# United States Patent

**Ikada**

[15] **3,691,569**

[45] **Sept. 19, 1972**


[54] **CUSHION**


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[52] **U.S. Cl.**.....**5/345,** 297/DIG. 2

[51] **Int. Cl.**.....**A47c 23/00**

[58] **Field of Search**.....5/345, 355, 361; 297/DIG. 1, 297/DIG. 2; 264/45



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[57] **ABSTRACT**

A cushion having a body comprising a layer composition formed of a mixture of rigid elastic fibrous materials and an elastomeric foam, said mixture being such that said rigid elastic fibrous material in part surround part of said foam, while part of said foam surrounds part of the fibers, thus said fibers and said foam occupying a defined space in mutually complementary relationship, said foam including a foam layer formed in integral connection with and extending outside the foam part surrounded by said rigid elastic fibrous materials.


**9 Claims, 10 Drawing Figures**

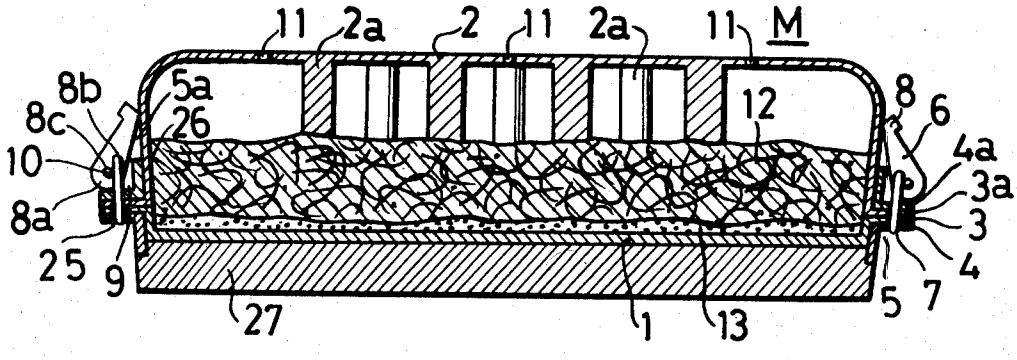


FIG. 1a

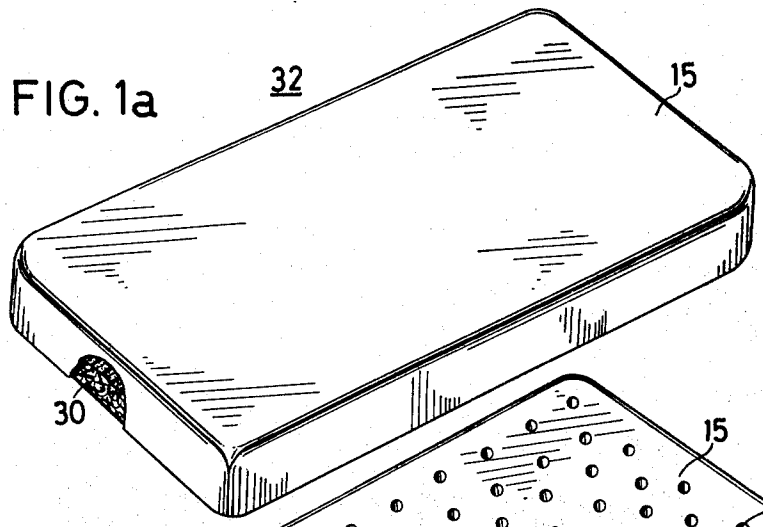



FIG. 1b

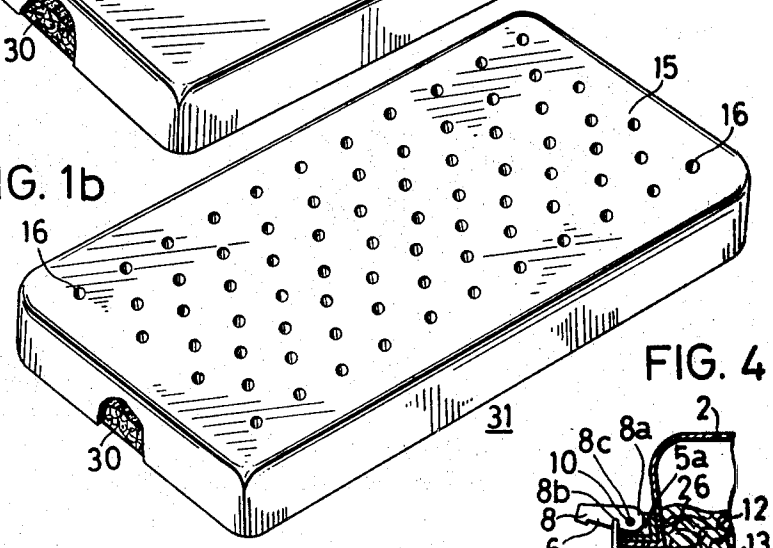



FIG. 4




FIG. 3

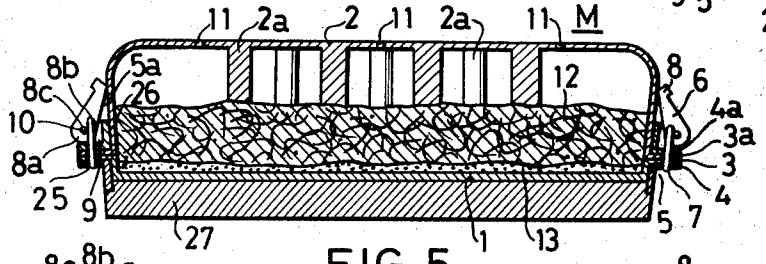



FIG. 5

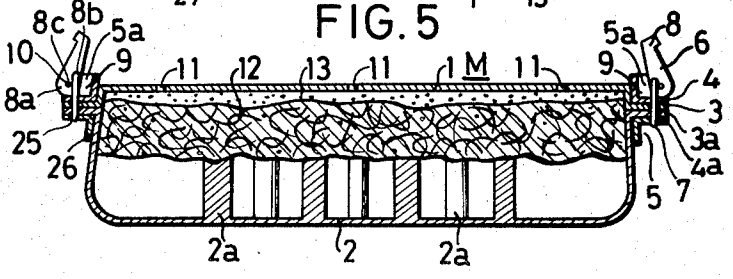


FIG. 1C

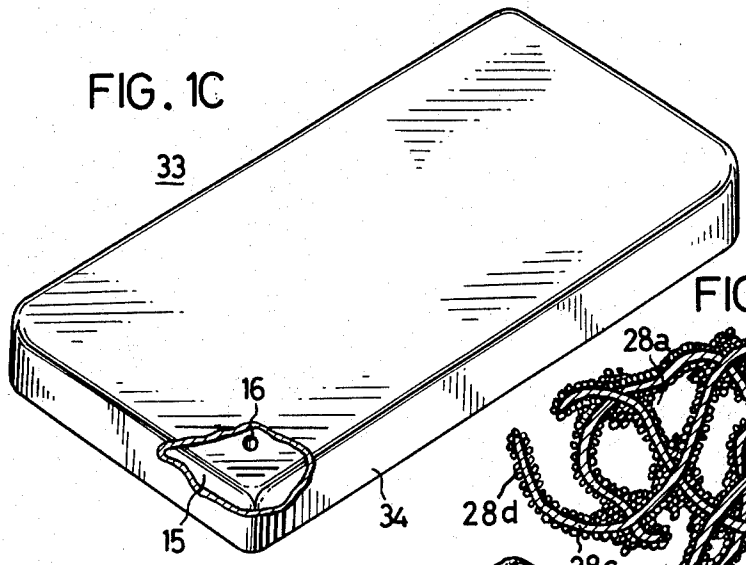



FIG. 7




FIG. 6

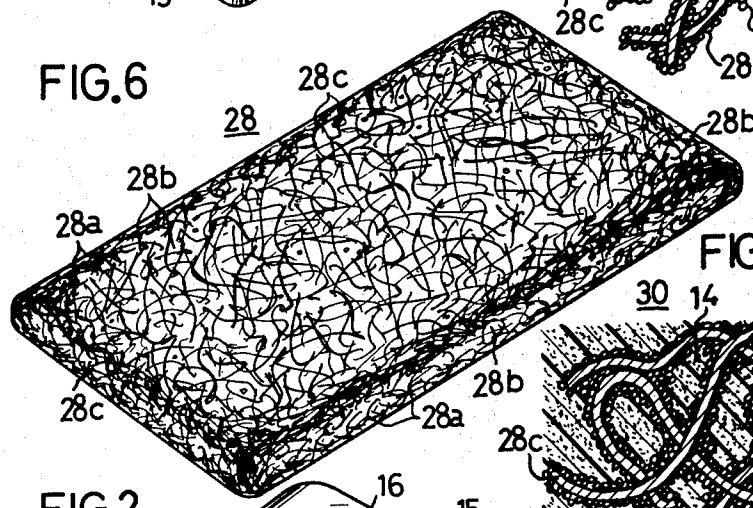



FIG. 8

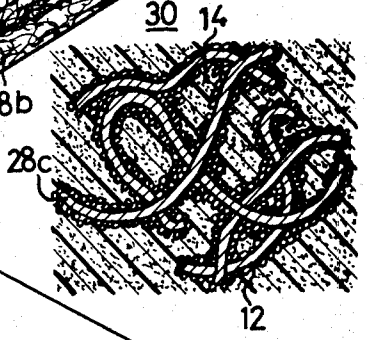
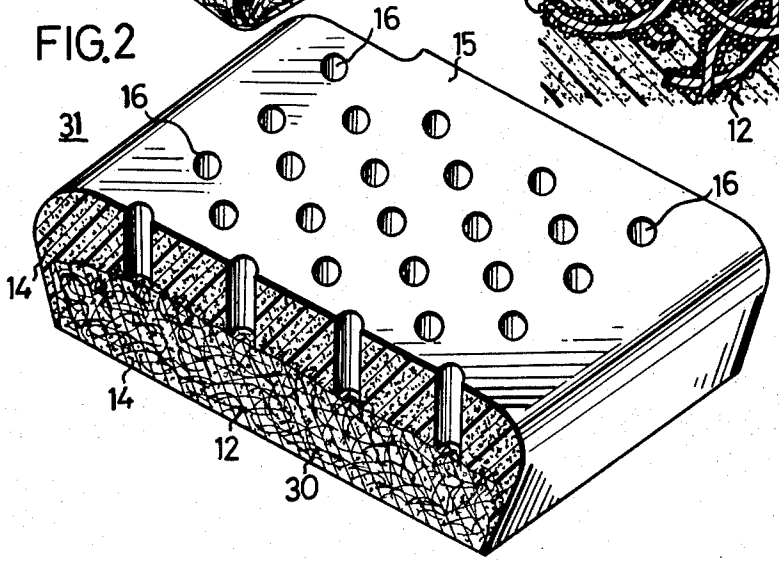



FIG. 2



# CUSHION

The present invention relates to cushions and the like and more particularly to novel cushions suitable for vehicle seats, back rests, sofas, beds and other furnishings and an economical method and apparatus for making new cushions having excellent properties.

Elastic foams, waste flax, rags, usual soft fibers, hair locks, coil springs, and other materials have heretofore been employed singly or in combination to provide cushions. These materials have been used with the view of making the most of their characteristics, but in actual practice have not necessarily display a satisfactory cushioning effect. Many cushions made of such materials, when loaded with heavy persons, may rebound or collapse, while others are very expensive.

An improved spring cushion made by covering coil springs with cloth and connecting the covered springs is also known in the art. This cushion, however, is also beset with an annoying problem. For example, when a driver sits down on a car seat having such a spring cushion or as soon as the seated driver starts the car, he receives a considerably high initial pressure from the cushion constituting the seat, thus having a feeling of hardness. It has been found by the present inventor that this phenomenon is common to all aforesaid cushions.

The inventor has also ascertained that most improvements in the conventional cushions have been directed to comfortableness and has realized that cushion stability is rather important.

An object of this invention is to provide new cushions and the like which are free from the above described initial pressure and excellent in stability as well as seating comfort.

A further object of the invention is to provide cushions capable of soft but strong support of heavy loads and effectively absorbing violent shocks.

Another object of the invention is to provide said cushions free from change in quality with time, exceedingly durable, and highly adaptable to articles to be furnished therewith.

Another object of the invention is to provide said cushions made of inexpensive materials in an economical manner.

Still another object of the invention is to provide said articles having an additional structural feature which helps to improve the cushioning effect.

Still another object of the invention is to provide a method for manufacturing said cushions by the use of a simple inexpensive apparatus which can be made with much ease and requires no skilled workers.

In order to attain these and other objects, which will become apparent from the succeeding description, the present invention contemplates a cushion having a body comprising a layer formed of a mixture of rigid elastic fibrous materials obtained from palm, coconut palm and the like and an elastomeric foam, said mixture being such that said rigid elastic fibrous materials in part surround part of said foam, while part of said foam surrounds part of the fibers, thus said fibers and foam occupying a defined space in mutually complementary relationship, said foam including a foam layer formed in integral connection with and extending outside the foam part surrounded by said rigid elastic fibrous materials.



In such a cushion wherein the rigid elastic fibrous materials and the elastomeric foam are mixed together, the high tensibility of the foam is controlled by the firmness of the rigid fibers. The fibers, together with the highly elastic foam mixed therewith, exhibit such combined shock-absorbing and cushioning properties that the cushion is substantially free from the initial-pressure hardness besetting conventional cushions. Furthermore, the fibers forming this cushion are stiff but have rough surfaces and retain the essential nature of being fibrous. The foam is therefore not only in surface-to-surface connection with the fibers, but also enters fiber micelles and micelle intervals so that the fibers are coupled directly and firmly with the foam and serve as a firm framework for the foam. According to such cushion construction of the present invention, a person who sits on or leans against the cushion can feel stabilized as well as comfortable. Such cushions, when used as automobile seat cushions, back rests and the like, are stable against vibrations and strong shocks taking place from side to side, up and down, back and forth, and in various oblique directions, and provide seating comfort even on bumpy rods. The cushion of this invention is also suitable for sofa, mattress and other furniture applications, since the cushion is free of local depression, thus giving rise to no backbone curvature or being capable of straightening bent backbones. Both the foam and the fibers have air permeability. In addition to this fact, the aforesaid mixture construction allows the cushion to receive a sufficient amount of air for good heat preservation and desirable perspiration. When employed for beds, the cushion can provide a comfortable rest and a quiet sleep.

The cushion of the present invention can be manufactured by placing a liquid foam-forming material and rigid elastic fibrous materials in a mold, closing the mold, and causing the liquid materials to form. Further, the provision of holding bars directly or indirectly in the mold is effective to prevent the fibers in the mould from moving owing to the foaming pressure of the liquid foam-producing material so as to give rise to difficult or insufficient foam expansion.

The holding bars are surrounded by the produced foam, and after the bars are removed, the remaining foam layer has the corresponding number of holes. When a cushion with such a perforated foam layer is used for a car seat, the driver seated on the cushion directly or through a cover can feel more comfortable and stable.

For this reason, a cushion embodying the present invention includes a relatively thick and perforated foam layer as an additional structural feature.

Other objects, features, effects and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1*a* is a perspective view showing a cushion embodying this invention, partly broken away;

FIG. 1*b* is a perspective view showing another type of cushion formed according to the invention, partly broken away;

FIG. 1*c* is a perspective view showing a covered cushion partly broken away;

FIG. 2 is a fragmentary perspective view, on a larger scale, of the cushion shown in FIG. 1*b*, partly broken away;

FIG. 3 is a vertical view in section showing an apparatus for molding a cushion according to the invention;

FIG. 4 is a fragmentary sectional view showing a portion of the arrangement of FIG. 3;

FIG. 5 is a vertical sectional view showing a modified cushion molding apparatus of the invention;

FIG. 6 is a view showing a fiber layer composition;

FIG. 7 is a fragmentary enlarged view showing a much smaller portion of the fiber layer of FIG. 6 which has been treated with a bonding agent; and

FIG. 8 is a fragmentary enlarged sectional view showing the fiber layer portion of FIG. 7 the clearance of which has been filled with an elastic foam.

Referring more particularly to the drawings, FIGS. 3 and 4 illustrate an apparatus for molding a car seat cushion according to the present invention. In FIG. 3 a mold M comprises two complementary split mold elements 1 and 2, one of which is installed on a frame 27. The bodies of the mold elements are made of an adequate material such as a metal plate or cast metal. When both mold elements are jointed together, their inner surfaces define a mold cavity in the shape of a car seat cushion. The bodies of the split mold elements 1 and 2 are equipped respectively with flanges 3 and 3*a* arranged along the circumferential edges and projecting substantially horizontally. Brackets 4 and 4*a* are made of plates bent so as to have L-shaped sections are fastened each at one side to the flanges 3 and 3*a* by means of welding, bonding or the like. The brackets 4 and 4*a*, with the L-sections, form recesses 5 and 5*a* respectively. The brackets 4 are each provided with a depression 25 facing the recess 5. The other brackets 4*a* are each provided with a boss 9 for fitting a fastener 6 which will be described later. In the exemplary illustration, the boss 9 is fixed to the bracket by welding as represented by the numeral 26. Instead of welding however, a strong adhesive agent may be employed to fix the boss. It is also alternatively possible to form the boss 9 so as to be in integral connection with the bracket. Each of the fasteners 6 has a handle 8, a clamp ring 7 and two small holes 8*b* and 8*c* bored at the base portion 8*a*. A shaft 10 is passed through the small hole 8*c* and the boss 9, therefore the fastener 6 is connected through the shaft to the boss 9 of the bracket 4*a* so as to be rotatable. The base portion 8*a* of the fastener is located in the bracket recess 5*a*. The clamp ring 7 is passed through the other small hole 8*b* of the fastener 6, and the top portion of the clamp ring 7 is designed to meet the depression 25 of the bracket 4. Thus, the fastener 6 and the depression 25 has a positional relation corresponding to the relation between the clamp ring and the depression. FIG. 4 shows the fastener 6 as positioned for releasing, with the clamp ring 7 separated from the depression 25.

It is now assumed that the handle 8 shown in FIG. 4 is turned toward the mold M. Then, the clamp ring 7 approaches the depression 25 until the ring engages with the depression as shown in FIG. 3 and, through the bracket 4 forces the split mold element 1 (directly the flange 3) to the mating split mold element 2 (directly the flange 3*a*) so that both mold elements register, with the mold closed. Escape holes 11, which will be described later, are bored in the split mold element 2.

Here follows a description of the rigid elastic fibrous materials.

Rigid fibers obtained from palm, coconut palm and the like are assembled into a bundle. The fiber bundle is twisted forcefully in the form of a coil spring. The twisted bundle is hard like a wood bar so that if we rub our hands with the twisted bundle, we feel a pain. The strongly twisted fibers are untwisted and spread. Then the fibers become curly and form a bulky and firm layer 28 having a multiplicity of clearances 28*b* and intersections 28*a* as shown in FIG. 6. In this operating stage, the thickness of the fiber layer and the fiber weight per unit area are optionally controlled. It is to be noted here that a plurality of combined fiber layers may be employed in place of the single fiber layer 28.

The fiber layer is sprayed with a bonding agent such as the dispersion liquid or solution of a natural or synthetic rubber latex to which adequate compounding and vulcanizing agents are added or of a synthetic resin emulsion to which adequate ingredients are added; or the fiber layer is immersed in the bonding agent and the superfluous liquor is squeezed out of the immersed layer. By such spraying or immersion, the bonding agent is attached to the fiber surface, with emphasis laid especially on the intersections. (A satisfactory ratio by weight of the fibers to the bonding agent (solid) is 1 to 0.1.) The fibers thus furnished with the bonding agent are subjected to drying and/or vulcanizing. The drying may be finished when moisture and the like have been removed. When rubbers are used, it is in many cases advantageous to use a pressure can to perform pressure vulcanization. Any of such bonding agents as mentioned above may contain a slight amount of foaming agent or may be used without any foaming agent. Two examples of bonding-agent recipes are disclosed below. The foaming agent found in the following example may be omitted, if desired. The fibers thus treated are cut to a suitable size and shape for providing a fiber layer 12 shown in FIGS. 3 and 4.

BONDING-AGENT RECIPE EXAMPLE I

| | Parts by Weight |
|---|---|
| Natural or synthetic rubber latex | 170 (Solid: 60%) |
| Sulfur | 2–5 |
| Zinc oxide | 2–5 |
| 10% ammoniated casein solution | 5–10 |
| Age resister (diphenylamine) | 0.5 |
| Vulcanization accelerator (diethyl ammonium diethyl dithis carbamate) | 1.0 |
| Filler (lithopone) | 20.0 |
| Foaming agent (Benzene sulfonyl hydrazide) | 10.0 |

BONDING-AGENT RECEPE EXAMPLE II

| | Parts by Weight |
|---|---|
| Emulsion of vinyl resin such as polyvinyl chloride | 170 (Solid: 60%) |
| Plasticizer (dibutyl phthalate) | 100 |
| Stabilizer (dibasic lead phosphite) | 2 |

In FIG. 7, part of a fiber layer 12 provided with a bonding agent is shown on a larger scale for convenience of reference. Rigid elastic fibrous materials 28*c* have a multiplicity of aperture 28*b* and intersections 28*a*. The fibers are each enclosed by a bonding agent layer 28*d*. The bonding agent bonds the fibers at the intersections as represented by the reference symbol 28*e*. Meanwhile, a liquid foam-forming material is separately prepared. The foam-forming liquid may produce foam by its own chemical change or mainly by the action of a foaming agent.

Various foam-producing synthetic resins can be employed in manufacturing the novel cushion embodying this invention. In view of the character of the cushion and from an economical viewpoint, it is preferable to employ polyurethane foams which may be made by reacting polyisocyanate with a compound having two or more active hydrogen radical such as hydroxyl groups, carboxyl group, amino group, active methylene group.

The polyisocyanate to be employed in making a polyurethane foam may be tolylene diisocyanate, 3,3'-bitolylene 4,4'-diisocyanate, diphenylmethane 4,4'-diisocyanate, 3,3'-dimethyl diphenylmethane 4,4'-diisocyanate, 2,4-tolylene diisocyanate dimer, or the like. Said tolylene diisocyanate may be tolylene 2,4-diisocyanate or tolylene 2,6-diisocyanate or a mixture thereof wherein the relation between ratio of tolylene 2,4-diisocyanate to tolylene 2,6-diisocyanate may be 80–65/20–35. (Said mixture is used in general.)

The typical compound having at least two active hydrogen radical may be chosen from polyethers and polyesters.

Polyethers, namely, polyether glycols or bolyoxy alkylene glycols have the general formula HO—R—O—R—O . . . R—O—R—OH (where "R" stands for an alkyl group) and are obtained by the ring-opening polymerization or copolymerization of cyclic ethers such as ethylene oxide, propylene oxide trimethyl oxide, bytylene oxide, α-methyltrimethylene oxide, 3,3'-dimethyltrimethylene oxide, tetrahydrofuran and dioxane. Polyethers will be described in more detail by way of illustration.

Diols such as polyoxypropylene glycols (Pluracol P–2010, a trademark produced by Wyandotte Chemical Corp. of U.S.A.; Niax Diol PPG2025, a trademark made by Union Carbide Corp. of U.S.A.; etc.) obtained by ring-opening polymerization of propylene oxide, and polyoxypropylene polyoxyethylene glycols (Pluronic L61, a trademark of Wyandotte Chemical Corp., U.S.A.) obtained by ring-opening polymerization of propylene glycol and ethylene oxide, and triols such as copolymers of propylene oxide and glycerol (Polyglycol 11–200, 11–300 and 11–400, trademarks of Dow Chemical Co., U.S.A.; Niax Triol LG–168, a trademark of Union Carbide Chemicals Corp, U.S.A.) and copolymers of propylene oxide and 1,2,6-hexane triol (Niax Triol LHT42 and LHT67, trademarks of Union Carbide Chemicals Corp, U.S.A.) may be employed singly or in adequate combination. When a diol is used in combination with a triol, there is a tendency that as the percentage of the triol increases, the produced foam becomes harder. Besides, polyol polyethers (Tetronic 701, a trademark of Wyandotte Chemical Corp., U.S.A.) produced by adding block polymers of propylene oxide and ethylene oxide to ethylene-diamine can be used for making flexible urethane foams.

On the other hand, polyesters are hydroxyl-terminated compounds obtained from polybasic organic acids, particularly dicarboxylic acids, and polyols. Dicarboxylic acids which can be employed are saturated fatty acids such as oxalic acid, succinic acid and adipic acid, unsaturated fatty acids such as maleic acid and fumaric acid and dimer acids thereof, aromatic acids such as phthalic acid and isophthalic acid, and anhydrides of the above named organic acids. These dicarboxylic acids may be used singly or in combination.

Polyols to be reacted with these dicarboxylic acids may be diols such as ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol and butylene glycol, triols such as trimethylol propane, trimethylol ethane, hexane triol and glycerol, hexaols such as sorbitol, and the like. These polyols are suitably combined with the aforesaid dicarboxylic acids to produce a wide variety of polyesters. So-called hydroxyl polyesters having hydroxyl groups at both chain ends are common. These polyesters can be produced by using the polyol component superfluously. Particularly, polyesters obtained from adipic acid or a dimer acid and diethylene glycol are commonest and can produce polyurethane foams excellent in properties and economically advantageous. As other active-hydrogen compounds, polyesters obtained by the ring-opening polymerization of lactones, copolymers produced by copolymerization of dimethyl-ε-caprolactone and ethylene glycol or propylene glycol in the presence of an organic metal compound catalyzer such as of tin or lead, polyesters containing tertiary nitrogen radicals (U.S. Pat. No. 2,802,795), polythioethers, and polyols obtained as a result of a reduction of chain polyketone (U.S. Pat. No. 2,495,286) which is formed by copolymerization of carbon monoxide and olefin can be employed singly or in combination with the aforesaid polyethers, polyesters and the like.

Urethane foams can easily be formed by adequately mixing polyether or polyester, isocyanate, a catalyzer, water activator and other ingredients and making the mixture produce foam at normal or elevated temperature. The conventional one-shot or prepolymer method may be employed in producing urethane foams. However, the one-shot method is preferable in respect of operation. This method eliminates the necessity of preopolymer production and heat treatment, and allows economically advantageous product of urethane foams having excellent properties.

In the prepolymer method, gelation takes place if the produced prepolymer is stored exceeding a fixed period. In order to prevent this, it is necessary to carry out the production adequately and to store the produced prepolymer in a closed container and a cold place so as to keep the product from impurities, especially moisture. The prepolymer having exceeded the limited storing period has a heightened viscosity and a reduced effective isocyanate content. Therefore, the properties of the foam produced by using said prepolymer are deteriorated. Compounds which can be employed as prepolymer stabilizer are those having an active hydrogen atom, for example, tertiary alcohols, aromatic secondary amines, mercaptanes, lactams, monohydric phenols, imidos, enol form compounds, and such compounds as phthalolyl chloride.

In producing a polyurethane foam, various assistants are used in combination to promote or control the foam formation and to improve the properties of the product, and include, as important assistants, a catalyzer and an emulsifier or a surface activator. The catalyzer hastens polymerization and bridging reaction and serves for forming a good-quality foam, while the emulsifier helps the ingredients to mix up and disperse well

and heightens the stability of the produced foam. Other assistants available are a special foaming agent, a bridging agent for increasing the foam strength, a reinforcing filler, a refractory agent, a water-proofing agent, an antibiotic agent, a colorant such as a pigment or dyestuff, a mold releasing agent, and so forth.

Catalyzer materials are, for example, tertiary amines such as tertiary amine and tetraalkyldiamine, organic metalic compounds such as dibutyltin dilaurate, dibutyltin di(2-ethylhexoate) 2-ethylstannous caproate, and stannous oleate, alkali metal compounds, and radical producing agents such as benzoyl peroxide and lauroyl peroxide. Especially, a catalyzer composed of a mixture of an organic tin compound and a tertiary amine shows a larger activity than each of the components exhibits singly.

The new foam cushion of the present invention can be made in the following manner.

## EXAMPLE 1

### POLYURETHANE FOAM RECIPE (Ether Type)

| | Parts by Weight |
|---|---|
| Polyether glycol | 100 (Solid: 80%) |
| Tolylene diisocyanate | 38 |
| Water | 2.9 |
| N-methyl morpholine | 0–10 |
| Triethylenediamine | 0.5 |
| Polydimethylsiloxane | 0.5 |

The ingredients in the above foam recipe I are mixed by high-speed agitation. The liquid foam-forming ingredients thus mixed (hereunder often referred to as the "liquid materials") are immediately injected into the split mold element **1** of the mold M so that the liquid materials are uniformly placed on the bottom of the mold element **1** as represented by the numeral **13** in FIG. **3**. The liquid materials are then covered with the aforesaid fiber layer **12**, which is then covered with the other split mold element **2**. In order to prevent the fiber layer from floating up and swaying and for another purpose, the holding bars **2***a* are provided in the mold element **2** so as to hold the fiber layer. The fasteners **6** are turned toward the mold to engage the clamp rings **7** with the depressions **25** so that the split mold elements may not be separated by the foaming pressure. The liquid materials react at room temperature without external heating and turn into the foam in several seconds. The produced foam fills the fiber layer and also expands outside the fiber layer. The escape holes **11** (the diameter of about 5 to 10 millimeters being preferable, but not limitative) made in the split mold element **2** allow the air and reaction gases and the superfluous liquid materials (if any) to jet out. Thus, the foam thoroughly fills the clearances provided by the rigid elastic fibers in the fiber layer and also expands to form a elastic foam layer outside the fiber layer. Then the materials thus molded are removed with or out of the mold and placed in an oven of about 70° to 100° C. for about 1 hour. Thereafter, the product is taken out of the oven and used as it is or after slightly finished. The amount of the liquid materials to be supplied into the mold varies according to mold capacity and the foam expansion factor, which should therefore be taken into account in calculating the desired material amount. The degree of the urethane arrangement may be varied according to its characteristics.

In FIG. **5**, the mold shown in FIG. **3** is reversed. The use of the mold, the molding process, etc. will be apparent from the above description concerning FIG. **3**. The fasteners are attached to the split mold element **1** instead of element **2**, but the function and operation of the fasteners and the related parts will be understood with much ease. In the arrangement of FIG. **5**, the liquid materials **13** may be injected into the mold element **1**, or may be supplied over the fiber layer **12** as shown in the figure.

The foam cushion thus produced is shown in FIGS. **1***b* and **2**. In these figures, the large number of clearances **28***b* in the fiber layer **12** are filled with the urethane foam **14**, while the rigid elastic fibers constituting the fiber layer are covered with urethane foam **15**. The urethane foam **14** in the clearance **28***b* is continuous with the foam **15** layered outside the fiber layer. The above description has been given in conjunction with the illustrative embodiment of the invention which has the fiber layer provided with the bonding agent layers. However, the cushion intended by this invention can be obtained also by using the fiber layer **28** without the bonding agent and performing the same operation as in the described example. The previous application of the bonding agent to the fiber layer **12** as represented by the symbols **28***d* and **28***e* is effective to heighten the elasticity and firmness of the resulting cushion. Another advantageous feature is that, although the fiber layer tends to be collapsed by the foaming pressure caused by the liquid materials, the tendency is smaller than when no bonding agent is applied. Therefore, the foam produced by the liquid materials in the mold can more easily fill the clearances existing in the fiber layer. It has also been found that the fibers are more firmly combined with the foam through the medium of the bonding agent layered on the fibers.

However it should also be understood that even the cushion produced by the use of the fiber layer **28** without the bonding agent can provide the desired seating comfort and stability characteristic of the present invention, since the fibers are elastic and rigid, the clearances in the fiber layer are filled with the elastic foam, and the fiber intersections are surrounded by the foam.

In the improved cushion of this invention, the layer thickness of the foam **15** extending outside the fiber layer may have various values, although a thin foam layer is not illustrated. The foam layer in the cushion shown in FIG. **2** has a large thickness. This cushion, with the thick layer of the foam **15** connected with the foam-filled fiber layer **30**, gives a soft support to the seated person and appears to be a high-class article in spite of the fact that fibers hold a considerably large proportion of the cushion materials.

The thick foam layer **15** of the cushion **31** shown in FIGS. **1***b*, **1***c* and **2** has the holes **16** made by the holding bars (**2***a*) projecting from the inner wall of the split mold element **2**. The hole diameter is approximately 3 to 30 millimeters (not limitative), and preferably about 5 to 20 millimeters. The holding bars have the corresponding diameter. The depth and number of the holes **16** may also be determined adequately. With the holes **16** adequately provided and with the fiber layer **30** filled with the elastic foam, the cushion **31** has an air

cushion effect. Thus, the cushion has a special elasticity and stability so that a car driver seated on the cushion will not be tired even after a long drive. Besides, the cushion is effective for heat retaining, temperature control, sound prevention, sound absorption, and so on. For example, the cushion serves to absorb and attenuate the noise of a running car before the noise reaches the ear.

A surface stabilizer and the like contained in the liquid materials are helpful to make the surface of the foam layer **15** lustrous and uniform so that the cushion looks very fine.

FIG. **1***c* shows the foam cushion **33** of the present invention which is provided with a cover **34**. Concerning the covered cushion no further description will be necessary.

## EXAMPLE 2

### POLYURETHANE FOAM RECIPE (Ether Type)

| | | Parts by Wt. |
|---|---|---|
| (A) | Polyoxypropylene triol (glycerol base) (Mole. wt.:5000; 32 hydroxyl groups) | 400.0 |
| (B) | Polyoxypropylene glycol (glycerol base) (Mole. wt.: 2000; 86 hydroxyl groups) | 60.0 |
| (C) | Triethylenediamine | 0.7 |
| (D) | Oxalate of dimethylethanol amine | 1.0 |
| (E) | Silicone oil | 1.5 |
| (F) | Water | 5.5 |
| (G) | Tolylene 2,4-diisocyanate | 50.8 |
| | Tolylene 2,6-diisocyanate | 12.7 |

The ingredients A to F are previously mixed. Thereafter, the material G is added to the mixture, and the whole ingredients thus assembled are rapidly stirred for about 3 to 5 seconds. The resulting liquid mixture is injected into the mold instead of that prepared according to the recipe I. Then, the same molding operation is carried out. The product is a similar foam cushion.

## EXAMPLE 3

### POLYURETHANE FOAM RECIPE (Ester Type)

| | Parts by Volume |
|---|---|
| Polyester (22°C) | 100 |
| Tolylene diisocyanate (18°C) | 47 |
| N-diethlaminoethanol adipate | 4 |
| Ammonium oleate | 1.3 |
| Sulfonated castor oil | 2 |
| Water | 2 |
| Paraffin oil | 0.7 |

The above ingredients, after uniformly mixed, can be used in place of those of the recipe I. The polyester is obtained by the reaction of 16 mols of adipic acid, 16 mols of diethylene glycol, and one mol of trimethylol propane.

## EXAMPLE 4

### POLYURETHANE FOAM RECIPE (Ether Type)

| | Parts by Weight |
|---|---|
| Propylene oxide-glycerol copolymer (Niax Triol LG-56 made by Union Carbide Corp., U.S.A.) | 100.0 |
| Tolylene diisocyanate | 45.0 |
| Stannous octoate | 0.5 |
| Polyoxyethylene-oxypropylene block copolymer | 0.9 |
| Water | 3.5 |
| N-methyl morpholine | 0.6 |

The above materials are well mixed by rapid agitation and can be used instead of those of the recipe I.

## EXAMPLE 5

### RUBBER FOAM RECIPE

| | Parts by Weight |
|---|---|
| Natural rubber (or synthetic rubber) latex | 100 (Resin solid: 60%) |
| Sulfur | 1.5 |
| Zinc white | 1.5 |
| Zinc diethyl dithiocarbamate | 2.0 |
| N,N'-di-β-Naphthyl-P-Phenylene-diamine | 0.8 |
| Casein | 0.2 |
| Potassium oleate | 3.0 |
| Sodium silicofluoride | 1.5 |

Natural rubber latex is previously well stirred and subjected to exhausting in order to remove its ammonium component. The ingredients except the latex, the foaming agent and the coagulating agent are thoroughly agitated in a ball mill so as to become a paste of fine particles.

The latex is weighed and placed in a vessel. Next, the paste made in the ball mill is weighed and added, together with the foaming agent, to the latex in the vessel. The materials placed in the vessel are then stirred by means of a high-speed rotating bar so as to produce the foam. The desired foam expansion factor is determined in terms of the foaming height. When the foam reaches the desired height in the vessel, the sodium silicotluoride is supplied into the vessel. The materials in the vessel are again stirred, and immediately fed by half the amount into the mold. Then the fiber layer **12** or **28** is placed in the mold and pressed by hand so that the produced foam enters the clearances defined in the fiber layer. Thereafter, the remaining half of the material mixture is fed into the mold just to overflowing. Then the cover is placed and fastened. After about 5 minutes, the mold is placed in a steam heating pressure can, and the molded foam is subjected to vulcanization for about 30 minutes under the pressure of approximately 3 kilograms per square centimeter. After the vulcanization, the foam is removed from the mold and subjected to rinsing, drying, and so on. The cushioning properties of the product is substantially the same as in the preceding examples. The filling amount, the fiber bulk specific gravity, and other conditions are the same as when polyurethane is used.

## EXAMPLE 6

### VINYL FOAM RECIPE

| | Parts by Weight |
|---|---|
| Polyvinyl chloride paste | 100 (solid) |
| Polyester derivative plasticizer (Paraplex, a trademark of Rohm & Haas Co., U.S.A.) | 100 |
| Dibasic lead phosphite | 5 |
| N,N'-dimethyl-N,N'-dinitroso terephthalamide (Foaming agent) (Nitrosan, a trademark of E.I. du Pont de Nemours and Co., U.S.A.) | 10 |

The above ingredients are fed into an open mold and covered with the fiber layer **12** or **28**, and then heated at about 100° C for 15 minutes to produce the foam. Then the materials are heated for gelation at about 18° C. for about 20 to 30 minutes. The heating is carried out by means of an air-circulated constant-temperature apparatus. The completion of the foaming reaction can be previously ascertained by the color change of the foaming agent. In this case, the color changes from yellowish green to white. The produced vinyl foam has a specific gravity of about 0.12. The bonding agent for

the fiber layer used with the vinyl foam is preferably vinyl acetate emulsion. It is desirable that the vinyl acetate emulsion with the 50 percent solid matter is diluted into an about 10 percent liquor to be sprayed. In other points this example is similar to the foregoing example except that no vulcanization is required.

## EXAMPLE 7

### POLYURETHANE FOAM RECIPE (Ether Type, Prepolymer Method)

(I) Prepolymer Preparation

| | | Parts by Wt. |
|---|---|---|
| (A) | Polyoxypropylene-polyoxyethylene glycol (Propylene oxide-ethylene oxide block copolymer) (Pluronic L61 made by Wyandotte Chemical Corp., U.S.A.) | 66.7 |
| (B) | Polyol polyether (obtained by adding propylene oxide-ethylene oxide block copolymer to ethylenediamine) (Tetronic 701 made by Wyandotte Chemical Corp., U.S.A.) | 33.3 |
| (C) | Tolylene diisocyanate | 33.8 |

The ingredient A and 10.1 parts of the ingredient C are placed in a reactor and stirred while heated at about 120° C. in an inactive gas atmosphere, until the viscosity reaches 5,000 centi-poise (25° C.). Then the material B is added to the stirred materials, and the mixture is agitated at an elevated temperature of about 70° C. until the viscosity becomes 7,500 centi-poise (25° C.). Thereafter the remaining 23.7 parts of the ingredient C is added. The mixture is further stirred for 30 minutes and then rapidly cooled down to 50° C. The viscosity of the resultant prepolymer is 4,500 to 5,500 centi-poise (25° C.), and the free isocyanate content is 8.2 to 8.4 percent.

(II) Foam Formation from Prepolymer

| Ingredients (1) | Parts by Wt. |
|---|---|
| Prepolymer (prepared as described above) | 100 |
| Dimethyl silicon oil | 0.4 |
| Ingredients (2) | |
| N-methyl morpholine | 1.0 |
| Triethylamine | 0.2 |
| Water | 2.3 |

The ingredients 1 and 2 are separately mixed, and both mixtures are combined and rapidly stirred by means of a high-speed agitator and thereafter injected into the mold. The succeeding operation and treatment for producing the desired foam cushion are similar to those described hereinbefore.

It will be understood that modifications and variations may be effected without departing from the scope and spirit of the invention hereinafter claimed.

What I claim is:

1. A cushion having a body comprising a first layer composition formed of a mixture of rigid elastic fibrous materials and an elastomeric foam, said rigid elastic fibers being in intertwisted in a random pattern having a multiplicity of clearances and intersections, said mixture being such that said rigid elastic fibrous materials in part surrounds part of said foam, while part of said foam surrounds part of the fibers, said fibers and foam occupying a defined space in mutually complementary relationship, and a second layer comprising a foam layer formed in integral connection with and extending outside and completely covering the foam part surrounded by said rigid elastic fibrous materials, said second layer only having a plurality of holes extending therethrough and into communication with said first layer.

2. A cushion according to claim 1 wherein said rigid elastic fibrous materials are obtained from such materials as palm and coconut palm.

3. A cushion according to claim 1 wherein said elastomeric foam layer extending outside the foam-filled fiber layer is relatively thick.

4. A cushion according to claim 1 wherein the rigid elastic fibrous materials are coated with a bonding material around each surface of said fibers and at the fiber intersections, and wherein said fibers and said foam in said first layer are combined through the medium of the bonding material.

5. A cushion according to claim 4, wherein the bonding material comprises a foamed material.

6. A cushion as set forth in claim 1, in which said second layer has a greater thickness than said first layer.

7. A cushion as set forth in claim 1, in which said rigid elastic fibrous materials are palm fibers, curled together in an entangled mass within said first layer.

8. A cushion as set forth in claim 1, in which said second layer has a plurality of holes extending therethrough and into communication with said first layer.

9. A cushion as set forth in claim 1, further comprising a bonding agent binding said fibers at said intersections.

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