United States Patent [19]

Smith

[11] **3,900,648**

[45] **Aug. 19, 1975**

[54] **SPACE FILLING MATERIAL AND METHOD**

[76] Inventor: **Imre Jack Smith,** 283 Hillhurst Blvd., Toronto, Ontario, Canada

[22] Filed: **Mar. 18, 1974**

[21] Appl. No.: **452,395**

[52] **U.S. Cl.** ..... **428/71;** 5/337; 5/355; 5/361 B; 260/2.5 AK; 428/74; 428/287; 428/298; 428/315; 428/362; 428/906

[51] **Int. Cl.** **B32b 3/20;** B32b 5/16

[58] **Field of Search** ..... 260/2.5 AK; 161/139, 158, 161/159, 162, 168, 169, 170, 173; 5/337, 355, 361 B

[56] **References Cited**

UNITED STATES PATENTS

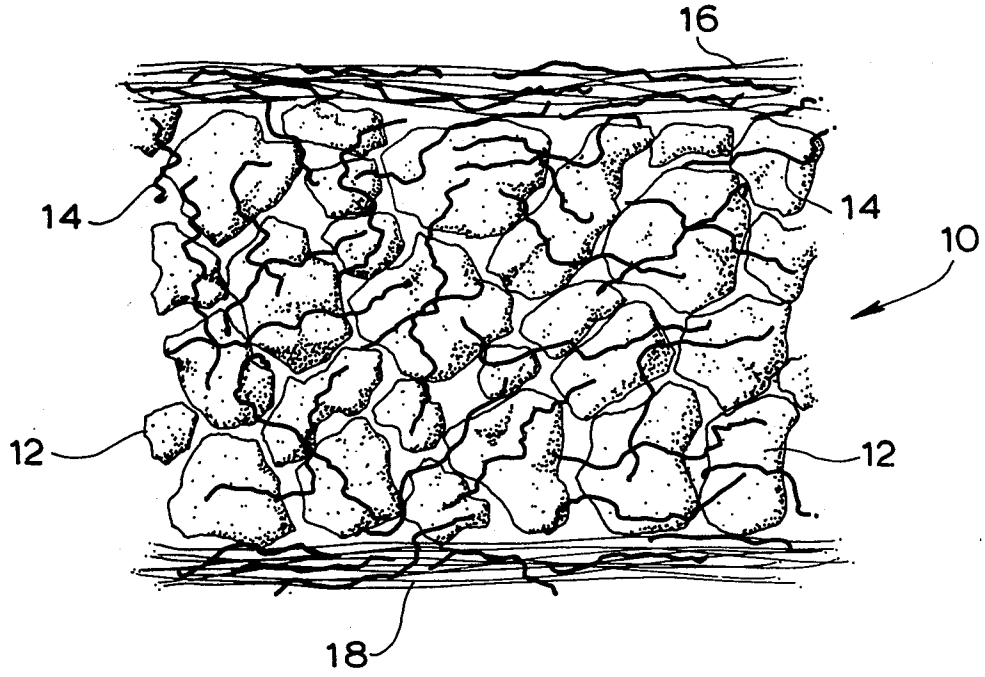
3,114,722	12/1963	Einhorn et al.	260/2.5 AK
3,242,508	3/1966	Smithson	161/160
3,300,421	1/1967	Merriman et al.	260/2.5 AK
3,395,066	7/1968	Tucker	161/166
3,461,026	8/1969	Schick	161/159
3,563,837	2/1971	Smith et al.	161/162

Primary Examiner—William J. Van Balen

[57] **ABSTRACT**

A space filling material which incorporates a mass of synthetic filaments and a quantity of pieces of flexible foam material, preferably synthetic, distributed throughout the mass of filaments and entangled therewith and secured by such entanglement, thereby extending the contained volume of the mass, or conversely expanding the volume contained by a given mass of such synthetic filaments.

13 Claims, 11 Drawing Figures



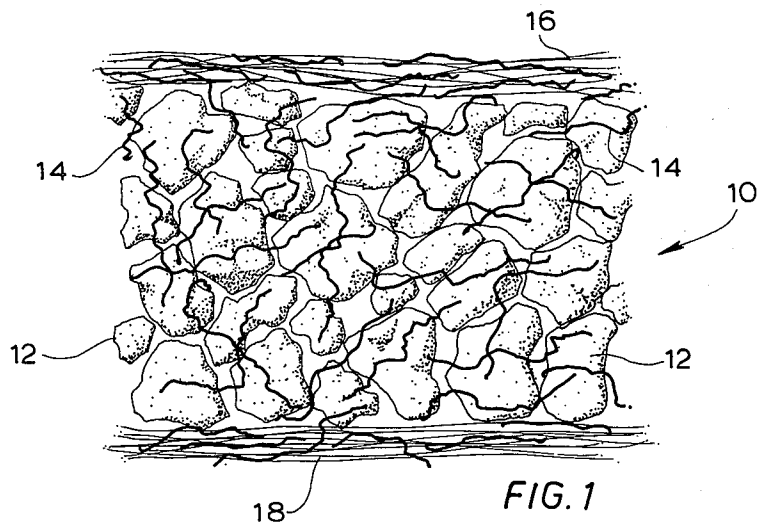


FIG. 1

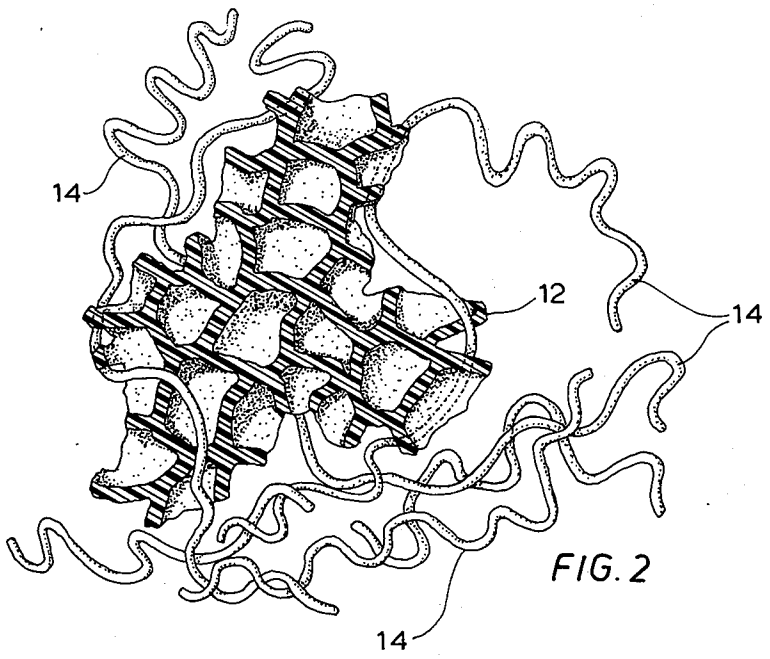


FIG. 2

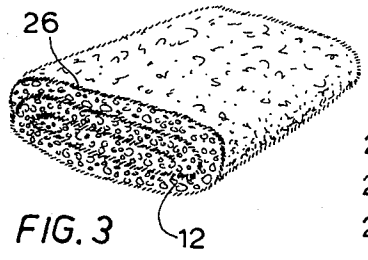


FIG. 3

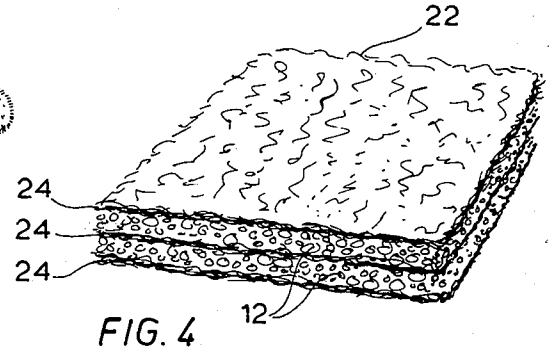


FIG. 4

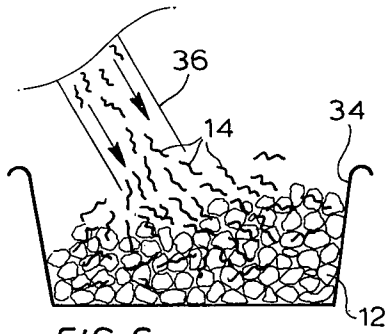


FIG. 6a

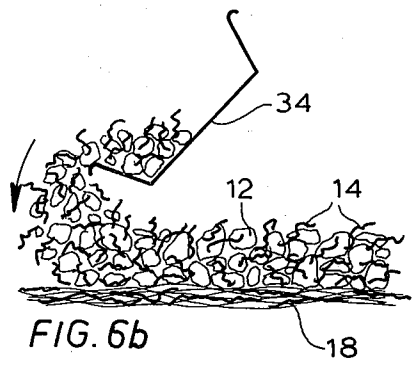


FIG. 6b

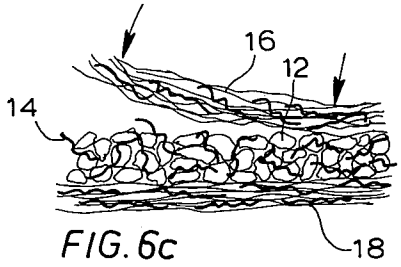


FIG. 6c

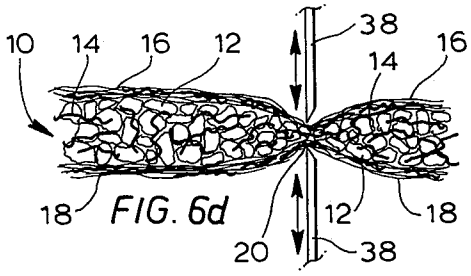


FIG. 6d

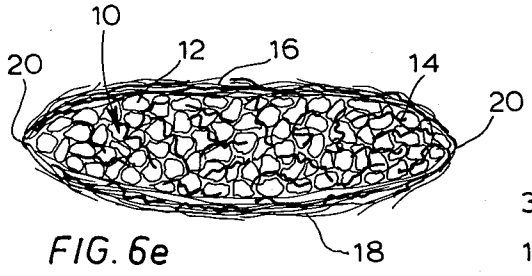


FIG. 6e

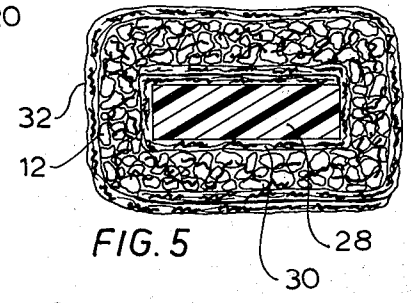


FIG. 5

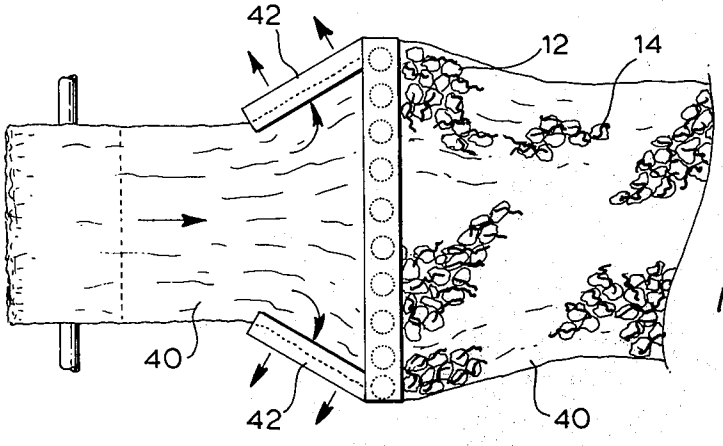


FIG. 7

SPACE FILLING MATERIAL AND METHOD

This invention relates to a space filling material for packing or padding upholstery, or for use as a thermal insulation material, or as a packaging material.

Various properties are required in such a space filling material. Preferably it should be both lightweight, and resilient and flexible, so that it retains its ability to fill a container, such as a cushion, or a piece of padded clothing, and does not become flattened or crushed permanently. It should be soft so as to provide comfort, for example when used in a pillow or in clothing, but it should retain its shape so that the filling does not move to one end or the other. It is also desirable that it should be easily cleaned and that it should not substantially deteriorate with age.

Natural materials such as down, cotton wadding or batting, kapok, horsehair, tow batting and the like have been used in the past for such space filling materials, but are now being replaced by latex and by synthetics. Flexible foam materials such as foam latex and foam polyurethane have many advantages. However they do not have the comfort or luxury of down, when used in upholstery, and are unsuitable for thermal insulation in clothing. They are also relatively expensive since the material required to fill a given volume is relatively great. Synthetic filaments formed into a batting or wadding type of mass have been developed, which are essentially similar to cotton wool, i.e. they simply comprise a mass of unorganized filaments. These batting materials have excellent space filling properties, and also provide great comfort. They are however considerably more expensive than synthetic foams. In addition, while such batting materials give great comfort they do have a slight tendency to become packed down after use.

It is desirable therefore to provide a space filling material which is cheaper than those in general use and which possesses all the advantages mentioned above to a maximum degree.

The general objective of the present invention is to provide such an improved space filling material which incorporates a mass of synthetic filaments and a quantity of pieces of flexible foam material, preferably synthetic, distributed throughout the mass of filaments and entangled therewith and secured by such entanglement, thereby extending the contained volume of the mass, or conversely expanding the volume contained by a given mass of such synthetic filaments.

The synthetic filaments are preferably crimped or curled in manufacture, and are of such fineness that they will readily wrap around and entangle the various pieces of foam. The foam pieces are preferably shredded or broken in a random manner, providing them with ragged edges and corners around which the filaments may become securely entangled.

It is a further objective of the invention to provide a material of the type described which is arranged either in sandwich-type layers, or in roll-form.

It is a related objective of the invention to provide a method of manufacturing such a material, in which the mass of synthetic filaments is stretched when the foam pieces are distributed therein.

The foregoing and other objectives of the invention will become apparent from the following description of a prefered embodiment of the invention which is given

here by way of example only with reference to the following drawings:

FIG. 1 is a perspective of a portion of the material according to the invention;

FIG. 2 is a greatly enlarged sectional illustration showing the manner of entanglement of the foam pieces;

FIG. 3 is a perspective of one useful embodiment showing the employment of the space filling material of the invention;

FIG. 4 is a perspective of another useful embodiment;

FIG. 5 is a sectional illustration of a still further useful embodiment;

FIG. 6 is a schematic illustration showing the method of manufacture of one form of the material, and,

FIG. 7 shows a schematic illustration of a method of manufacture of another form of the material.

Referring to FIGS. 1 and 2 the prefered embodiment of the invention is there illustrated comprising a layer **10** consisting of an intimate combination of synthetic foam plastic chips or chunks **12**, and crimped synthetic filaments **14**, the chips and filaments being intermingled so that the chips are entangled with the filaments and form a homogeneous mass.

Foam chips when bonded together by such mechanical entanglement form a resilient spongy space filling material which does not readily become separated or dispersed. Thus it can be used as a stuffing material for pillows, cushions etc, without the usual disadvantages encountered when using foam chips or chunks on their own. Foam chips when used alone behave like other loose granular material and will move about within a cushion or pillow, and bunch up at one end, leaving the rest of the casing flat.

In order to further improve the feel, and comfort of a pillow or cushion containing the inventive material, the upper and lower surfaces of layer **10** may be enclosed or reinforced by upper and lower webs **16** and **18.** The webs **16** and **18** may be crimped synthetic filaments formed into batting, ie an unorganised unwoven layer of filaments of similar nature to "cotton wool." The webs **16** and **18** may be bonded eg. by a hot knife, adhesive or the like as at seam **20** so as to both enclose the filling material **10** of the invention and to provide a more attractive shape.

The webs **16** and **18** also provide a softer feel to the cushion or pillow and prevent a user from consciously feeling the shape of the foam chips **12.**

The mixture or combination of the synthetic filaments with the foam chunks **12** takes place initially during the manufacturing of the material according to the invention, and the expansion or dispersal of the filaments by the intermingling of the foam chips within the filaments is an important and significant feature of the invention, and leads to the achievement of its significant advantages.

The material according to the invention occupies a greater volume than the sum of the volumes of the foam chips and the filaments when separate from one another and there is a significant improvement in the feel and comfort of the material. When using foam chips alone there is a resilient springy feeling which is unacceptable to many persons who prefer the softer more luxurious feel of down.

This springy feeling is significantly reduced in the material according to the invention. It is believed that

this is due partly to the much greater air spaces between the foam chips, in the inventive material, and partly due to the interweaving or entangling of the chips by the filaments, which tends to spread the weight from one part of the pillow or cushion over a greater area.

The cohesiveness of the material according to the invention results in large measure from the effectiveness of the mechanical entanglement of the foam chunks amongst the mass of filaments, and the property is not possessed by all types of filament material. The selection of the most suitable filament materials for the purpose of the invention must therefore be carried out with various factors in mind.

Thus natural fibre battings such as cotton wool, tow, kapok and the like do not possess this entangling property to any significant degree. Similarly the straight type of synthetic filaments (i.e. uncrimped) do not entangle and grip the foam material to any extent.

Synthetic filaments which are crimped during manufacture possess a much greater inherent degree of entanglement, and, will function adequately for many purposes. Such filaments may in some cases include any type of filament which will crimp satisfactorily during manufacture such as acetates, triacetates, polyamides and polyesters and the like.

However, of the various classes of synthetic filaments that are available, and will crimp satisfactorily, many of them are unsatisfactory for other reasons such as are generally well known in the art. Some will not withstand repeated washing or dry cleaning. Others will not retain their crimp for any length of time. Polyester filaments are found to be the most satisfactory in practice, being possessed of good serviceability, and retaining their crimp more or less permanently.

Preferably such filaments will be as fine as possible. Filaments in the range of about 0.0005 inches thickness have been used with excellent results, but filaments in the range of about 10–15 denier, down to as fine a denier as possible will be useful in various circumstances.

Crimped synthetic filaments are available both in continuous lengths, and also as chopped staple, is about 1 to 2 inches in length. The chopped staple, herein referred to as short filaments, are cheaper, and are easier to handle, and are accordingly preferred for mixture with the foam chips. They are adequate for almost all purpouses of the invention and are readily mixed or combined with the foam chips in various ways. Layers of the material can be built up to several inches in thickness in which the arrangement of the foam chips will remain stable throughout extended periods of use.

The chopped staple, or short filaments, may also be used for the formation of the webs **14** and **16** of batting. Such batting is preferably stabilised by applying a light coating of a suitable bonding agent on each side thereof. Such bonding agents are known in the art and may be a liquid resin spray, a solvent, or an adhesive for example.

Where very heavy duty use is anticipated, or where extra long life is required, the continuous filament material may be used. Such material is obviously cut to about the length of the article to be made, ie a pillow, or a mattress pad. Mixing of the continuous filaments with the foam chips is more difficult. Accordingly such long filaments are arranged in very thin dispersed layers throughout the foam chips. The long filaments are used in the form of an unorganised unwoven batting type material, stretched out relatively thin. The layers of foam chips may typically be about 1 to 2 inches thick.

Such an arrangement is shown in FIG. **4**, showing a mattress pad **22** built up in layers of webs **24** and chips **12**. Another arragement is shown in FIG. **3** in which a continuous web **26** carrying a layer of chips **12** is wound around several times to build up thicker articles such as pillows, cushions and the like, and as a packaging material. The pad form **22** will be useful in upholstering furniture, or providing a mattress pad, or for thermal insulation in clothing, or in buildings, automobiles or the like. In all of these situations the material according to the invention may be handled, cut, stitched, and stuffed or inserted into containers, without losing its qualities as a cohesive mass, and without losing any noticeable percentage of the foam chunks. In addition, in use the foam chunks do not become displaced in the mass, so that for example in a pillow the foam chunks do not collect at one end leaving the other end empty. Even though repeatedly compressed and released, the foam chunks will remain entangled by the filaments, and will remain in the same positional relationship in the overall mass without any tendency to separate.

In fact, in practice the more the material is compressed and released, the greater will be the degree of entanglement of each of the pieces of foam within the filaments, and the filaments will become more and more dispersed from one another and the filament material and foam chips will be expanded in this way.

For certain types of padding or packing, where very heavy duty wear is anticipated, it may be considered of utility to still further bond the mass of filaments and foam together by applying a light coating of some form of adhesive or bonding agent such as a solvent. Such a coating may be applied only to the exterior of the mass in the form of a fine spray or mist, and may help to retain the mass in its original shape, or may make it easier to handle. However, for the great majority of types of use for which the invention finds its greatest utility no such additional bonding or spraying is required.

The invention therefore envisages the use of any such mass of foam chips and filament material that provides an effective mechanical entanglement of the foam chunks, to a degree sufficient for the particular purpose. The degree of mechanical entanglement of any particular material can readily be determined in practice, and will be readily apparent to those skilled in the art.

Individual filaments of this type have very little resistance to breakage, but when formed into an unorganized cohesive mass of filaments, they possess great strength and have excellent durability for the purposes described.

The foam material may again be of various types, having the necessary capability of forming a good mechanical entanglement with the filaments. The foam material will be generally a fine celled cellular material, with the material forming the cell walls in the foam being relatively thin and forming sharp edges where the cells are broken away. In this way, the tendency for the filaments to wrap around and entangle the foam chunks is greatly enhanced. Preferably the chunks will have average maximum dimensions ranging from about 0.2 inches to about 1 inch and may be of any random shape. Preferably, they are formed in any coarse form

of shredding or tearing operation and are formed with ragged edges. Foam chunks which have been carefully or precisely cut into cuboid or any other geometrical shape will not usually provide an adequate degree of entanglement for the purposes of the invention.

Flexible latex foam has been used with some success, when broken up into random chunks, and may be suitable for certain purposes but is generally too expensive, and does not form a fully effective mechanical entanglement.

Better results are obtained with flexible polyurethane foam chips or chunks and such foam exhibits a much higher degree of mechanical entanglement with the filaments.

In all cases however the object of the invention is to as it were dilute, or extend the volume of the filament mass and foam chips to the greatest extent possible by incorporating a substantial amount of the foam chips in the filaments. In this way, the greatest economy is achieved, while at the same time the luxury and softness of the feeling of down or synthetic filament batting is retained, and the slightly greater resilience of the foam material provides a slightly greater degree of recovery or retention of the shape of the article than is the case with plain filament batting material, or down.

It will be appreciated that since the filament batting material may cost anywhere between ten and twenty times the cost of the chips or pieces of foam, that very considerable economies can be achieved without losing the desirable qualities of the filament batting.

The invention may be further understood with reference to the following, non-limiting specific examples.

EXAMPLE 1

One pound of crimped long filament polyamide batting material was stretched out on a table by hand, and approximately three pounds of foam latex chips were spread on the surface of the material and smoothed out by hand. The material was then rolled up and inserted into a cushion cover. The resulting cushion exhibited considerable resilience, and repeated compression and extension of the cushion failed to produce any substantial displacement of the foam pieces within the filament mass. The cushion retained its shape and appearance.

EXAMPLE 2

Example 1 was repeated, and the rolled mass of material was then sprayed with a fine mist of liquid resin which was then left to set. The exterior of the mass was found to be stiffer than the interior, and the mass was then inserted into a cushion cover much more readily, and could be handled and stored without any tendency to disintegrate or entangle with other similar material.

EXAMPLE 3

Between 3 and 4 ounces of fine gauge crimped long filament polyester material (brand-name fortrel-7, a trade-mark) was spread out on a table by hand and was stretched. Between one and one and half pounds of chips of flexible foam urethane material were then spread on the extended mass of filament batting. The filament batting was then released. It was noted that it sprang back only partially into its original size, and did not fully contract down to the size and shape of the original mass. It was then rolled up and inserted into a pillow case. The resulting pillow provided a soft luxurious support, and readily recovered its original shape when released.

EXAMPLE 4

Example 3 was repeated, with the exception that the filament material was reduced to approximately 1 to 2 ounces, and approximately 1 to 2 ounces of short-length crimped polyester filaments were mixed with the foam chips. The mixture of chips and short length fibres was spread evenly on the long filament batting while the same was held stretched out thinly on the table. The batting was then released, and was rolled up and again inserted into a pillow casing. The resulting pillow had a somewhat firmer feel than the pillow of Example 3.

EXAMPLE 5

Approximately 2 ounces of crimped long filament polyester batting material was spread on a table and streched out by hand. Approximately one pound of foam urethane chips were spread on the batting material by hand. The batting was then released, and it was noted that it exhibited little or no contraction from its stretched condition.

A further 2 ounce portion of batting was then stretched over the foam chips, and lowered into contact therewith.

A further 1 pound quantity of foam chips was then sprinkled on the second layer of batting. The second layer of batting was then released.

A third 2 ounce portion of batting was then stretched above the second layer of foam chips and lowered into contact therewith and released.

The resulting sandwich-like material was then tested as a pad for upholstering a mattress and was found to provide a comfortable reclining surface. While being so applied it was found that the mass of material exhibited great cohesion and retained substantially all of the foam chips without losing any substantial quantity during manual working.

EXAMPLE 6

An economical pillow stuffing was prepared by mixing about one and a quarter pounds of polyurethane foam chips with about 2 ounces of short filament crimped polyester. The material was then stuffed into a pillow casing. It was found to provide a firm support but without excessive resilience. However some feeling of the shape of the foam chips could be detected.

EXAMPLE 7

The material of example 6 was arranged in a homogeneous layer between two layers of short filament polyester batting. The sandwich was then inserted into a pillow case. A somewhat softer feeling resulted, and the shape of the foam chips could not be detected.

EXAMPLE 8

Example 7 was repeated on a larger scale and rectangles of the sandwich were cut out with a hot knife. This bonded the edges of the upper and lower batting layers and formed a more attractive shape.

EXAMPLE 9

Quantities of polyurethane foam chips were tested for entanglement by mixing with cotton wool, glass fibre batting, tow, kapok and even steel wool and also

with uncrimped synthetic filaments. However, no significant degree of entanglement of the foam chips was achieved and the tests were deemed failures.

It will of course be appreciated that the invention may be applied as the sole form of padding or packing material. It may also applied as an outer softer cover to an inner more resilient padded article. For example, as shown in FIG. 5, a cushion or other similar article may be provided having a core **28** of solid flexible foam material such a flexible foam latex or flexible foam polyurethane in the form of a block cut to a predetermined shape and size. A thin layer of long fibre polyester batting material **30** is then wound around the exterior of the foam block.

Chips of polyurethane foam **12** are then applied to the exterior of the batting layer **30.** A further outer layer of long fibre batting **32** is then wound around the foam chips.

The final article may then be covered with any suitable cushion covering or other upholstery covering material depending upon the use. The inner solid foam core will provide great springiness and resilience, and the outer covering of space filling material according to the invention will provide a softer more luxurious surface feeling.

The material according to the invention may be manufactured in at least two different processes.

PROCESS 1

Chips **12** of polyurethane foam are placed in a suitable container **34** (FIG. 6*a*). A large diameter air hose **36** is then used to blow short fibre polyester filaments **14** into the chips **12.** The air stream causes intimate mingling of the chips and short filaments and entanglement takes place simultaneously.

This material then may be used as is. Altenatively it may then be placed on a layer of short fibre stabilised polyester batting **18** and a further layer of batting **16** is placed on top (see FIGS. 6*a* to *e*). Article-sized rectangles or shapes are then cut out by hot knives **38** which effectively seals the edges of the batting layers together.

PROCESS 2

A continuous web **40** of long fibre crimped polyester batting is fed along a table (see FIG. 7). The web **40** is stretched sideways ie. transversly to its direction of travel by guides **42.** It may also be stretched lengthwise.

Chips of foam polyurethane are then spread over the web **40,** while stretched.

These chips may be either loose, in which case the layer will be thinner, or may be combined with short fibre polyester as described in Process 1, in which case the layer may be thicker.

The web **40** is then released and filaments therefrom will immediately entangle the foam chips.

The web **40** and chips can then be either be rolled up, as in FIG. **3,** or a further web or webs (not shown) can be stretched and spread into overlying engagement and successive sandwich-like layers built up in this way.

In either Process 1 or Process 2 the end result will produce foam chips and filaments intermingled and entangled with one another therefore producing the inventive material either with short fibre, or long fibre filaments, or with a combination of short and long fibre filaments, and either on their own, or in a thick sandwich layer or in successive thinner sandwich layers, or in roll form.

EXAMPLE 10

A mattress was prepared by arranging the space filling material of Example 6, foam chips and short fibre crimped polyester, on a sheet of latex foam material. A further sheet of latex foam was then placed on the space filling material. The space filling material was about four inches, and the latex sheets were about one half inch each in thickness.

The latex sheets were then glued together at their edges.

The mattress was firm and comfortable without being excessively springy.

Experiments were made to determine the proportions of fibres to foam chips in the material of Example 6. It was found that if much less than one ounce of short fibres were used in one pound of foam the bonding was weakened and the material became too springy. If much more than three ounces of fibres were used no increase in bonding, or firmness was achieved.

Optimum results were obtained with between one and two ounces of fibres per pound.

The foregoing description of a preferred embodiment of the invention is given by way of example only. The invention is not to be taken as limited to any of the specific features or examples but comprehends all such variations as come within the scope of the appended claims.

What is claimed is:

1. A light-weight, space filling material for use as upholstery padding, packing material, thermal insulation, cushion filling, and the like and comprising:

a mass of non-woven crimped synthetic filaments, and,

random shaped cellular foam particles interspersed in said mass and engaged by and entangled in said filaments.

2. A light-weight, space filling material as claimed in claim **1,** wherein said filaments comprise short cut staple filaments.

3. A light-weight, space filling material as claimed in claim **2** wherein said filaments are formed of polyester material.

4. A light-weight, space filling material as claimed in claim **1** wherein said foam particles are flexible and resilient.

5. A light-weight, space filling material as claimed in claim **4** wherein said foam particles are polyurethane foam.

6. A light-weight, space filling material as claimed in claim **1** wherein said filaments are long fibre polyester filaments arranged in at least one layer, and wherein said foam particles are entangled with filaments extending from at least one side thereof.

7. A light-weight, space filling material as claimed in claim **6** including successive layers of said long fibre filaments.

8. A light-weight, space filling material as claimed in claim **6** wherein said layer is arranged with foam particles on one side thereof and is rolled up upon itself.

9. A light-weight, space filling material as claimed in claim **1,** wherein said material is arranged between upper and lower layers of crimped synthetic filament batting material.

10. A light-weight, space filling material as claimed in claim 9 wherein said filaments are short fibre staple crimped polyester, stabilised by a suitable bonding agent.

11. A light-weight, space filling material as claimed in claim 10 wherein said upper and lower batting layers are seamed together at their edges enclosing said space filling material therein.

12. A light-weight, space filling materias as claimed in claim 1 wherein said mass of filaments comprises between 5% and 20% by weight of said material, and wherein said foam particles comprise between 95% and 80% by weight of said material.

13. A light-weight, space filling material as claimed in claim 1 wherein said foam particles comprise random shaped chunks of foam having a maximum dimension of between about 0.2 inch and 1 inch.

* * * * *