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METHOD AND APPARATUS FOR MAKING FELTED MATERIALS

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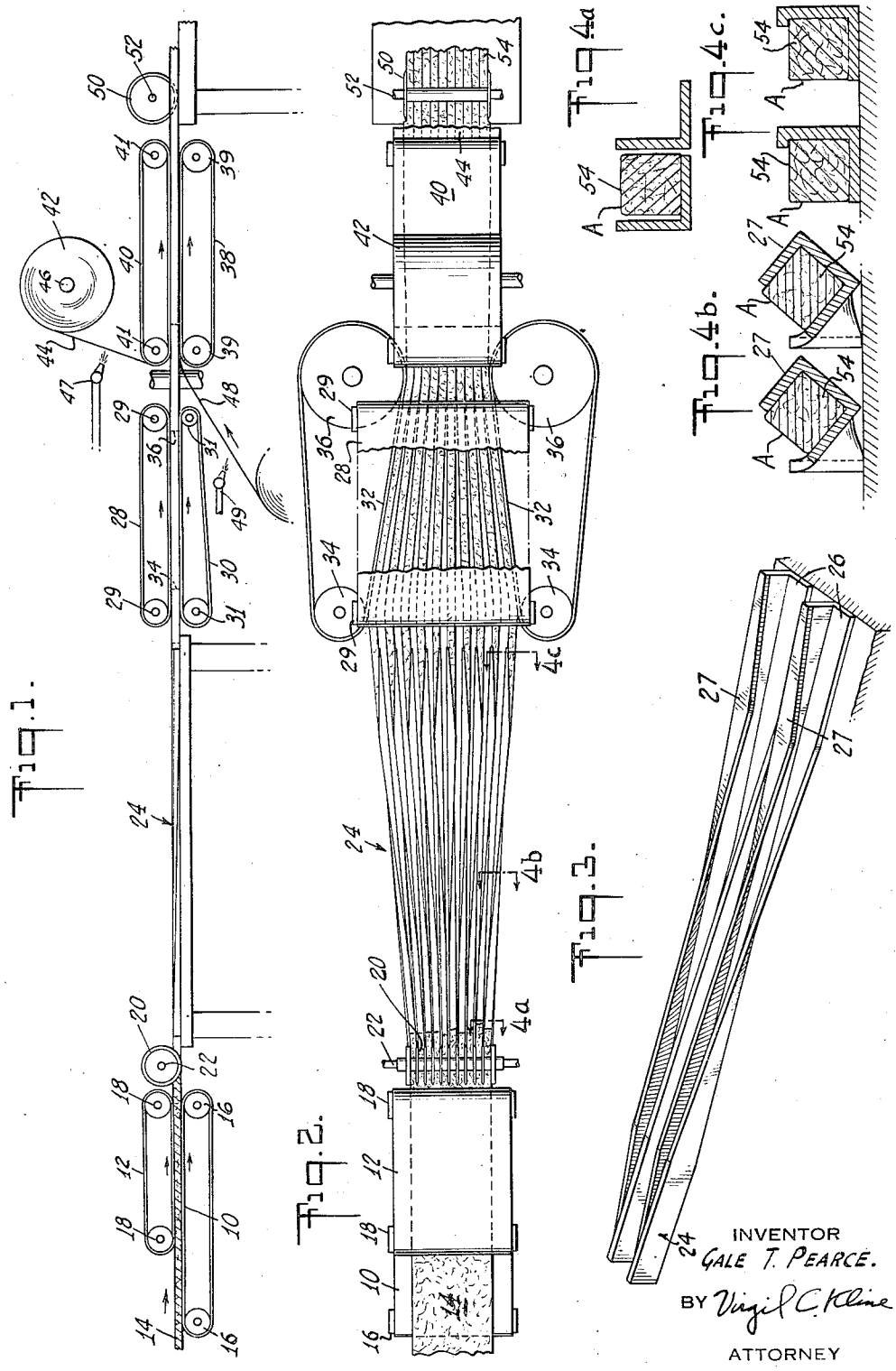


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4a

Fig. 4b.

Fig. 4c.

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METHOD AND APPARATUS FOR MAKING FELTED MATERIALS

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This invention relates to felted sheet materials such as fibrous blocks or batts and more particularly to those made from mineral wool fibers. It will be understood that the term "mineral wool" is employed herein in a generic sense to denote fibers formed from rock, slag, glass, and other like raw materials and mixtures thereof.

Heretofore in the manufacture of felted slabs and sheets of mineral wool fibers a suitable raw mineral wool forming material is melted and the molten material shredded by means of a high pressure steam jet or the like into a multiplicity of fibers. The fibers are carried, while suspended in an air stream, into a collecting chamber where they settle from the air stream onto the bottom of the chamber, the latter usually comprising a continuously moving conveyor. Suitably a binder is added adjacent the place of formation of the fibers, the fine particles of binder being carried into the blow chamber with the fibers and settling with them to become intermingled therewith throughout the thickness of the felt. Thereafter the felt is subjected to treatment to set the binder, preferably while the felt is under compression, whereby a resilient, compressible product is formed.

Although the product, formed as briefly described above, has been widely used, it is found that particularly for some purposes, it does not have certain desired properties. The fibers falling onto the conveyor or onto the previously deposited fibers assume positions generally parallel to the conveyor, this being accentuated by the forward movement of the conveyor. As a result, the fibers lie predominantly in a series of planes generally parallel to the faces of the felted product imparting a high degree of compressibility thereto. Also, due to the resiliency of the felted material and the difficulty of achieving uniform distribution of the fibers throughout the width of the felt, variations in density and thickness of the felt occur. It has been found, for example, that the thickness cannot be controlled successfully within a plus or minus 15 percent of that desired.

The principal object of the invention is the provision of a method and apparatus which will produce a felt of uniform thickness and of greater resistance to compression and delamination.

Another object of the invention is the provision of a method and apparatus of the above referred to type which will permit any predetermined thickness of the material to be obtained within close limits.

A further object of the invention is the provision of a method and means for reorienting the fiber arrangement of the known type of mineral wool products, and more specifically to produce a material of this type including facing sheets applied over both surfaces of the fibrous body.

My invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description thereof which is to follow and to the accompanying drawing in which:

Fig. 1 is a diagrammatic side elevational view of an apparatus in accordance with the invention and to be employed for performing the method;

Fig. 2 is a diagrammatic top plan view of the apparatus of Fig. 1;

Fig. 3 is a detail view on an enlarged scale of a portion of the apparatus of Fig. 1;

Figs. 4*a*, 4*b*, and 4*c* are sectional views on an enlarged scale taken on the lines 4*a*—4*a*, 4*b*—4*b* and 4*c*—4*c* respectively, of Fig. 2.

Referring now to the drawing, opposed conveyors 10 and 12 supported on driven rolls 16 and 18 are shown for supporting and causing forward movement of a felt 14. The felt, as previously referred to, is suitably one in which the fibers lie predominantly in planes parallel to the faces of the felt, for example, a mineral wool felt made by disintegrating a stream of molten material into fibers and collecting the fibers on a conveyor forming the floor of a blow chamber. Preferably the felt includes a suitable binder and at the stage illustrated in Fig. 1, the felt or sheet 14 has been compressed, and the binder set. In the preferred embodiment, felted sheet 14 is supported directly and continuously from its place of formation to conveyors 10 and 12 although previously formed and stored felts may be used if desired.

Adjacent the forward ends of conveyors 10 and 12 are a plurality of sharp edged disks or saws 20 keyed or otherwise secured to a shaft 22 for rotation therewith, the disks constituting slitting or cutting means. Preferably the mounting of the disks is such that the distances between them may be adjusted when desired.

Forwardly of the slitting disks are a plurality of troughs 24 each made up of thin metal or the like. One side of the rearward end of each trough is closely adjacent and in alignment with a disk. Troughs 24 are twisted through an angle of 90 degrees as illustrated more particularly in Fig. 3 and their forward ends are fanned out as shown in Fig. 2 to define spaces between the ends of the several troughs. The troughs comprise an L shaped portion 26 and an additional flange 27 defining an opposite side over the greater length of the trough. Flange 27 is preferably of less width than the sides of the L shaped portion and tapers to zero width adjacent the ends of the trough as illustrated in Figs. 3 and 4*c*.

Forwardly of troughs 24 are opposed upper and lower conveyor belts 28 and 30, respectively, travelling in the direction indicated by the arrows on driven rolls 29 and 31 respectively. Upper conveyor belt 28 is suitably mounted for adjustment relatively to conveyor 30. Associated with conveyors 28 and 30 are compression belts 32 carried

by rolls 34 and 36, the latter rotating on vertical axes. Belts 32 are suitably formed of thin steel strips or the like, the strips being of a width to be accommodated between the adjacent reaches of belts 28 and 30 in any position of vertical adjustment of belt 28. The inner reaches of belts 32 lie between the adjacent reaches of belts 28 and 30 and converge as illustrated to provide edge compressing means. The convergence of the belts may be obtained as shown by employing rolls or pulleys 36 of greater diameter than rolls 34 or alternatively the rolls may be of the same or similar diameter and their axes lie in converging planes.

In a line with belts 28 and 30 are another pair of opposed belts 38 and 40 supported on rollers 39 and 41 respectively and travelling in the same direction as those previously described as indicated by the arrows. Belt 40 is suitably mounted for adjustment relative to the lower belt 38 similarly as belt 28. Above belt 40 there is provided a supply 42 of sheet facing material 44, the supply comprising a spool of the material mounted on a spindle 46. A similar spool or other supply of flat semi-rigid metal or composition sheets of facing material 48 is mounted in any suitable location below the conveyors. Coating applying devices such as spray heads 47 and 49 connected to any suitable source of adhesive supply, are located in position to coat the facing material as it is drawn from the supplies. Forwardly of conveyors 38 and 40 are edge slitting disks 50, keyed or otherwise secured to a shaft 52 for rotation therewith. If desired, shaft 52 may carry additional slitting disks to divide the sheet longitudinally into strips or batts of any desired width.

The several conveyors are driven by any suitable means (not shown) and at the same speeds. One main driver may be employed or if desired separate drivers for each set of conveyors may be used. The shafts 22 and 52 supporting slitting disks 20 and 50 are rotated at high speed by suitable driving means which may constitute the same means employed to drive the several conveyors.

In the operation of the apparatus described above and in carrying out the preferred method of the invention a sheet or blanket of felted fibrous material, suitably a mineral wool blanket, formed as previously described and with the fibers lying predominantly in planes parallel to the face of the felt, is conveyed directly from the felt forming operations to conveyor 10 by which it is carried into the bight between conveyor 10 and conveyor 12 and forced forwardly against the slitting disks 20, which divide it into a plurality of strips 54.

The width of the strips is determined by the spacing of the slitter disks 20 and is made substantially equal to the desired thickness of the finished product. The strips subdivided from the sheet 14 by the slitter disks enter the troughs 24 and are twisted through an angle of 90 degrees as they travel through the troughs to cause their slit surfaces to assume the positions of the top and bottom faces of the strips as disclosed particularly in Figs. 4a, 4b, and 4c. Thus it will be noted from an examination of these figures that the side A, which immediately after the slitting operation constituted the upper face of the strip, is gradually rotated in the trough until it becomes a side edge of the strip (see Fig. 4c). It will be understood that although a particular means for rotating the strips through the 90 degree angle has been shown other equivalent means may be employed for this purpose.

As the strips leave the troughs, with their slit faces forming their upper and lower surfaces, they are picked up by conveyors 28 and 30, which are adjusted a sufficient distance apart to confine the strips therebetween and provide a frictional contact against both surfaces. As the strips are moved forwardly by these conveyor belts they are subjected to lateral movement by pressure belts 32 which converge as illustrated in Fig. 2 to reassemble the strips in edgewise contiguous relationship and to preferably place them under at least some degree of lateral compression. The sheet or mat composed of the combined strips then passes into the bight between belts 38 and 40 at which point surfacing sheets 44 and 48 are applied. The surfacing sheets may comprise any suitable material for this purpose, for example, kraft paper, a felt of the type of sheathing felt, metal sheets, a woven cloth or the like and may carry any suitable impregnant or coating material or may be of a type to receive decorative coatings. The surfacing material may be supplied in continuous lengths from the supply rolls, the upper roll being shown at 42, or may be fed in successive sheets from any suitable supply means. Surfacing sheet 44 for the upper face of the felted mat is supplied with an adhesive coating as by the spray head 47 and is then passed between the upper conveyor 40 and the mat whereby it is pressed against and adhesively secured to the felted mat. Surfacing sheet 48 is similarly supplied with an adhesive coating and applied to the lower face of the felted mat. During the travel of the material between the conveyors the adhesive is set or substantially so. Any suitable type of adhesive may be employed. The sheet or mat then passes to the slitters 50 where its edges are trimmed and it is divided into strips if desired. The material may then pass to cut-off devices to divide it into units of the required length and to any further finishing and handling operations.

By the instant invention the fiber arrangement of the felted material is reoriented to critically modify certain characteristics of the felted sheet. The original material was of a laminar structure, as previously pointed out, with the laminations lying substantially parallel to the faces of the felt. Consequently, the material was subject to comparatively easy delamination. Also, due to the arrangement of the fibers predominantly parallel to the faces of the sheet, the material was highly compressible. In the product of the instant invention, at least a high percentage of the fibers lie in planes extending substantially vertically to the faces of the felted sheet whereby both the compression resistance and resistance to delamination are greatly increased. Inasmuch as the thickness of the material is determined by the setting of slitters 20, this dimension may be fixed as desired and will be uniform throughout. Thus variations due to uneven distribution of the fibers in the blow chamber and the like do not seriously affect the dimensions or other essential characteristics of the finished product. The surfacing sheets provide smooth impact resistant faces for the product and may carry suitable decorative finishes.

Having thus described my invention in rather full detail, it will be understood that these details need not be strictly adhered to but that the various changes and modifications will suggest themselves to one skilled in the art, all falling within

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the scope of the invention as defined by the subjoined claims.

What I claim is:

1. A method of making a product from a sheet of felted fibers in which the fibers lie predominantly in planes parallel to the faces of the sheet, said method comprising dividing the sheet by slits extending through the sheet at substantially right angles to the major faces of the sheet into a plurality of strips of predetermined width, rotating said strips through an angle of 90° and recombining said strips into a substantially unitary body.

2. A method of making a uniform thickness product from a sheet of felted fibers in which the fibers lie predominantly in planes parallel to the faces of the sheet, said method comprising dividing the sheet into a plurality of strips of predetermined substantially equal width by slits extending through the sheet and substantially at right angles to the major faces thereof, rotating said strips until their slit edges lie in the same planes and assembling said strips in contiguous relationship with their slit edges lying in said planes.

3. A method of making a product from a sheet of felted mineral wool fibers in which the fibers lie predominantly in planes parallel to the faces of the sheet, said method comprising dividing the sheet into a plurality of strips of predetermined width by slits extending through the sheet at substantially right angles to the major faces thereof, rotating said strips through an angle of 90°, assembling said strips into continguous relationship and adhesively applying a facing sheet to a surface of said assembled strips.

4. A method of making a substantially uniform thickness product from a sheet of felted mineral wool fibers in which the fibers lie predominantly in planes parallel to the faces of the sheet, said method comprising dividing the sheet into a plurality of strips of predetermined equal width by slits extending through the sheet at substantially right angles to the major faces thereof, rotating said strips until the slit edges thereof lie in the same planes, assembling said strips into contiguous relationship while maintaining said faces in said planes and adhesively securing facing sheets to said assembled strips.

5. The continuous method of making a uniform thickness product from a sheet of felted mineral wool fibers in which the fibers lie predominantly in planes parallel to the faces of the sheet, said method comprising dividing the sheet continuously with its formation into a plurality of strips by slits extending through the sheet at substantially right angles to the major faces thereof, moving said strips forwardly, twisting said strips through an angle of substantially 90° during their forward travel to rotate their slit edges into common planes, assembling said strips in edgewise contiguous relationship and adhesively securing facing sheets to said assembled strips.

6. An apparatus for reorienting the fibers in a felted fibrous sheet comprising a plurality of equally spaced slitters in alignment with a sheet delivering means, means to rotate the strips issuing from the slitters through an angle of 90° and to place said strips in spaced relationship with their slit edges lying in the same planes, and means for assembling said strips into contiguous relationship while maintaining their slit edges in said planes.

7. An apparatus for reorienting the fibers in a felted fibrous sheet comprising a plurality of equally spaced slitters in alignment with a sheet delivering means, means to rotate the strips issuing from the slitters through an angle of 90° and to place said strips in spaced relationship with their slit edges lying in the same planes, means for assembling said strips into contiguous relationship while maintaining the slit edges of said strips in said planes, and means for applying sheet material to opposite faces of said combined strips.

8. An apparatus for reorienting the fibrous structure in a felted fibrous sheet comprising a plurality of slitters equally spaced across the width of said sheet, means to rotate the strips of said sheet issuing from the slitters through an angle of 90° and to place said strips in spaced relationship with their slit surfaces in the same planes, opposed conveyors for contacting said slit surfaces and for moving the strips forwardly, and pressure means for forcing the strips laterally into contiguous relationship as they are moved forwardly by said conveyors.

9. An apparatus for reorienting the fibrous structure in a felted fibrous sheet comprising a plurality of slitters equally spaced across the width of said sheet, means to rotate the strips issuing from the slitters through an angle of 90° and to place said strips in spaced relationship with their slit faces in the same planes, opposed conveyors contacting said faces of said strips for moving the same forwardly, pressure means for forcing the strips into contiguous relationship as they are moved forwardly by said conveyors, and means for adhesively securing sheet material to opposite faces of said contiguous strips.

10. An apparatus for modifying a felted fibrous sheet, the apparatus comprising a plurality of slitters equally spaced across the width of said sheet, means to rotate the strips issuing from the slitters and to place said strips in spaced relationship with their slit faces in the same planes, opposed conveyors contacting said faces of said strips for moving the strips forwardly, opposed belts extending between said opposed conveyors for moving said strips laterally into contiguous relationship, and means for securing a surfacing sheet to a face of said contiguous strips.

11. A method of making a uniform thickness sheet product from a sheet of felted fibers in which the fibers lie predominantly in planes parallel to the faces of the sheet, said method comprising dividing the sheet into a plurality of strips of predetermined, substantially equal width by slits extending through the sheet, rotating said strips until their slit edges lie in the same planes, and assembling said strips in contiguous relationship with their slit edges lying in said planes to form opposite surfaces of the assembly.

12. A method of making a uniform thickness sheet product from a sheet of felted fibers in which the fibers lie predominantly in planes parallel to the faces of the sheet, said method comprising dividing the sheet into a plurality of strips of predetermined, substantially equal width by slits extending through the sheet, rotating said strips until their slit edges lie in the same planes, assembling said strips in contiguous relationship with the slit edges lying in said planes to form the opposite surfaces of the assembly, and adhesively applying facing sheets to said surfaces.

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