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FILAMENTOUS MATERIAL AND METHOD OF MAKING SAME

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My invention relates to improvements in filamentous materials and methods of making same.

The object of my invention is to provide a filamentous material, which is highly cellular, of a strong and durable character, which is light in weight, flexible, a thermal insulator, sound absorptive, resilient and moth proof and moisture repellant and especially adapted for use as a thermal insulator, sound deadener, acoustic modifier, or carpet or rug lining.

I am aware that materials have been constructed of short fibre stocks, such, for instance, as pulp-waste, hollandered or shredded or pulped cereal straws or bagasse, and other vegetable substances, or from cattle, or other animal hair, or from various mixtures of these ingredients.

It becomes obvious, that unless these materials are reinforced with sustaining coverings or interlinings, such, for instance, as burlap or paper, held to the material by couplings of stitches or by a cementitious gum attached to the interlining, there is not the required strength within the unsupported loosely-felted fibre-mass to sustain them unless cemented and compressed to keep the material together and to insure uniform strength. The latter process necessarily, however, converts the product into a more or less compact board.

But there are two added causes in those forms of constructions that greatly impair their insulating efficiency, namely, the stitch holes and thread perforations which permit the establishment of a free circulation of water-vapor laden air and ultimate condensates, which freely conduct the heat from one to the other side of the insulating material and cause a more rapid thermal interchange than when these stitch holes and thread passages are not present. The other cause for impairment is the susceptibility of the coverings or interlinings exposed to the dampness, common to refrigerator cars and cold storage places, to yield to rapid destruction by anaerobic bacilli (mildew).

I am aware that many different forms of viscous materials, such, for instance, as viscose, acetol and cupra-ammonium celluloses, etc., are compounded for drawing and forming filaments from which threads are spun and for the making of these filaments or threads into tulle and lace, but, to my best knowledge, the art of filament drawing from viscous masses has never before been applied to the manufacture of a built up material or materials of the classes above described and in the manner herein illustrated. Thus my invention creates new and important articles of manufacture.

In the drawings Fig. 1 is a diagrammatical side elevation of an apparatus adapted for the making of the material of my invention. Fig. 2 is a diagrammatical end elevation of the apparatus. Fig. 3 is a diagram showing the manner in which the continuous filaments are laid up. Fig. 4 is a fragmental, enlarged sectional elevation of the material; and Fig. 5 is a view similar to Fig. 4 with the addition of a "filler."

Referring to the drawings, 6 designates a carriage, having wheeled tracks 7 and tracks 8 and is arranged to be moved in opposite directions by a rack 9 and pinion 10, the pinion being supported on a shaft 11 which is intermittently reversely driven. Supported on the carriage is a bed or tray 12 in which the material is built up. Extending transversely of the carriage, over the bed or tray is a stationary manifold 13, carrying a plurality of spinnerets or jets 14 and in communication with a mixture tank (not shown) by a pipe 15 having a flow-control valve 16. Surmounting the carriage and bed or tray is a track 17 having a trend at an angle to the recited tracks 18 for the support of a carrier 18 for a manifold 19, having spinnerets or jets 20, similar to the recited spinnerets 14, and which manifold is in communication with the recited mixture tank by means of the pipe 21 having a flow-control valve 22. The carrier 18 is provided with a rack 23 and is moved by a pinion 24 driven by an intermittently reversed shaft 25.

Assuming the manifold 13 to be filled with a suitable viscous material and the flow-control valve 16 open, it will be apparent that continuous filaments will be formed as the
5 material is formed through the spinnerets 14 and that they will fall to the bed or tray 12, and assuming further that the carriage 6 is being moved in one direction by the rack and pinion, it will be apparent that there will be deposited on the bed or tray a series of parallel filaments the length of the tray as shown at A in Fig. 3. The criss-cross or laterals B are formed similarly to the filaments A and their trends produced by simultaneous movements of the carriage 6 and carrier 18, the carriage moving in one direction and the carrier in a direction at an angle thereto.

15 If it is desired to form a firm, durable skin or surfacing, the action of one or the other spinneret may be continued until several parallel layers of filaments are formed. This action firmly adheres one filament to the other, from the fact that up to this point no attempt has been made to "fix" or to prevent, by recognized means, the adhering of these filaments one to the other. Thus, a firm, homogeneous mass or skin of any desired thickness may be formed. If found expedient, this skin may be subjected to a fixing or hardening bath, or may be fixed and dried and used in this form, or used as a base on which to build up a less dense, filamentous structure thereon, for example the criss-cross material structure shown in Fig. 3.

20 In order to facilitate the formation of the recited skin or surfacing, I provide means such as the threaded stem 26 and nut 27 (see Fig. 2) for transversely adjusting the manifold carrying the spinnerets 14 whereby the superposed filaments will be relatively staggered as shown in Fig. 4, wherein C designates the first series and D a subsequent series staggered relative to C, to form a substantially striated surface.

25 In forming this skin it is desirable to lay up filaments of ovate section having their major axes horizontal and to this end the spinnerets are held a relatively short distance from the bed whereby the filaments will reach the bed in a relatively soft, unfixed condition.

30 Upon the skin so formed, I cause to be deposited filaments E (see Fig. 4) which may have a trend at any angle or parallel to the filaments D and C of the skin, and sections substantially that of the section of the spinnerets, which section of the filaments is controlled by the distance separating the spinnerets from the plane of the layer, or course of the material on the bed, and to this end I provide means for vertically adjusting the spinnerets comprising the slotted hangers 28 and set screws 29 (see Fig. 2), affecting the spinnerets 20, and threaded stems 30, for vertically adjusting spinnerets 14.

35 After one or more layers, or series of filaments are thus laid up, then one or the other groups of the multiple spinnerets may again lay up one or more series of longitudinal filaments F, as shown in Fig. 4. It will be understood that filaments F, and filaments E, while shown in Fig. 4 as parallel to the filaments C and D forming the skin, may be laid up at any angle to the filaments forming the skin. If a less dense internal filamentous structure is desired, the filaments E and F of Fig. 4 may be cross-piled in the manner of A and B in Fig. 3. In any event, the formation of the skin on the surface of the material, serves to seal the air cells inside of the material.

40 This alternate process goes on until a desired thickness of cellular body is obtained. If it is desired, a second skin may be formed opposite the described skin composed of filaments G, H and I deposited similarly to the recited filaments C and D. The tray supporting the newly formed material may then be run off the carriage and placed in a seasoning room and a second tray put on the carriage and the operation repeated.

45 It is obvious, that in this manner, a built up body of material composed of finely-divided and well-sealed air cells is formed, since the filaments become permanently sealed at their points of contact. In fact, this is a very important step in the forming of said filaments into a cellular structure having the walls of said cells adhering one to the other in the manner described, and special means may be employed either to accelerate or retard their set, such as the adjusting devices 29 and 30.

50 These filaments, of course, may be of any desired thickness, but are of one continuous length.

55 I have found that material which has a thin, dense, unbroken, and flexible interlining is superior in its thermal resistivity and water-vapor repellent values to one without this lining.

60 In these articles of manufacture, for which I claim invention, by closely paralleling the filaments and adhering them one to the other, there is formed a thin, unbroken film of suitable density, which, when primarily laid over and adhered to a single or multiple course of cross-piled filaments with a like course of multiple cross-piled filaments superimposed, will be stronger and more satisfactory in every way than in the compositions heretofore used.

65 The finished product may be of any desired thickness or density flexibility, or any degree of rigidity found expedient. It may be made water-vapor and fire resistant throughout its mass by adding the necessary water and fire repellent materials to the viscous compound or by treating the finished material with suitable water and fire resisting mediums.

70 This new product lends itself admirably to what is known to the trade as "filling." As the various series or courses of the mater-
material are laid, carded wool or carded animal or vegetable mixtures may be laid either with the filaments parallel, as in Fig. 5, or with some or all of the filaments cross-piled, thereon by suitable means, (not shown) the card-laps being reinforced and fixedly held by the subsequent series of filaments; or card wool-waste, broken lustro-cellulose filaments, or shortened or full length fibres of sea island floss (known as "kapok") or other fibres, many of which suggest themselves, may either be blown on to the top couring, or dusted thereon from a porous, revolving or reciprocating duster 31. The card-laps or fibre particles will adhere to the freshly laid filaments and the next couring will likewise firmly adhere thereto. This process may be repeated between each or alternate courses, as desired, throughout the thickness of the finished material (see Fig. 5).

The finished product is an extremely light composition with the filaments laid up in endless courses and cross-piled in such a manner as to product myriad air cells with the filaments so firmly adhered at their junctions as to produce in effect a sealed cell containing in toto a great body of air between remote cell walls, thus retarding air convection to a degree surpassing anything heretofore known.

I claim:

1. A cellular material composed of continuous filaments forming sealed cells.
2. An imperforate cellular material composed of parallel, continuous filaments, the adjacent filaments being adhesively related to each other.
3. A cellular material composed of self-adhered filaments forming sealed cells.
4. A cellular material, the internal structure of which is characterized by spaces sealed from atmosphere, and composed of continuous filaments adhesively united throughout their lengths.
5. A material composed of self-adhered, continuous filaments and having sealed cells internally of the material, and an imperforate, fluid-tight covering forming the opposite, exterior surfaces of the material and formed by certain of said filaments disposed in close, adhesive adjacency.
6. A material composed of self-adhered filaments and having sealed cells formed by filaments located internally of the material, and sealed by a fluid-tight arrangement of filaments on the surface thereof.
7. A material composed of divided sealed air cells, the walls of which are formed by relatively adhered filaments, certain of the filaments near the surface of the material being disposed in parallel adjacency, forming an imperforate covering.
8. As an article of manufacture, an impervious fabric comprising surficial filaments disposed in parallel adjacency and adhesively joined, and filaments between spaced layers of said surficial filaments, arranged to form therewith sealed cells internally of the fabric.
9. A material comprising a foraminous, internal body portion composed of continuous, drawn filaments forming cells and relatively dense surfaces formed of an imperious, plastic substance, for enclosing the body and sealing said cells.
10. A material having sealed cells and including cross-piled courses of relatively spaced filaments, the filaments of one course being adhesively secured to a second course at their intersections, and imperforate surface courses of additional filaments, laid up in sealing relation to the cross-piled courses.
11. An intersicated material having an internal structure formed of relatively angularly disposed and adhesively secured filaments and a surface covering forming sealed cells.
12. A material formed of a visous substance comprising a filamentous, intersicated body and relatively dense, unbroken surface portions, in sealing relation with the intersicates of the body.
13. A cellular material composed of filaments relatively adhered about the cells of the material and forming a relatively dense, imperforate surface.
14. The herein described method of forming a fabric of a visous substance, which consists in depositing parallel series of filaments in visous condition in superimposed courses to form a material having sealed cells.
15. The herein described method of depositing parallel series of filaments in visous condition in superimposed courses to form an imperforate cellular material, in sealing the cells of the material with other of said filaments, and in subjecting the material to a fixing and hardening treatment.
16. The herein described method of making a sealed cell material which consists in depositing parallel rows of threads of visous material in superposed layers, in depositing certain of said threads in close adjacency to form the surfacing of the material and sealing the internal rows from atmosphere, and in placing the threads of the internal rows in spaced relation.
17. The herein described method of making a fabric-like material of a visous substance which consists in forming continuous impervious filaments having visous superficialities; in depositing same to form an air-tight skin consisting of a substantially unbroken covering; in superposing said film a body of similarly characteristic filaments in cross-piled formation to form air cells and in depositing on said body a second unbroken airtight surfacing.

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