Aug. 7, 1945. W. GARNER 2,381,214

THERMAL INSULATION MATERIAL MADE FROM FIBROUS SUBSTANCES

Filed Sept. 18, 1943

Fig. 1.

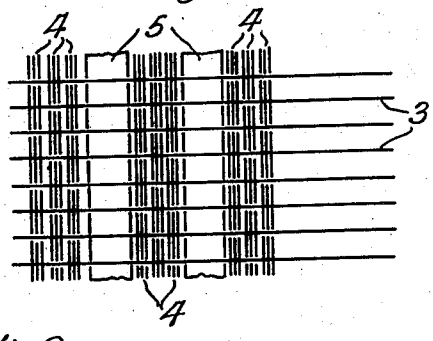


Fig. 2.

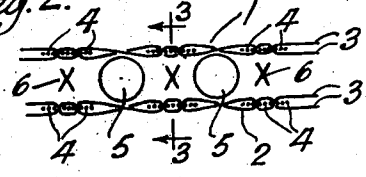
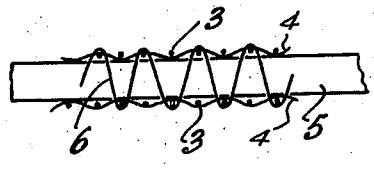


Fig. 3.



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THERMAL INSULATION MATERIAL MADE FROM FIBROUS SUBSTANCES

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3 Claims. (Cl. 139—410)

This invention relates to improvements in thermal insulation materials (against heat or cold) made from fibrous substances and useful in a wide variety of applications, for instance in the construction of clothing, sleeping bags, and coverings or linings in or in connection with the construction of buildings, transport vehicles and other structures.

The expression "fibrous substances" includes any mineral, vegetable, protein, cellulosic or synthetic material, or mixtures of the same, in the form of filaments or fibres, especially fibres of an average diameter less than 500 microns and preferably less than 100 microns. Examples of such fibres are wool, cotton, mohair, kapok, glass fibre, asbestos, and rayon, and preferably those fibres which are inherently springy and resilient such as wool.

The primary object of the invention is to convert fibrous substances into textile fabrications which contain in their interior a layer of fairly still air, which can be readily manufactured by a weaving operation, which are relatively strong in withstanding manipulation and use, and which have very good thermal insulation properties.

Broadly stated, the basic feature of the thermal insulation material according to the invention is that it comprises, as component elements, two textile fabrics spaced apart, preferably by at least one-sixteenth of an inch and not more than three inches, and connected by textile elements which are woven in the two fabrics. Such a fabrication may be produced, for example, in one operation on a loom capable of weaving a "warp pile" fabric (to the uncut stage), such as a "double plush" loom, which weaves for subsequent separation by cutting in the manufacture of plush, two distinct textile fabrics, preferably light in weight, tied together or connected by the "pile." Other looms which enable the connecting elements to be inserted in the form of weft may also be employed.

In this way a layer of fairly still air is contained in the interior of the fabrication, and it is considered that this layer of still air is the true insulator.

In one form of the invention the textile elements which connect the two textile fabrics are preferably composed of fibres which when in an unsized condition, are very loosely packed or lightly twisted together with the result that when the two outer fabrics become closer together, e. g. by collapse from the loom state, by pressure or consequent upon a finishing process such as scouring, the interior becomes largely filled with a comparatively loosely packed mass of fibres, which entrap a layer of still air in a manner which hinders the setting up of convection currents.

Accordingly there may be used connecting yarns which are twisted only to the extent usual for "singles" yarns or even to the minimum extent which will allow them to be processed. Also, the textile elements or yarns may have been subjected to the process known as "astrachan curling" and/or may be composed of fibres which are naturally or have been artifically crimped and/or which belong to the class of fibres having a small diameter. The connecting elements themselves may however be of large diameter or "counts."

In another form of the invention the textile elements or yarns employed as connectors may be comparatively rigid in character, or closely packed, or both, with the result that the fabrication is resistant to compression, thus ensuring a content of fairly still air even when compressed. Thus relatively thick fibres such as horsehair, or relatively rigid fibres such as mohair, may be used.

Instead of using fibres which inherently possess the desired degree of resilient flexibility, there may be employed other fibres which have been treated, e. g. by impregnation with synthetic resin, so as to impart or augment such property. The connecting elements may in this case be tightly twisted and may be employed twofold or manifold. In this form the outer fabrics may be tightly woven so as to contain between them a layer of fairly still air.

In a preferred development of the invention, the fabrication includes between the two spaced apart textile fabrics a packing of fibrous material in addition to the connecting elements and which in contrast to these is not woven into either of the textile fabrics. Such fibrous material may be incorporated in the form of loosely twisted or even untwisted rovings or slivers more or less filling the interior of the finished fabrication with a comparatively loosely packed mass of fibres. Such packing may be incorporated during the weaving of the fabrication or it may be inserted afterwards in the woven fabrication by pulling, into its interior, singles yarn, rovings or slivers, or any combination thereof, substantially parallel to the selvedge or the weft of the cloth so that they lie between rows of connecting yarn which are suitably spaced. The connecting yarn may accordingly be sparsely dis-

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tributed or reduced, as to number and/or thickness, to the minimum required to tie the two outer cloths together with reasonable strength according to its intended application. Thus, for example, the connecting elements may be single pile yarns, or small groups of pile yarns, say two or three in each group, with gaps of say one quarter of an inch or even one inch or more, so that there is formed a number of channels filled or to be filled with the singles yarn, rovings, slivers or other forms of loose fibrous mass.

The packing or the connecting elements may be composite yarns consisting of the fibrous substance twisted with or wrapped around or within another yarn or filament subsequently to be removed. For example, a yarn of wool may be wrapped in a spiral around a filament of rayon, composed of calcium alginate so that when the cloth is scoured, e. g. in soap and sodium carbonate solution, the alginate will dissolve and the released spiral of wool yarn will expand; or the rayon may be wrapped around an untwisted sliver or roving to hold the fibres together during weaving, the rayon being subsequently removed.

Any or all of the yarns, rovings, or slivers, may of course be sized in order to assist manipulation, and they may after weaving be de-sized and/or scoured with the effect of causing them to become more bulky.

The outer cloths may be fabricated or treated in various ways in order to enhance the properties of the fabrication with regard to its thermal insulation or to the nature of its employment, or merely for decorative purposes. For example, one or both cloths may be sprayed or coated with metal, rubber or other substance, or be woven with a float of rayon or other material which is especially useful for the inside of garments. Also two or more layers of the fabrication may be stuck or sewn or otherwise fastened or held together, or a layer may be stuck or sewn to another textile fabric, to form a composite unit.

It is to be understood that fabrications according to this invention possess sound insulation properties as well as thermal insulation properties. Accordingly the term "thermal insulation material" used in the appended claims is to be understood as comprising sound insulation material.

An example of the invention is shown in the accompanying diagrammatic drawing, in which—

Figure 1 is a flat section of the fabrication;

Figure 2 is a cross section; and

Figure 3 is a section on the line 3—3 of Figure 2.

In the drawing 1 and 2 are two woven fabrics with weft 3 and warp 4. Slivers 5 are floating between the two fabrics. They are kept in position and the fabrics are held together by connecting elements constituted by the binding ends 6 weaving in and between the fabrics.

What I claim is:

1. A fibrous structure comprising textile fabrics into which are woven textile elements which connect the fabrics together and a packing of fibrous material between the said fabrics, the said textile elements being in rows, the said packing being in lengths lying respectively between the rows, and each of said textile fabrics having a weft in a direction transverse to the rows and a warp substantially only between the packing lengths.

2. The fibrous structure as claimed in claim 1 in which the packing of fibrous material is in the form of slivers.

3. Thermal insulation comprising a plurality of fabrications held together, each fabrication being a fibrous structure comprising textile fabrics into which are woven textile elements which connect the fabrics together and a packing of fibrous material between the said fabrics, the said textile elements being in rows, the said packing being in lengths lying respectively between the rows, and each of said textile fabrics having a weft in a direction transverse to the rows and a warp substantially only between the packing lengths.

WALTER GARNER.