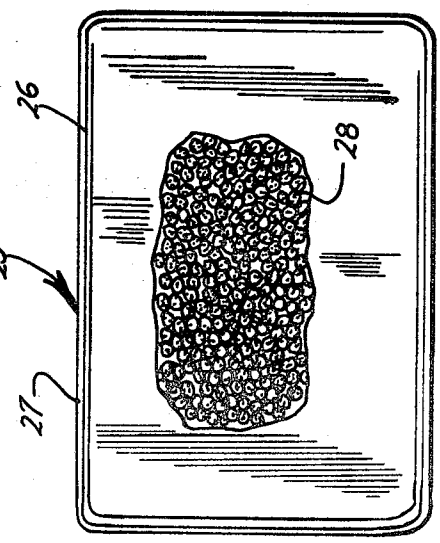


Fig. 2



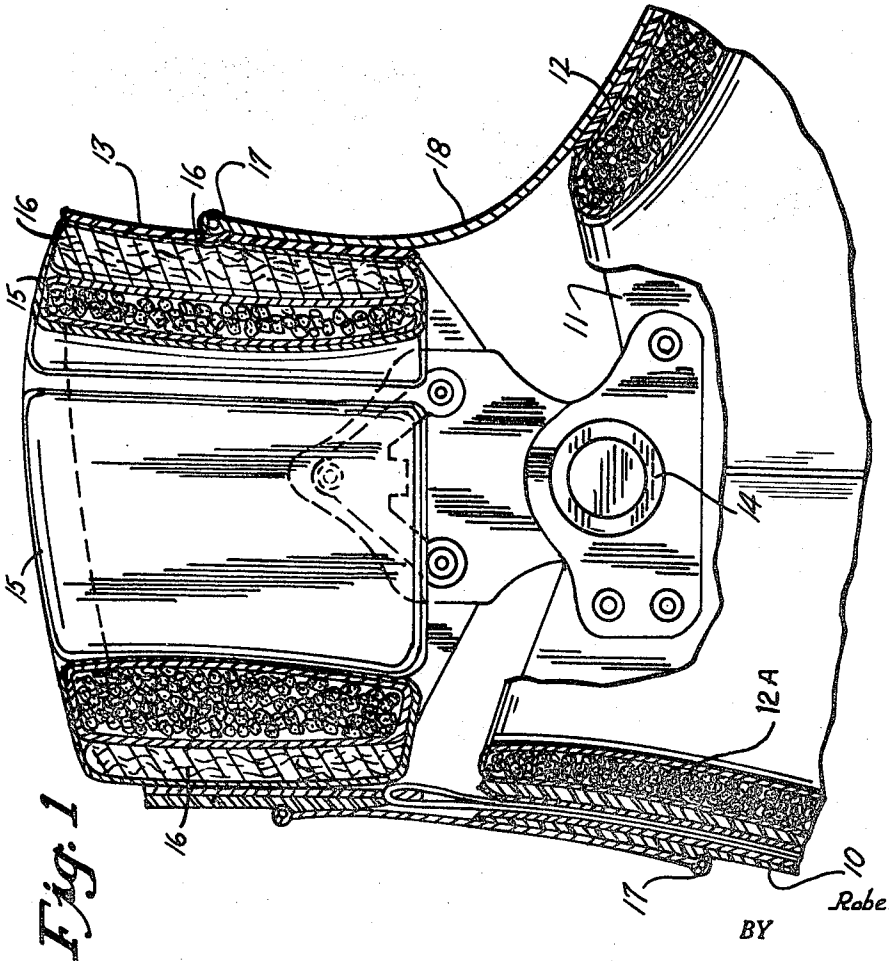


Fig. 1

Fig. 3

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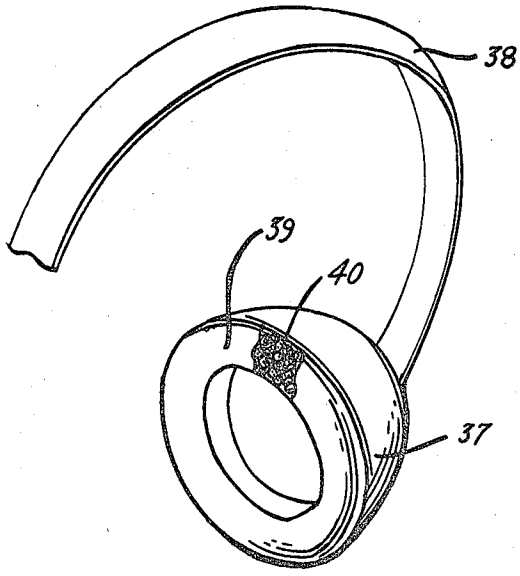

Fig. 5

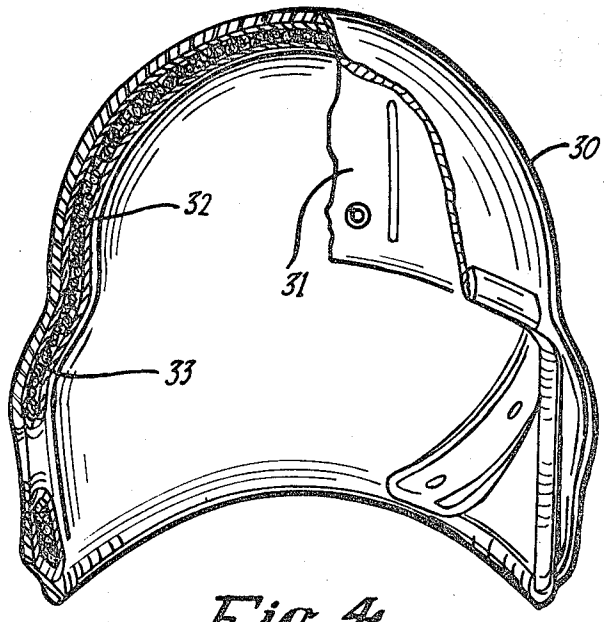

Fig. 4

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CONFORMABLE PAD FILLED WITH ELASTOMERIC PARTICLES

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Continuation-in-part of application Ser. No. 695,167, Jan. 2, 1968. This application Dec. 30, 1968, Ser. No. 787,862

Int. Cl. A63f 5/00; A43b

U.S. Cl. 36—71 14 Claims

ABSTRACT OF THE DISCLOSURE

A pad which will conform to irregular objects, such as portions of the human body, relatively quickly and which is filled with elastomeric particles coated with a thin layer of a lubricant. The elastomeric particles are preferably in the range of 1/16–1/4 inch in major dimension and upon load application flow readily at first and later act much like an open cell foam material as the particles redistribute between the padded surface and the supporting surface toward a uniform load distribution.

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my co-pending application Ser. No. 695,167, filed Jan. 2, 1968, and now abandoned, for Conformable Pad Filled With Elastomeric Particles.

BACKGROUND OF THE INVENTION

(1) Field of the invention

The invention relates to pads that conform to irregular shapes.

(2) Prior art

A first type of conformable pad is shown in Pat. No. 3,325,920 which shows a material which conforms to a shape from repeated working relatively slowly but will retain the shape when the load is removed. A quickly conformable pad is shown in U.S. Pat. No. 3,374,561.

The slowly conforming material of Pat. No. 3,325,920 does not flow quickly enough for certain applications where high, rapidly changing loads are encountered. The use of liquid pads for quick conformability has been found to have some difficulties in manufacturing of the liquid tight covering for the pads. The need for a quickly conformable padding material which gives adequate support during usual skiing loads, in particular, and which will then also quickly conform or flow under high loads to redistribute loads has been recognized.

SUMMARY OF THE INVENTION

The present invention relates to the use of elastomeric pellets or particles of sizes usually about 1/16 to 1/4 inch in major dimension covered with a very thin coating of lubricant so that they will slide past each other relatively easily and enclosed within a closed container having flexible, but essentially non-distensible walls to obtain a quickly conformable pad that is very economical to make.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary vertical sectional view of a ski boot through the upper portion of the boot showing a pad made according to the present invention installed in the cuff section of the ski boot;

FIG. 2 is a plan view of a pad made according to the present invention with the covering broken away to show the particles filling the pad;

FIG. 3 is a plan view of a pad with the cover broken away to show a different form of particles than that shown in FIG. 2;

FIG. 4 is a front view of a football helmet using pads made according to the present invention with parts in section and parts broken away; and

FIG. 5 is a perspective view of an ear defender having a pad made according to the present invention installed thereon.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a ski boot **10** is shown fragmentarily to give a proper setting for the usage of the pad. The boot has a lower portion **11** with lining pads **12** at the front part of the boot and pads **12A** at the rear of the boot (about from behind the ankle bone rearwardly) and an articulated ankle cuff section **13** which is pivoted with members **14** to the lower part of the boot. As shown, the ankle cuff section is lined with pads **15** made according to the present invention. The pads **15** are made so that they have a backing pocket into which pillows **16** are inserted for backing up the pads **15** so they fit closely to the leg of the wearer. The pockets have suitable openings into which the pillows can be inserted. The boot has a side flap which opens to let the foot be inserted into the boot, and a pair of encircling cables **17**, **17** attached to a cover **18** used for holding the door in closed position. The boot construction is shown in U.S. Pat. No. 3,374,561 and also shown is a more detailed showing of the normal pad configuration.

The pads **15** as shown in FIG. 2, comprise an outer covering **21** of a strong cloth cut into the desired outer configuration and filled with a material indicated at **22** comprising discrete or individual particles or pellets **23** of elastomeric material. The pellets of elastomeric material are each uniformly coated very thinly with a lubricant material. The coating is shown in shading only in the drawings because it is a very thing coating, but does cover the entire surface of each pellet thinly. The material pellets **23** substantially fill the bag and then the bag is sealed by stitching or other techniques of closing so it is a sealed unit. The pellets **23** substantially fill the bag, so that as the pellets **23** move under pressure, they deform or change the shape of the bag or outer covering **21** in another area.

Thus, the cloth or the covering **21** and the stitching or sealing members have to have a tensile strength high enough to withstand the in use loads tending to burst the bag when loads are applied to the bag itself. Desirably, the cloth should be coated with a material that is not adversely affected by grease and which prevents the grease or lubricant coating the particles **23** from wicking through the cloth. The lubricant is preferably a silicone base type grease or oil. Dow Corning No. 7 silicone grease has proved satisfactory. The elastomeric members used in one example were made from rod material supplied by the Shell Chemical Corporation and sold under the trademark "Thermolastic" having a durometer reading of about 45 Shore A (Type 226 "Thermolastic" material was used). "Thermolastic" is a butadiene-styrene copolymer. The pellets used were about 1/8 of an inch in diameter and random length, but usually about 1/8 of an inch long, forming small cylinders that had substantially equal dimensions in all directions, which is important for good flow properties. The softer durometer material rods are usually slightly longer ranging up to 1/4 inch long. In mixing, only enough of the silicone grease to thinly coat each pellet was used. Cylinders were used in this application because of their availability, low cost and their success in testing.

The cloth cover used was a Hypalon-coated nylon cloth. In use, the pad gives adequate support without harsh feel within the ski boot cuff, and when subjected to high loads, from the leg of a boot wearer, the particles **23**, being relatively large and having the coefficient of the friction between the pellets reduced with the lubricant, will "flow" or move out of the way of the highest load areas and conform more generally to the shape of the leg in the high load carrying areas, such as around the configuration of the front portions of the leg bone when a forward load is encountered, or around the side portions of the leg bone when a side load, such as when edging a ski is encountered. The pellets or particles **23** initially flow or redistribute relatively readily under this load, and then cease to flow when the loads are quite evenly distributed. The bag or cover restrains the pellets from further flowing. At this point, the material acts like an open celled rubber foam. The elastomeric pellets compress and deform into the interstitial spaces between the pellets. The pad then has force-displacement characteristics almost wholly dependent on the shapes of the pellets and their modulus of elasticity. When being displaced easily, the pellets will deform slightly as well to make them slip past each other readily. These elastomeric pellets then give a cushioning effect even after they have stopped flowing or moving when very high loads are encountered on the leg and this adds to the comfort of the leg in the cuff area of the ski boot where high loads are encountered. The pad will still conform to give comfort and snug fit when under lower loads. When the high loads are removed, the forces on the pellets are then redistributed as they were initially, since the pellets flow or move within the sealed bag back to their initial position supporting the leg in a normal manner.

The rubber or elastomeric pellets have a durometer range that is preferably between 35 Shore A and 65 Shore A for use in the ski boot application described. However, the total range can be from about 4 Shore A up to 95 Shore A depending on the loads encountered and the physical dimension of the particles and pads. The pellets are elastomeric material and must have the ability to withstand the lubricant being used. Any combination of lubricants can be made and even a dry lubricant can be used.

The pellets can be natural rubber, urethane rubber or other synthetic elastomers.

Ratios normally used for mixing of the pellets by volume include a 240 to 1 ratio (240 parts of the pellets to 1 part of the lubricant), or by weight a 150 to 1 ratio, using the Type 226 "Thermolastic" pellets and the Dow Corning 7 silicone grease. The pellet volume given is the free flowing bulk volume which may be measured by pouring a quantity into a container of known volume. The ratio can range from approximately 120 to 1 up to 480 to 1 by volume (the pellets representing the larger volume).

The pads **12** and **12A** are constructed similar to pad **15** just described. They have outer covers and are filled with elastomeric particles having a thin liquid or lubricant coating. As described subsequently, the pellets in each set of pads **15**, **12** or **12A** can differ in durometer to achieve different holding properties.

A second pad **25** is shown in FIG. 3, this again has an outer covering **26** made of a strong material and sewed along its edges **27** to be sealed. The interior of the pad here is shown with spherical elastomeric pellets **28**. The spheres can be of uniform size or varying size and will also flow or move quickly out of the way when subjected to load, much like the cylinders previously described. The pellets **28** are made of any suitable elastomeric material. Once the flowing of the pellets has stopped, the material takes on the qualities of and becomes much like an open celled foam. The pellets individually will compress and thus will give high support characteristics without discomfort.

The material can be used for medical seat cushions or other areas where quick conformability is desired, such as shoe pads, ear defenders (noise suppressors) and the like.

The present pad does not rely on a liquid for quick conformability under high rapidly changing load thereby eliminating the problems encountered in containing a liquid in a pad. The filler material is low cost, and it will flow quickly when the particle size for the ski boot example is over 1/16 of an inch and up to 1/4 inch and the preferred range of particle size about 1/8 of an inch major dimension. The dimensions of the particles are substantially equal in all directions. When the material stops flowing the material will act like an open celled foam to give a cushioning effect and not flow completely out of the way of the high load applying object.

In boot applications, the cuffs can be padded with pads having pellets about 45 Shore A durometer hardness, the pads in the instep and front portion of the foot about 55 Shore A durometer hardness, and in the heel portion of the foot 65 Shore A durometer hardness, to give good holding action. The pellet pads enhance skiing because of rapid conformability, and the firmness of the pad can be varied for the individual portion of the boot. Soft particles are used in the cuff where rapidly changing loads are encountered; medium hardness around the instep and front of the foot for a balance of comfort and good control and firm particles (65 durometer) around the heel where the pads should not compress greatly. The sides of the foot in the heel area are held firmly for good control. The durometer of the pellets can thus be easily changed to fit conditions.

The pads **12** and **12A** can be compartmented to prevent excessive movement of the material and extend to fully support and hold a foot in the boot.

The back up pillows or pads **16** are used for fitting the boots properly and can be filled with material such as that disclosed in U.S. Pat. No. 3,325,920 or can be filled with pellets just as pads **15** or **25**. If the back up pads **16** are filled with pellets, the firmness of the overall pad system can be varied by having a different durometer pellet in the back up pad **16** from the pad it is backing up. Back up pads **16** are used to back up pads **12** and **12A** to obtain good fit too.

The heel portion of the foot refers generally to the part of the foot below and generally to the rear of a transverse vertical plane passing through the ankle bone. This part of the foot is held down for good control of skis. The front portion of the foot means the part generally ahead of the angle bone.

The elastomeric particle pads have an advantage in that the durometer of the particles can be selected to suit individual usages.

Referring specifically to FIG. 4, a football helmet **30** is shown. The helmet has a liner member **31** which can be suitably fastened in place, with snaps as shown, and the liner member **31** comprises a double wall pad that can be compartmented, and is filled with the pellets **32** of elastomeric material covered with a very thin coating of the oil, in the ratios previously given. The pellets **32** would be of a durometer in the range of 45 Shore A, and these pellets will give a very good impact resisting cushion to the head, and also will conform very quickly to irregularities of the head. Back up pads again can be used for getting a good fit.

If desired, the pads around the ears as indicated at **33** can be filled with pellets that are softer or smaller size to give better comfort. The range here may be around 35 Shore A hardness. The pads can be made so that they can be backed up (other pads inserted) with other pads, if desired, to change the fit of the helmet.

In FIG. 5, an ear defender or protector **37** is shown. This comprises a cup shaped member fastened to a head cross band **38** (there are two cups, one for each ear) which is used for deadening sounds. A cushion member **39** surrounds the openings of the cup shaped member. The cushion member **39** is filled with pellets **40** made of

an elastomeric material thinly coated with oil or grease as previously described to provide conformability around the ear and to insure that the sound is adequately deadened. The elastomeric particles used are soft enough to give a cushion here as well, and would range in the area of 35–45 Shore A durometer reading. The pellets **40** conform quickly to the irregularities of the head and provide a cushion. The conformability insures that the cushion will seal around the ear to deaden all noises and will not become uncomfortable after wearing the defender for a substantial length of time. The elastomeric material provides an adequate cushion to prevent discomfort.

With the larger elastomeric particles, ranging from 1/16 inch up to 1/4 of an inch, and averaging about 1/8 of an inch in major dimension the conformability characteristics are enhanced substantially because the larger particles will slide past each other easily. The particles also will crush or conform under load to prevent any sharp edges from digging into the skin of the wearer. The amount of liquid material, of course, is kept to a minimum and is well below the volume of the void spaces between the particles. The lubricant merely insures that the particles will slip easily by each other to provide a conforming action, and the particles will merely compress if further loaded.

What is claimed is:

1. A pad comprising an outer container substantially filled with material consisting of discrete elastomeric particles having a thin coating of lubricant material on the surface of each particle comprising a mixture of a lubricant material and particles in a ratio between 120 to 1 and 480 to 1 by volume, where the 1 represents the lubricant material.

2. A pad according to claim **1** wherein the elastomeric particles are cylindrical.

3. A pad according to claim **1** wherein the elastomeric particles are spherical.

4. The pad specified in claim **1** wherein the lubricant material is a grease.

5. A pad comprising an outer container substantially filled with a material consisting of discrete elastomeric particles having a durometer in the range between 35 and 65 Shore A and having a thin coating of lubricant material on the surface of each particle.

6. The pad of claim **5** wherein the particles have substantially uniform dimensions in all directions.

7. A pad comprising an outer container substantially filled with material consisting of discrete elastomeric particles having a durometer in the range between 4 and 95 Shore A and having a thin coating of lubricant material on the surface of each particle.

8. The pad of claim **7** wherein the lubricant material is a grease.

9. The pad of claim **7** wherein the material substantially filling said pad is made by mixing a lubricant material and elastomeric particles in a ratio between 120 to 1 and 480 to 1 by volume, where the 1 represents the lubricant material.

10. The pad of claim **7** wherein the particles range in size between 1/16 inch and 1/4 inch in major dimension.

11. The pad of claim **7** wherein the particles are larger than 1/16 inch in major dimension.

12. A pad for cushioning a portion of the human body against a hard outer member comprising a flexible, substantially non-stretchable container of size and shape to cover the portion of the human body to be padded, and a filling insert container consisting of discrete elastomeric particles ranging in size between 1/16 inch and 1/4 inch in major dimension, and a thin coating of a lubricant material on the surface of each particle.

13. The pad according to claim **12** wherein the particles range in durometer reading between 35 and 65 Shore A.

14. The pad of claim **12** wherein the discrete particles are comprised of cylindrical members having a major dimension over 1/16 inch.

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U.S. Cl. X.R.

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