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INSULATION, FILLING, AND PACKING

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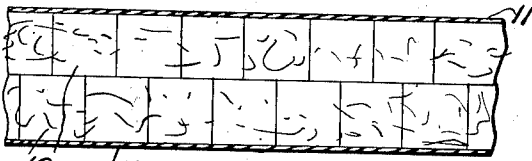


Fig. 1

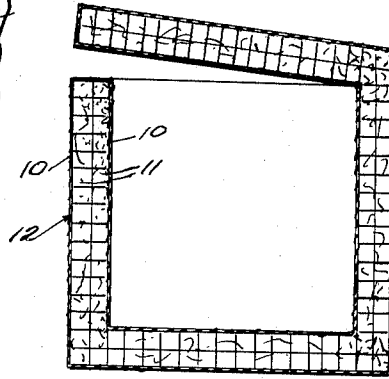


Fig. 2

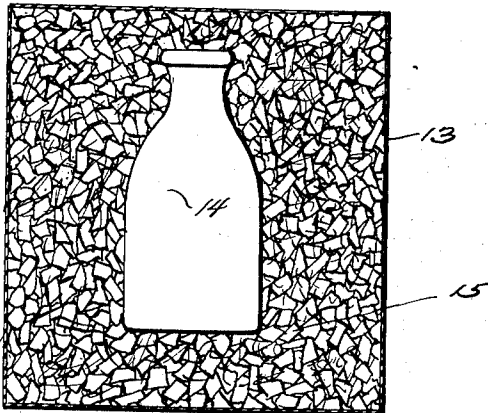


Fig. 3

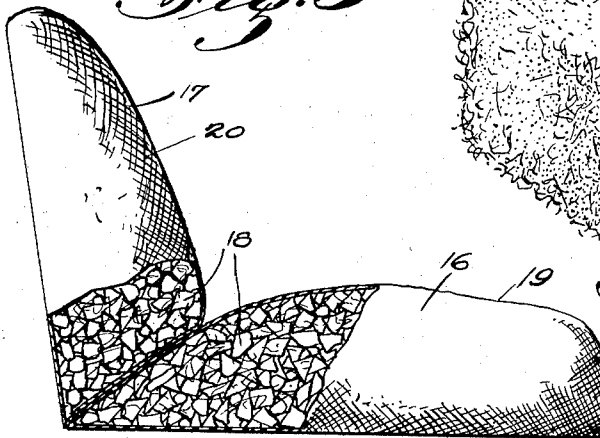


Fig. 4

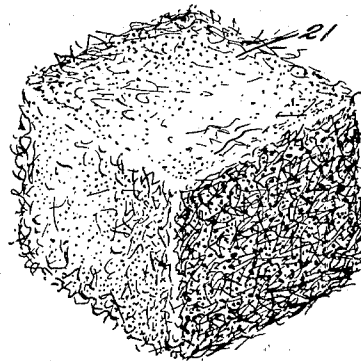


Fig. 5

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INSULATION, FILLING, AND PACKING

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4 Claims. (Cl. 154-44)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein, if patented, may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to an improved resilient insulating and filling material. More particularly, the invention concerns the utilizing of synthetic and prefabricated elastic and non-elastic fibers of resilient character formed into resilient prefabricated bodies and the bodies collected en masse to serve as packing, filling and prefabricated insulating materials.

Heretofore, the filling materials for bedding, mattresses, cushions, furniture, insulation packings and the like, have been in the nature of feathers, hair, cotton batting, wool or the like, and materials of this nature. In addition, there has been developed a spongy rubber material which, although subject to rot and other faults, is suitable for use as a filling agent, but, due to the cost of raw rubber, it becomes expensive and is oftentimes not available. Further, with the use of the above and other materials certain requirements in the nature of softness, durability and fluffability cannot be obtained and maintained to provide the best practical results required in actual usage. Further, there has been attempted the use of straight fibrous material in the nature of glasswool batting and the like for the purpose of stuffing or packing in bedding or furniture. In actual practice, it has been found that such fibers are too stiff and also unsatisfactory from many standpoints, including silvering, and a gradual working out of the fibers through its covering. Altogether, there is need for a relatively self-positioning or fixed, soft, flexible packing material, economical and practical to produce and insert within or between conventional covering material. Another material need is for a filling and insulating material which will withstand long wear and hard usage and at the same time be capable of reasonable conventional laundering without deterioration.

It is well known that in the use of the above type of materials certain unsatisfactory results occur when numerous of the items are subjected to laundering, hard and repeated usage, storage and exposure to the elements.

Consequently, it is an object of the invention to provide an improved prefabricated insulating and filling material capable of being used as packing for mattresses, furniture, and for insulating purposes generally.

Another object is to provide an improved resilient filling and insulating material in regular and irregular shaped bodies formed of synthetic

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fibers bonded together by an adhesive and capable of use as stuffing and packing.

A further object of this invention is to provide an insulation material formed of synthetic and prefabricated fibers having an elastic modulus on the order of 1×10^{12} dynes per cm.² or higher bonded together and prefabricated into predetermined subdivided regular and irregular shapes collected en masse to provide lightweight packing.

Other objects, advantages and adaptations will become apparent when considered in connection with the following disclosures and accompanying drawings wherein:

Fig. 1 is a partial cross-sectional side view of an insulating sheeting;

Fig. 2, a cross-sectional side view of a container utilizing the sheeting of the character shown in Fig. 1;

Fig. 3, a cross-sectional view of a container illustrative of loose packing;

Fig. 4, a seat illustrated in elevation partly broken away; and

Fig. 5, an enlarged perspective view of a prefabricated insulation and packing briquette.

I have discovered that when a plurality of synthetic or prefabricated fibers having an elastic modulus of substantially 1×10^{12} dynes per cm.² or higher are adhesively secured together in a network-like structure and cut into varying shapes or sizes, generally not exceeding substantially 6" in any direction, the subdivided bodies will provide, when packed en masse, a filling or stuffing of improved packing and insulating values.

More specifically, synthetic fibers in the nature of threads formed from siliceous and resinous material, of the character indicated herein, are gathered or packed in the form of matting or batting. The fibers of this batting may, for example, be impregnated preferably with a water-proof binder as a conventional self-vulcanizing rubber adhesive in an amount substantially between 10% and 35% binder to fiber by weight. After the binder is set by conventional means, the impregnated fibrous mat is cut into strips of suitable and desired width and the strips subsequently divided by cutting into portions forming squares, rectangles, triangles, cubes, cones, spheres, or other desired shapes. These prefabricated bodies are three-dimensional open network structures formed of fibers 21 bonded together in the manner described and cut to a desired shape, for example, as herein disclosed or as illustrated by Fig. 5.

With the adhesive binder substantially uni-

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formly dispensed throughout the fibrous material, in an amount which causes adherence of the fibers without destroying their elasticity, the mass can be cut into bodies of the character indicated. These bodies are cut to the size and shape desired, which preferably, when used in furniture, mattresses, containers, and structural insulation or the like, will not exceed a dimension in any one direction which prevents free flowing movement in packing or as related to usage.

As shown in Fig. 1, two rows of rectangular briquettes 10 of a size on the order of $\frac{1}{2}$ inch x $\frac{1}{2}$ inch x $\frac{1}{2}$ inch, cut from the material above described, are cemented between the paper sheets 11 to form structural insulation. The briquettes are surface-coated in any suitable manner with, for example, a casein glue adhesive, and placed or uniformly distributed over one surface of each of the sheets 11. Thereafter, the coated sheets are joined by moistening or application of a new coating of adhesive to the exposed surface of the briquettes which are then joined and set-up by drying to form the composite sheeting. Thereafter, the sheeting can be used as such or formed into insulation bags or containers 12. In a somewhat similar arrangement or construction the sheets 11 may be replaced by spaced sheeted forms and the briquettes 10 poured or aligned between the sheets to produce prefabricated insulation structure. Obviously, the briquettes either in loose or prefabricated structures, may be utilized for household and wall insulation, seat pads and the like, or as insulation on refrigerator, steam pipes or utensils, and the like.

As illustrated in Figure 3, a container 13 is provided for holding, for example, a bottle 14 or other material, and about the bottle 14 is a packing 15 of three-dimensional prefabricated resilient fibrous structures of the character as described herein and illustrated in Figure 5. This packing has, for example, been used to keep bottled material ice cold for a period of at least 16 hours in a room where the temperature exceeded 90° F. In this experiment, the bottled goods were contained in a loose fitting paper bag with glasswool briquettes gently packed between the bag walls and bottle.

As shown in Fig. 4, a seat 16 and back rest 17 made in conventional manner are provided with packings 18 beneath their external coverings 19 and 20, respectively. When utilized as loose packing in furniture or other instances, a plurality of the bodies are packed within the conventional covering until it is filled to the extent desired. Thereafter, the covering may be closed and the block-like resilient bodies remain substantially evenly distributed without need for the usual stitching or tufting. Likewise, mattresses may be filled or packed with the resilient bodies, as when packed en masse, the resilient bodies will retain their separate entity and shape without becoming lumpy, felted, attenuated or disintegrated under normal conditions of usage. Further, the materials will withstand body perspiration, climatic conditions and conventional laundering without disruption, although, for obvious reasons, solvents and temperatures detrimental to the fibers and binder are to be avoided.

Prefabricated glass fiber structures of the character herein described and illustrated in my co-pending application, Serial No. 53,947 for Bedding Filler and Insulation, filed October 11, 1948, may be formed by impregnating a fibrous glass

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wool batting with a conventionally applied and solidified urea-formaldehyde resin on the order of from 10% to 30% binder to fiber by weight, or slightly more or less binder, according to the characteristics desired or required in the ultimate use of the fabricated body forms. More specifically, a fibrous batting impregnated with substantially 20% resin binder in the nature of a conventional urea-formaldehyde adhesive, set up by conventional drying and cut up into briquettes or other shapes, have a loss in filling power of not more than approximately 17% under compact pressure of .0005 pound per square inch, and with a 35% bond the loss is further reduced with a gain in stiffness.

The loss in filling power of a prefabricated fibrous body bonded with approximately 10% resin binder is on the order of 55% under the same conditions illustrated above. Accordingly, the relative flexibility of prefabricated fibrous bodies may be evaluated on a comparative basis relative to bonding in utilizing them as packing and/or insulation. Further, in some instances of use where features of resiliency, bonding, harshness, etc., may be sacrificed, impregnation and/or bonding of the fibers can be diminished or increased to any extent so long as the fibrous bodies can be formed as separate entities. Preferably, however, the resiliency or elastic modulus of the fibers is retained by keeping the impregnation and/or bonding within the limits of substantially 10% to 35%. The insulating value of the briquettes and/or other prefabricated forms is increased by retention of air pockets or air spacings within the network.

In some instances, when slivering of the glass fiber would be detrimental to its use, a thin layer in the nature of latex or a synthetic elastomer in the nature of a butadiene product or the like, is coated over the fibers. This coating can be made integral with the impregnation and bonding or before or after the fibers are bonded. When the coating is applied concurrently with the bonding of the fibers, it may serve as the bonding medium, or if applied to the fibers before they are secured together as a network may serve as the bonding medium by application of heat and/or solvent to the batting as required to energize the coating to self-adherence.

Other fibrous material of the nature as indicated may be of the character formed by conventional commercial processes, which provide fibers having an elastic modulus on the order of 1×10^{12} dynes per cm^2 or higher. These materials when formed into threads are bonded by impregnation or self-bonding in a manner as herein indicated and cut to the configurations desired for use as filling and insulating materials. The bonding agent may be used in proportions which render the prefabricated bodies resilient to the degree necessary for the particular benefits desired. Accordingly, the bonding agent for furniture stuffing is preferably within the approximate proportions of from 10% to 35% for retention of softness and resiliency. For application wherein the prefabricated bodies are to be used as packing and the like, the degree of saturation may be more or less than the above values, with the purpose in some measure of retaining a network without destroying the flexibility and resiliency of the fibers.

The rubber bonding agent or adhesive is of conventional commercial character containing a self-vulcanizing agent and deterioration pre-

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venting or retarding agents. Such rubber adhesives are commercially available and may include, for example, in minor conventional amounts a deterioration preventative as aromatic methylenethio esters and terpenethiols, or many other anti-oxidants commercially available. Adhesives and bonding agents of a waterproof character in the nature of synthetic rubbers and resins, bitumens, and the like, or admixtures of the same used in the proportions indicated will likewise secure the fibers and retain them in the body shapes desired.

Additional bonding agents in the nature of phenol (e. g. phenolformaldehyde thermosetting resin), silicon, melamine, urea, acrylic, vinyl, polyvinyl, and other type resins of the condensation or polymerization type, e. g. vinyl-polymerization type, glues, silicates, rubbery elastomers, and others of similar character, may be utilized for securing and/or coating the fibers in the manner as above illustrated. Otherwise in some instances, the fibers may be self-bonded by application of heat.

I have thus disclosed insulating and packing materials having relatively highly resilient bulk volume which are of light weight and possess a high efficiency in insulation value, and dielectric strength. It will be understood that the details set forth in the foregoing description of certain illustrative embodiments of my invention need not be strictly followed, but that various modifications and changes, which will readily occur to those skilled in the art, fall within the scope of my invention which I define by the appended claims.

I claim:

1. A heat insulating structure comprising a covering and a filling of freely flowing insulating material contained therein, said material comprising a plurality of individual shape-sustainingly bonded 3-dimensional elastic glass fiber bodies, each of said bodies having a length of from about $\frac{1}{2}$ inch to about 6 inches in any direction and being uniformly impregnated with from about 10% to about 35% by weight of resin binder, said bodies being packed in said covering in irregular arrangement.

2. A heat insulating structure comprising a

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covering and a filling of freely flowing insulating material contained therein, said material comprising a plurality of individual shape-sustainingly bonded 3-dimensional elastic glass fiber bodies, each of said bodies having a length of from about $\frac{1}{2}$ inch to about 6 inches in any direction and being uniformly impregnated with about 20% by weight of resin binder, said bodies being packed in said covering in irregular arrangement.

3. A soft flexible cushioning structure comprising a flexible covering and a filling of freely flowing insulating material contained therein, said material comprising a plurality of individual shape-sustainingly bonded 3-dimensional elastic glass fiber bodies, each of said bodies having a length of from about $\frac{1}{2}$ inch to about 6 inches in any direction and being uniformly impregnated with from about 10% to about 35% by weight of resin binder, said bodies being packed in said covering in irregular arrangement.

4. A soft flexible cushioning structure comprising a flexible covering and a filling of freely flowing insulating material contained therein, said material comprising a plurality of individual shape-sustainingly bonded 3-dimensional elastic glass fiber bodies, each of said bodies having a length of from about $\frac{1}{2}$ inch to about 6 inches in any direction and being uniformly impregnated with about 20% by weight of resin binder, said bodies being packed in said covering in irregular arrangement.

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