July 1, 1958 A. W. BATEMAN 2,840,881

ARTICLE OF MANUFACTURE AND PROCESS OF MAKING SAME

Filed May 13, 1955

Fig. 1

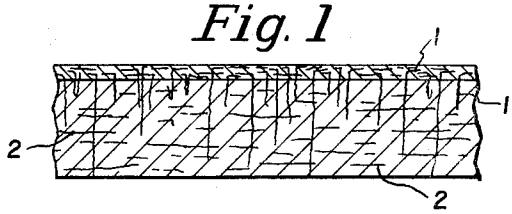


Fig. 2

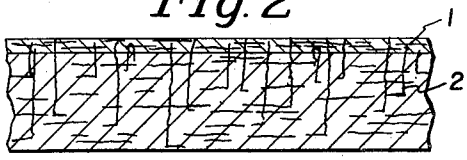


Fig. 3

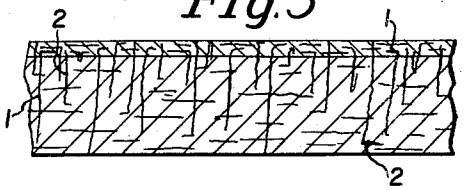


Fig. 4

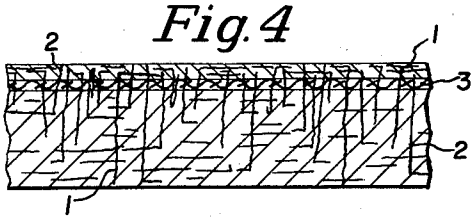
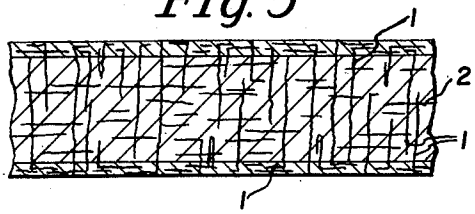


Fig. 5



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2,840,881

ARTICLE OF MANUFACTURE AND PROCESS OF MAKING SAME

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Application May 13, 1955, Serial No. 508,181

11 Claims. (Cl. 28—79)

This invention relates to fibrous structures and particularly to a fibrous structure composed of a plurality of strata of different fibers, the surface stratum of which exhibits lubricity.

An object of this invention is to provide a bulky fibrous structure, the surface of which exhibits lubricity. A further object is to provide non-woven fibrous felt-like products having polytetrafluoroethylene fibers on the surface. Other objects will become apparent from the following description of the invention.

These and other important objects are accomplished by forming a non-woven batt of natural or synthetic staple fibers, such as, e. g. asbestos, wool, cotton, flax, jute, nylon, viscose rayon, cellulose acetate, polyethylene terephthalate, polyacrylonitrile, glass, polyvinylidene chloride and copolymers of polyvinylidene chloride with other monomers copolymerizable therewith. A batt of non-woven polytetrafluoroethylene fibers is superposed over a non-woven fibrous batt substantially free of polytetrafluoroethylene fibers and some of the polytetrafluoroethylene fibers are forcibly oriented perpendicular to the ultimate faces of the fibrous sheet. The perpendicularly oriented polytetrafluoroethylene fibers are extended into the non-woven batt of non-polytetrafluoroethylene fibers, to unite or combine the two separate batts. Alternately the non-polytetrafluoroethylene fibers may be forced into the batt of polytetrafluoroethylene fibers. To provide additional combining strength fibers from each batt may be forcibly extended into the other batt. A further modification involves a woven fabric between the batt of polytetrafluoroethylene fibers and the batt of non-polytetrafluoroethylene fibers in which the fibers from either or both batts are forcibly extended through the woven fabric and into the other batt on the opposite side of the woven fabric.

In the drawing Figure 1 is a diagrammatic illustration of a batt **2** of fibers other than polytetrafluoroethylene, having a surface layer of polytetrafluoroethylene fibers **1** needled into the batt **2**. Figure 2 is a diagrammatic illustration of a batt of fibers other than polytetrafluoroethylene **2** having a surface of polytetrafluoroethylene fibers **1**, the fibers **2** having been needled into the batt of polytetrafluoroethylene fibers **1**. Figure 3 illustrates a batt of polytetrafluoroethylene fibers **1** attached to a batt of fibers other than polytetrafluoroethylene **2** in which the fibers of each batt are needled into the other batt. Figure 4 illustrates a three layer structure comprising a surface batt of polytetrafluoroethylene fibers **1**, an intermediate layer of a woven fabric **3** and a third layer of a batt of fibers other than polytetrafluoroethylene **2**, the polytetrafluoroethylene fibers **1** and fibers other than polytetrafluoroethylene **2** each needled through the woven fabric **3** into the batt of other fibers. Figure 5 illustrates a batt of fibers other than polytetrafluoroethylene **2** having on each side thereof a batt of polytetrafluoroethylene fibers **1** needled into the batt of fibers **2**.

The following examples are given by way of illustration and not limitation. The parts and percentage figures are expressed on a weight basis unless stated otherwise.

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Example I

A window channel run lining was made by first preparing a non-woven batt weighing about 12 ounces per square yard of drawn 3.0 denier, 1.5 inch staple nylon filaments. The nylon web may be prepared on any suitable web forming apparatus. Another non-woven batt of drawn, heat retractable, 6.6 denier, 4.5 inch polytetrafluoroethylene staple fibers weighing about 6.0 ounces per square yard was prepared by passing the staple fibers through a garnett one or more times to open it up, the final time through the fibers were collected as a loose batt. The batt of polytetrafluoroethylene fibers was superposed over the nylon batt and the assembly was passed through a needle loom 12 times, each time the needles entered the assembly from the polytetrafluoroethylene side and at least some of the polytetrafluoroethylene fibers were forcibly extended into the nylon batt at various depths as well as completely through in a direction substantially perpendicular to the top and bottom surfaces of the non-woven laminated felt-like structure as illustrated in Figure 1 of the drawing. The batt of polytetrafluoroethylene fibers was attached to the nylon batt.

The laminated felt was used as a window channel lining as described in copending application S. N. 478,851, filed December 30, 1954, by R. L. Lester et al. The polytetrafluoroethylene side of the laminated batt formed the outer surface of the lining and provided a satisfactory seal with the edge of the glass window against wind and water. The fibrous polytetrafluoroethylene surface had sufficient lubricity to reduce the power required to raise and lower an automobile window having a channel run lined with the laminated batts as compared to an automobile window having a channel run lined with a conventional felt.

Example II

A laminated felt was prepared in the same manner as described above except that the nylon batt was superposed over the polytetrafluoroethylene batt and passed through the needle loom 12 times, each time the needles entered the assembly from the nylon side. At least some of the nylon fibers were forcibly extended into and through the batt of polytetrafluoroethylene fibers substantially perpendicular to the top and bottom faces of the final product as illustrated in Figure 2 of the drawing. The two batts were united together.

Example III

A laminated web was prepared in the same manner as described in Example I except the assembly was needle loomed 12 times from alternate sides, i. e., six times on each side. At least some of the polytetrafluoroethylene fibers were needled into the batt of nylon fibers and at least some of the nylon fibers were needled into the batt of polytetrafluoroethylene fibers as illustrated in Figure 3 of the drawing. The two batts were united together.

Example IV

An ironing roll cover or press pad was prepared by first forming a non-woven batt weighing about 20.0 ounces per sq. yd. composed of heat retractable polyacrylonitrile fibers, 1.5 denier, 3.0 inch staple on a conventional web forming apparatus. A woven fabric of heat retractable polyacrylonitrile fibers, formed from staple filament, weighing about 2.0 ounces per sq. yd. having a thread count of 20 x 20 was superposed over the non-woven batt of polyacrylonitrile fibers. A needled

batt of heat retractable polytetrafluoroethylene fibers 6.6 denier, 4.5 inch staple weighing about 14.0 ounces per sq. yd. prepared as described in Example I was superposed over the woven fabric. The assembly was needle loomed 16 times from alternate sides, i. e. 8 times from each side. At least part of the polytetrafluoroethylene fibers and at least part of the polyacrylonitrile fibers of the non-woven batts were forcibly oriented through the woven fabric and into the non-woven batts on opposite sides of the woven fabric as illustrated in Figure 4 of the drawing. The needled assembly was subjected to a temperature of about 350° F. for about 15 minutes. There was about 10% decrease in the area without any appreciable change in thickness.

The felt-like product of this example is ideally suited for press pads and ironing roll covers in view of the resiliency of the polyacrylonitrile fibrous batt and woven fabric and heat resistant polytetrafluoroethylene surface.

A press pad or ironing roll cover composed entirely of polytetrafluoroethylene fibers has the desired heat resistance but compacts on continued use and loses its property of resiliency which property is desirable for this use.

In the above example the polyacrylonitrile woven fabric may be replaced by a fabric woven from other types of yarn, such as, e. g. polytetrafluoroethylene, polyethylene terephthalate, nylon, cotton, viscose rayon, wool, glass, etc.

Example V

A felt gasket having two sides which exhibit lubricity was prepared by first forming a batt of cotton fibers weighing about 16 ounces per sq. yd. on a conventional web forming apparatus. A batt of 30 denier 4.5 inch staple polytetrafluoroethylene fibers, weighing about 7.5 ounces per sq. yd. was separately prepared. A three layer structure was formed by placing the cotton batt between two layers of the polytetrafluoroethylene batt. The assembly was needle loomed 10 times from each side, alternating sides each pass through the loom. At least some of the polytetrafluoroethylene fibers in each surface layer were oriented into and through the cotton batt and into the polytetrafluoroethylene batt on the opposite side as illustrated in Figure 5 of the drawing.

The needle looming operation may be carried out with a needle loom equipped with needles having an irregular profile such as those disclosed in copending application S. N. 427,465, filed May 4, 1954, by H. G. Lauterbach.

In order to facilitate the handling of the batt of polytetrafluoroethylene fibers in preparing the laminated structures of this invention, it may be needle punched as it comes from the web forming apparatus and before superposing over the batt of fibers other than polytetrafluoroethylene. The two batts are subsequently united by needle looming.

The fiber other than polytetrafluoroethylene which makes up the major portion of the composite felt-like products is not critical and may be selected from a large group of fibers which includes; asbestos, wool, cotton, flax, jute, glass, nylon, viscose rayon, cellulose acetate, polyethylene terephthalate, polyacrylonitrile, polyvinylidene chloride and copolymers of vinylidene chloride with other monomers copolymerizable therewith such as, e. g. acrylonitrile and vinyl chloride. The end use and economic considerations will usually determine the fiber to be used in connection with the polytetrafluoroethylene fibers.

The denier of the polytetrafluoroethylene fibers and other than polytetrafluoroethylene fibers which may be used in carrying out this invention may vary depending on the type and appearance of sheet material desired. The preferred denier of the polytetrafluoroethylene fibers is 6.6; however, useful products can be made with much coarser fibers having a denier of 50 to 70, as well as finer fibers such as 3.0 denier or less. The denier of the fibers for the resilient batt to which the polytetrafluoroethylene fibers are attached may likewise vary over a wide range, there being no particular limits with respect to denier in either batt of fibers. The fibers may be straight or crimped. The length of the staple fibers forming the batt are not critical except for those limitations imposed by the card or other web forming apparatus. In the case of synthetic fibers forming the reinforcing woven fabric they may be formed from spun staple yarn or continuous filament yarn.

For various applications useful products can be made by substituting a non-woven batt composed of asbestos, wool, cotton, nylon, viscose rayon, cellulose acetate, polyethylene terephthalate, polyacrylonitrile, glass, polyvinylidene chloride, and copolymers of polyvinylidene chloride with other monomers copolymerizable therewith such as, e. g. vinyl chloride and acrylonitrile, for the non-woven nylon batt of Examples I, II and III, the polyacrylonitrile non-woven batt of Example IV or the cotton batt of Example V. The end use will dictate the composition of the fibers making up the batt of fibers other than polytetrafluoroethylene.

The relative thickness of the polytetrafluoroethylene batt and the batt substantially free of polytetrafluoroethylene fibers is not critical. However, in the preferred embodiment the layer of polytetrafluoroethylene fibers is thinner than the other batt of fibers. One of the important features of the fibrous felt-like products of this invention is the surface lubricity combined with resiliency of the entire structure.

By the terms "needle loomed" and "needle looming" as used throughout the specification and claims is meant forcibly oriented or orienting, respectively, fibers from one batt into an adjacent batt.

While there are above disclosed but a limited number of embodiments of the structure, process and product of the invention herein presented, it is possible to produce still other embodiments without departing from the inventive concept herein disclosed, and it is desired therefore that only such limitations be imposed on the appended claims as are stated therein, or required by the prior art.

I claim:

1. A resilient fibrous structure comprising at least two layers an outer layer being composed primarily of non-woven intermingled polytetrafluoroethylene fibers, and another layer composed primarily of fibers other than polytetrafluoroethylene, at least some of the fibers of at least one of said layers extending into the other layer to bind the separate layers together.

2. The product of claim 1 in which the polytetrafluoroethylene fibers are needle loomed into the fibers of the first mentioned layer.

3. The product of claim 1 in which the fibers of the first mentioned layer are needle loomed into the layer of polytetrafluoroethylene fibers.

4. The product of claim 1 in which the fibers of each layer are needle loomed into the other layer.

5. A resilient fibrous structure which exhibits lubricity on at least one side which comprises a non-woven batt of fibers selected from the group consisting of asbestos, wool, cotton, nylon, viscose rayon, cellulose acetate, polyethylene terephthalate, polyacrylonitrile, glass, polyvinylidene chloride, and copolymers of vinylidene chloride and needle loomed to at least one side of said batt, a batt of polytetrafluoroethylene fibers.

6. A resilient fibrous sheet which exhibits lubricity on the top and bottom sides thereof which comprises a resilient non-woven batt of fibers selected from the group consisting of asbestos, wool, cotton, nylon, viscose rayon, cellulose acetate, polyethylene terephthalate, polyacrylonitrile, glass, polyvinylidene chloride and copolymers of polyvinylidene chloride, and needle loomed to both the top and bottom sides of said batt a batt of polytetrafluoroethylene fibers.

7. A resilient fibrous sheet which exhibits lubricity on at least one side which comprises a resilient non-woven

batt of fibers selected from the group consisting of asbestos, wool, cotton, nylon, viscose rayon, cellulose acetate, polyethylene terephthalate, polyacrylonitrile, glass, polyvinylidene chloride, and copolymers of vinylidene chloride, superposed over said batt a woven textile fabric, superposed over said woven fabric a batt of polytetrafluoroethylene fibers, the fibers in the first mentioned batt and the polytetrafluoroethylene fibers extending through the fabric and into the batt on the opposite side.

8. The product of claim 7 in which the woven fabric is formed of polyacrylonitrile fibers.

9. A resilient heat resistant ironing roll cover or press pad cover which exhibits lubricity on the surface comprising a batt of polyacrylonitrile fibers, a woven fabric of polyacrylonitrile fibers superposed over said batt, a batt of polytetrafluoroethylene fibers superposed over said woven fabric, the polytetrafluoroethylene fibers extending through the woven fabric and into the batt of polyacrylonitrile fibers.

10. A window channel run lining which exhibits lubricity on the surface comprising a batt of nylon fibers and needle loomed on one surface of said batt a batt of polytetrafluoroethylene fibers.

11. The process of preparing a resilient fibrous structure which exhibits lubricity on the surface thereof which comprises forming a resilient non-woven batt of fibers selected from the group consisting of asbestos, wool, cotton, nylon, viscose rayon, cellulose acetate, polyethylene terephthalate, polyacrylonitrile, glass, polyvinylidene chloride, and copolymers of vinylidene chloride, separately forming a batt of polytetrafluoroethylene fibers, superposing the batt of polytetrafluoroethylene fibers over the first mentioned non-woven batt, needle looming the batt of polytetrafluoroethylene fibers to the first mentioned batt of fibers.

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