

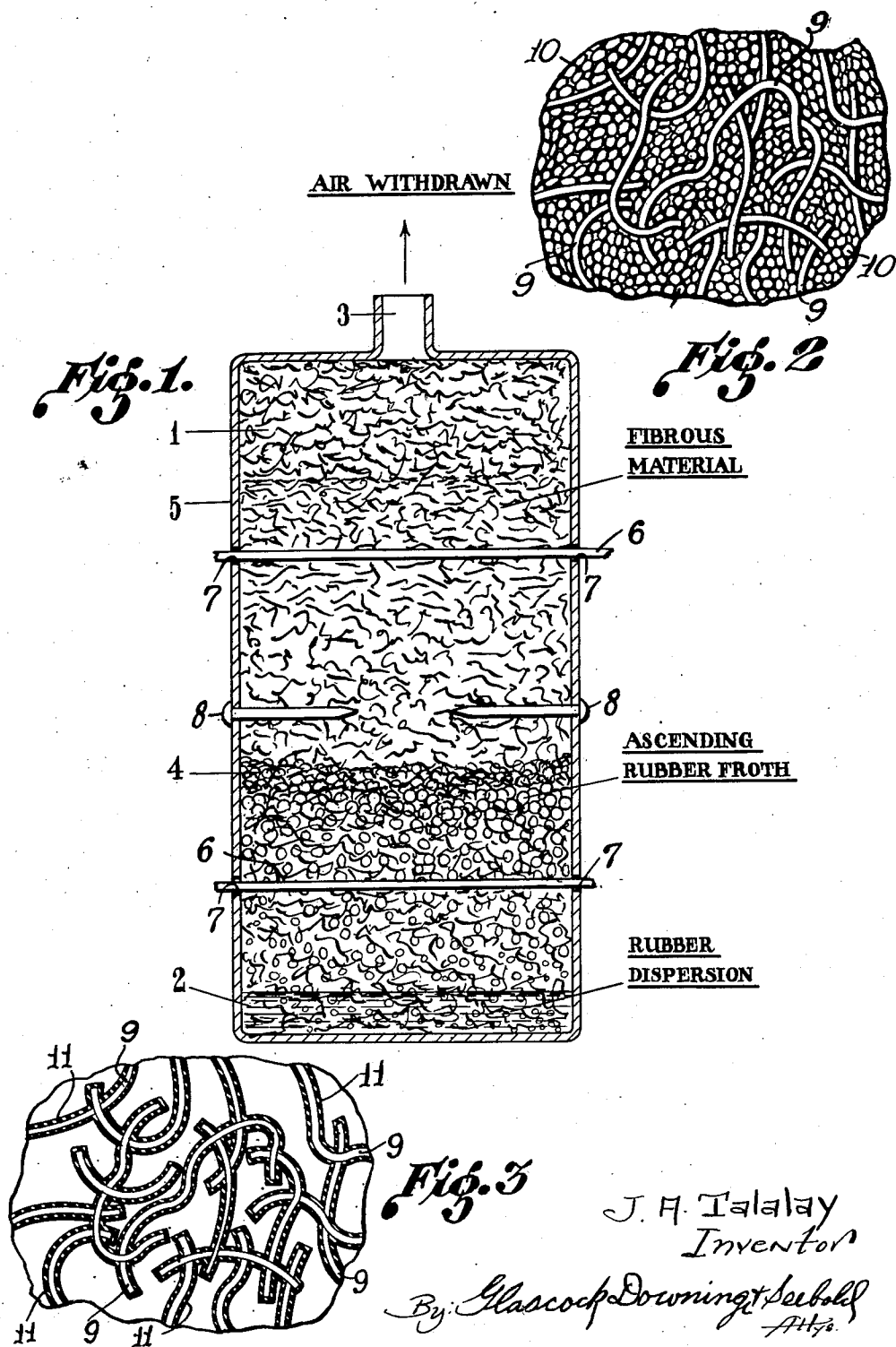
Dec. 13, 1938.

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2,140,063

PROCESS FOR PRODUCING RESILIENT FIBROUS MATERIAL FOR STUFFING UPHOLSTERY

Filed Feb. 18, 1937



UNITED STATES PATENT OFFICE

2,140,063

PROCESS FOR PRODUCING RESILIENT FIBROUS MATERIAL FOR STUFFING UPHOLSTERY

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Application February 18, 1937, Serial No. 126,480
In Great Britain December 8, 1936

8 Claims. (Cl. 18—53)

This invention relates to the production of reinforced fibrous material, suitable for use for example as a filling or stuffing for upholstery, mattresses and the like, and to the production of sponge rubber products incorporating the same.

In the specification of U. S. application No. 67,990, filed March 9, 1936, (British Specification No. 455,138) a method is described for making a porous or spongy rubber or rubber-like product which consists in converting into a froth an unfrothed dispersion of rubber-like substances by subjecting it, either alone or in the presence of one or more substances capable of giving rise to a gas under the froth producing conditions, to a reduced pressure whereby gas contained in the dispersion is caused to expand and possibly liquid contained in the dispersion to vaporize and so impart porosity to the material, and then setting the material while still in the form of a froth. In this prior process it has been proposed to incorporate fibrous material of any kind whatsoever, vegetable, animal or mineral, artificial or natural, with the porous spongy product by for example placing the fibrous material (e. g. hair, coconut fibre, asbestos) into a container and allowing the dispersion to froth up over it under the influence of the subatmospheric pressure whereby a spongy article of rubber or rubber-like material reinforced with fibrous material is obtained.

It has now been found that methods of frothing dispersions of rubber or rubber-like material which involve the use of vacuum at some stage during the froth formation can be used for reinforcing a loose fibrous structure with rubber or rubber-like material, and so obtaining a reinforced fibrous product which is superior in many ways to the rubber-bonded fibrous material known up to now.

The method of reinforcing a loose fibrous structure with rubber or rubber-like material provided by the present invention consists in causing the froth of a dispersion of rubber or rubber-like material produced or enhanced by the application of a vacuum to ascend through the said loose fibrous structure and collapsing the froth prior to, or during, the setting of the rubber or rubber-like material in the fibrous mass, whereby the said individual fibres are slightly covered, and also the interstices between the fibres are slightly filled, with rubber or rubber-like material. By this means the loose fibres are converted into a reinforced structure in which they are covered slightly with rubber or rubber-like material, are joined together at some of the crossing points, and are interconnected by slight rubber connections extending from one fibre to another.

In carrying out the invention for example, the loose fibrous structure, e. g. hair mass, and the dispersion are placed in a vessel or mould. Pref-

erably the hair mass is put in first, then the cover is put on the vessel or mould, and then the dispersion is introduced or poured in, e. g. through an aperture in the cover. The pressure within the vessel or mould is then reduced, say to about one-fifth of an atmosphere, as a result of which the dispersion will froth up and rise through the mass of hair. The froth is then collapsed to, or during, the setting of the same. If desired the vessel or mould may be rotated during or after the frothing under vacuum, whereby a more uniform distribution of rubber or rubber-like material through the mass of fibrous material is ensured. If desired also the hair may be moistened with water or a solution of a coagulating salt, such as ammonium chloride, before being permeated with froth in order to promote the setting operation. This moistening may be effected by spraying the hair mass with, or dipping it into, water or coagulating salt solution.

The collapsing of the froth may be effected for example by releasing the vacuum in the vessel, i. e. by fully or partly restoring atmospheric pressure. The froth cells collapse, leaving slight coatings of rubber or rubber-like material on the hair fibres and slight connections of the same material interconnecting the fibres at a number of places. Another method of bringing about the collapse of the froth which may be adopted consists in using such a small amount of the dispersion compared with the volume of the fibrous mass to be impregnated that after the froth has permeated the whole of the mass it spontaneously collapses, probably owing to the walls of the froth cells, because of the small amount of rubber or rubber-like material they contain, being insufficiently strong on commencing to set to withstand the forces prevailing therein.

The rubber or rubber-like material in the impregnated product is set in the usual way, under vacuum or atmospheric pressure as desired or convenient. It may be left to dry and solidify in the original container, or alternatively it can be shaped before being allowed to set, e. g. by being introduced into a mould whereby it can be distended or compressed. Vulcanization may be effected if desired by any known process.

The present invention is not limited to the use of any particular frothing method, but it is preferred that the method employed at one stage involve the use of a vacuum. It is preferred, however, to work in accordance with the method disclosed in British Specification No. 455,138. Another possible frothing procedure which can be employed with convenience consists in starting with a dispersion of rubber or rubber-like material which has been preliminarily foamed, e. g. by whipping or beating, and then enhanc-

ing or expanding this foam by subjection to a vacuum.

It is also to be understood that the invention is not limited to the use of any particular fibrous material. Artificial or natural horsehair and asbestos may be mentioned as examples of suitable material, but others may be employed. Mixtures of various fibres may also be used. Further, as rubber dispersions may be used both natural dispersions (e. g. latex) and artificial dispersions. Examples of rubber-like material which may be employed in dispersed form are the synthetic product known as Thiokol (a reaction product of ethylene chloride and sodium polysulphide) and the substance known under the registered trade-mark Duprene. The latter substance has the particular advantage that it is non-inflammable. The dispersion of rubber or rubber-like material used in this invention may also contain one or more of the additions: vulcanizers, setting agents, stabilizers, accelerators, softeners and/or fillers, such as is known to those skilled in the rubber art.

It sometimes happens, more particularly when a very loose and sparse fibrous structure is being impregnated, that as the froth ascends through the structure the fibres of the latter are carried up by the froth with production of irregularity in the distribution of the fibres in the working vessel or mould. It has been found that this drawback can be prevented if the fibres of the mass being used are first of all bonded together, at least to a considerable extent, by means of adhesive. Any bonding agent may be used for this purpose, and it need not be an elastic adhesive. Casein may be mentioned as an example of an adhesive which may be used. However, natural or artificial aqueous dispersions of unvulcanized or of vulcanized rubber or rubber-like materials may also be used. The fibrous material may be dipped in the bonding agent, or the latter may be sprayed on to the fibres. The adhesive temporarily bonds the loose structure to a uniform whole, thereby stabilizing the same sufficiently to resist being lifted by the rising froth. It is also possible to use other means for temporarily restraining the rise of the fibrous mass, however, viz. mechanical means. For example, wires can be passed across the mould at one or more levels for the purpose, or nails, spikes, needles or the like may project into the fibrous mass from the sides of the vessel in which the impregnation is being effected. When projections from the side of the mould are employed they must be removed before the final reinforced product can be removed from the vessel; in the case of wires, however, these may be cut to enable the mass to be taken out of the vessel, and the lengths of wire remaining in the mass may either be withdrawn therefrom or left therein. If the wire used is fine it may often be left in the reinforced structure without harm.

The reinforced fibrous product resulting from the method of the present invention is characterized by great uniformity and is superior to the bonded hair material heretofore known in that it has better and, what is more important, more lasting resiliency accompanied by a very low density. The method enables the relative proportion between the quantity of rubber or rubber-like material and the quantity of hair to be precisely controlled, so that a heavy or a light coating can be obtained with ease as desired. In this way reinforced hair products can be produced adapted to particular needs. The reinforced

hair products obtained are suitable for all upholstery purposes, e. g. as a stuffing or filling for seats, cushions, mattresses, etc.

Example 1

Three grams of sulphur, 1 gram of pentamethylene-piperidine dithiocarbamate (the accelerator known as PPD), 1 cc. of oleic and 5 grams of zinc oxide are mixed up to a paste with 20 cc. water; to this paste are added 135 cc. of latex containing 75% rubber (revertex). To the mix are then added 2.5 cc. of ammonia ($d=0.880$) and 20 cc. of water.

About 250 grams of curled carded horsehair in the dry state in the form of a loose structure of fairly uniform distribution and having a bulk specific gravity of 0.015, are placed in a mould of round about 20 litres capacity. Nails projecting from the walls of the mould retain the hair in position and prevent it ascending during the subsequent froth ascension. The mould is then closed except for a small opening in the cover or elsewhere. To 500 g. of the liquid rubber mix described above is added a solution of 7 grams of ammonium carbonate and 14 grams of ammonium chloride in 50 cc. of water and 14 cc. of hydrogen peroxide (40% by weight). This mixture is introduced into the mould through the small opening which is left. After introduction of the latex mixture, which runs to the bottom of the mould, the pressure within the mould is reduced to about 12 cms. mercury, at room temperature. When the resulting froth has risen through the mass of hair the pressure in the mould is restored to that of the atmosphere, whereby the froth collapses. After about 15-30 mins., when the mass has set, the mould is opened, the mass dried by warming at 75° C., and then vulcanized by known methods, such as heating in air to 105° C. The nails projecting into the mass of reinforced hair are then removed and the mass removed from the mould.

Example 2

The impregnating procedure in this example is exactly the same as in the preceding example except that the rubber mix is employed without the ammonium carbonate and ammonium chloride. After the froth has collapsed the mould is opened before setting occurs, and, the projecting nails being withdrawn if necessary, the coated hair picked up by means of fork-like implements and placed in a larger mould of the shape desired for the final product, in which it is loosened slightly by being manipulated with forks or other implements whereby it is extended so that it fills the mould. The product is then dried and vulcanized as in Example 1. The procedure of this example results in a lighter product shaped in a desired manner.

Example 3

The rubber mix (containing the ammonium salts) described in Example 1 is introduced in a quantity amounting to about 250 grams of dry substance content into the mould containing hair exactly as in Example 1. The pressure within the mould is reduced to about 12 cm. of mercury, and the froth which forms ascends through the hair mass and, with the proportion of rubber mix mentioned, spontaneously collapses. The product is then set and treated in the manner described in Example 1.

Of the accompanying drawing:

Fig. 1 is a vertical section of apparatus adapted

for the practice of the invention, with the materials therein.

Fig. 2 is a fragmentary section of the materials as they appear when the interstices of the mass of fibers have been filled with the foamed dispersion, before the latter has been collapsed.

Fig. 3 is a corresponding fragmentary section illustrating the condition of the materials after the foam has been collapsed to provide sheaths of rubber on the fibers.

Fig. 1 of the accompanying drawing shows schematically by way of example one manner in which the reinforcement of fibrous material, in this case hair, according to this invention may be carried out. Into a container 5 a hair mass 1 is introduced after which the container is closed and through the aperture 3 latex mix 2 is introduced. This mix runs to the bottom of the container. The air in the container 5 is then withdrawn through the aperture 3 as a result of which the latex 2 froths up into a foam 4 which rises through and permeates the hair mass 1. The foam is collapsed when it has risen through the hair mass by one of the methods described above.

In Fig. 2, the fibers are shown at 9, 9 and the foamed dispersion, filling the interstices of the mass of fibers, is shown at 10.

In Fig. 3, the sheaths of rubber upon the fibers, resulting from the collapse of the foam, and preferably connecting them at their crossing position, are shown at 11, 11.

The reinforced hair product which results from the method of this invention has been found to be a particularly suitable material for incorporation with rubber or rubber-like material in spongy form for making a porous spongy product or body. The reinforced hair prepared as described above, and if desired moulded during its preparation to a desired shape or shaped or brought into any suitable configuration after preparation, may be incorporated with the sponge rubber or rubber-like product in any manner, but for convenience in working it is advantageous to make the sponge by a forthing operation on a dispersion of rubber (e. g. latex) or rubber-like material which involves the use of a vacuum. The froth rising under the action of the reduced pressure can then be allowed to ascend through and permeate the reinforced fibrous structure (which, if desired, may be prevented from rising by wires, nails, needles, strings or the like) after which the product can be set, and vulcanized if desired, in the known way. It is preferred to work in accordance with the method described and claimed in the specification of U. S. application No. 67,990 (British Specification No. 455,138) for incorporating the reinforced fibre with sponge to form a spongy article, but other ways may be adopted. For example, a pre-foamed dispersion of rubber or rubber-like material may be subjected to vacuum, and the ascending froth allowed to permeate the reinforced structure. The froth being incorporated with the reinforced structure need not be produced by a method involving the use of a vacuum at all, however, and the invention is not limited in this respect in any way. Before the incorporation with the spongy mass, the reinforced fibre may, if desired, be vulcanized. The spongy article produced may, of course, be shaped during formation by working in a suitable mould.

If desired, e. g. when making sheets and certain other articles, the reinforced hair mass, whether dried and/or vulcanized or not, may be

torn apart before being incorporated with spongy mass to form a spongy article. It may then be necessary to adopt mechanical means to prevent its rising with the impregnating froth when this is produced with the aid of vacuum. The tearing apart of the reinforced mass may, if desired, be carried out whilst the mass is still moist and unset.

If a spongy article is to be prepared which is non-inflammable the dispersion used for impregnating the reinforced hair structure is preferably a dispersion of Duprene. The reinforced hair itself is also then preferably prepared with employment of a Duprene dispersion.

The froth with which the reinforced fibrous material is permeated may contain some or all of the substances vulcanizers, accelerators, fillers, softening agents, stabilizers, setting agents, for the purposes known to those skilled in the rubber art.

Spongy articles or bodies of rubber or rubber-like material reinforced with the reinforced hair material prepared in accordance with this invention are characterized by great durability and resilience, superior to those of similar articles heretofore known.

In the appended claims the words "a substance having the pertinent characteristics of rubber" are to be understood as meaning a substance having all of the following characteristics: that it can be in the form of a dispersion; that it can be caused to extend itself as a foam; that the solid content of the foam can be irreversibly set as a coating upon the fibers by collapse of the foam; and that when set it will have an elasticity and resilience similar to that of vulcanized natural rubber.

What I claim is:—

1. A method of producing a porous mass of fibrous material having fibers thereof bonded to each other which comprises causing a dispersion of a substance having the pertinent characteristics of rubber to extend itself as a foam through the interstices of a reticulated mass of fibrous material, by increase of volume of the foam, and then causing the foam to collapse while remaining extended in the said reticulated mass.

2. A method as defined in claim 1 in which the amount of dispersion used is so small in relation to the volumetric amount of fibrous material that the foam collapses automatically as a result of extending itself in the fibrous material.

3. A method as defined in claim 1 in which the foam is collapsed by subjecting it to fluid pressure such as to decrease its volume and thereby cause it to collapse as a dense coating upon the fibers.

4. A method as defined in claim 1 in which the fibrous material is locally restrained by mechanical means against being excessively moved by the extending foam.

5. A method as defined in claim 1 in which the fibrous material is treated with an adhesive before the dispersion is caused to extend itself in it.

6. A method as defined in claim 1 in which the dispersion is caused to extend itself by subjecting it to a sub-atmospheric pressure.

7. A method as defined in claim 1 in which the fibrous material is held in a predetermined shape in a mold while the foam extends itself therein.

8. A method as defined in claim 1 in which the mass is re-shaped to the form of a finished article after the collapse of the foam and then is set in that form.

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