

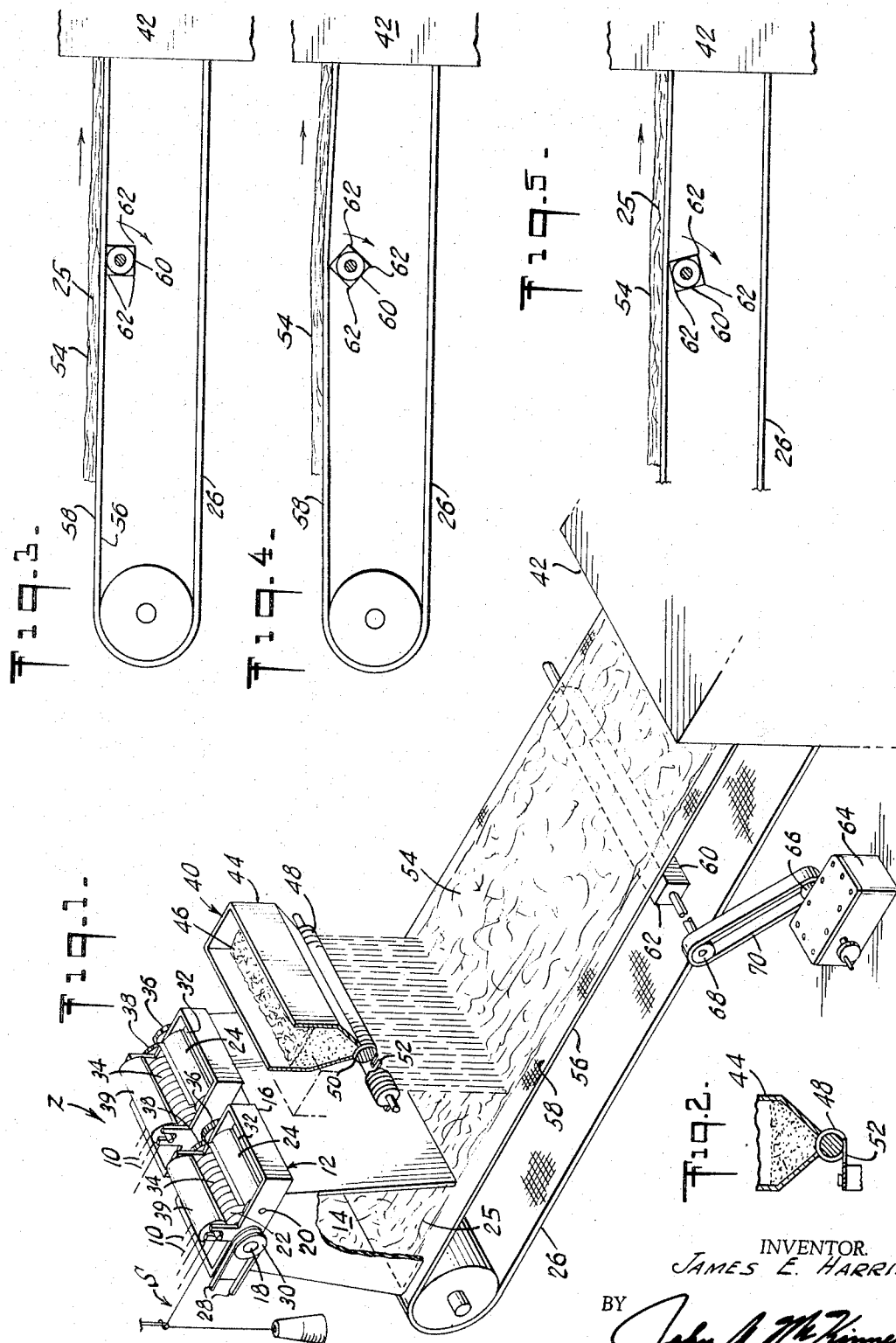
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METHOD OF TREATING FIBERS WITH DRY BINDER MATERIAL

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METHOD OF TREATING FIBERS WITH DRY BINDER MATERIAL

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This invention relates to method for dispersing pulverulent material in a fibrous base. More particularly this invention relates to method for dispersing powdered binder material in glass fiber blankets.

Fibrous base materials bound with various fillers and binder materials have many uses, such as insulation, acoustical and decorative panels, etc. It is desirable to have the filler or binder material dispersed uniformly throughout the base to enhance the quality and appearance of the final product. It is common practice to introduce binders such as phenolic resins into mats or batts of fibrous materials as the mats are formed or hold the fibers together. In the forming of glass fiber mats after the dry binders are added the mats are passed through a curing oven to set the binder. If the binder material is not uniformly dispersed part of the mat, usually the top, is "rich" with binder and when cured becomes more stiff than the remainder of the mat and makes the mat difficult to manipulate.

It is known in the art to add dry binders or other pulverulent material to fibrous mats by applying suction to the underside of a foraminous travelling apron upon which the mat is formed. With such methods excessive binder, and some of the loose fibers are entrained in the suction air stream. The cost of reclaiming the binder carried to the collection box is substantial. Another disadvantage of such systems is that the loose ends of the fibers at the bottom of the layer become entrained in the apertures of the foraminous apron. As the mat is cured in the curing oven the loose ends are "caked" to the apron and consequently the mats are more difficult to remove.

The principal object of this invention is to improve the dispersion of pulverulent material in a fibrous layer base.

A further object of the present invention is to decrease the amount of pulverulent material wasted as a result of applying an excessive amount of such material to insure dispersion throughout a fibrous base.

The present invention is embodied in method employing elevating means to intermittently raise the surface supporting a layer of fibrous material to which pulverulent material has been added and lowering the surface thereby shaking the layer and causing the pulverulent material to filter through the layer. Preferably, the fibrous layer is formed by depositing the fibrous material in random orientation upon a resilient travelling apron, such as a foraminous conveyor to form a layer thereon, which apron is intermittently raised and lowered by eccentric means. The pulverulent material, which may be in the form of dry binder, is continuously deposited across the width of the formed layer as the layer is advanced thereby from a source such as a hopper. The pulverulent material may be comprised of particles of various but graded sizes so as to become entrapped by the fibers at various levels. As the layer is further advanced it is subjected to shaking by virtue of the raising and falling of the travelling apron. It is important that the apron be sufficiently heavy to over-

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come any tendency to be continuously vibrated by harmonic motion. Otherwise, most of the material will filter completely through the layer and settle on the apron or be lost.

This invention will be better understood from the following description of a preferred embodiment taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

FIG. 1 is a schematic pictorial view of mat forming apparatus utilizing the pulverulent material dispersing device of this invention;

FIG. 2 is an enlarged cross-sectional view of the pulverulent material feed roll together with cooperating means for removing the material therefrom; and

FIGS. 3-5 are schematic representations of the relative positions of the mat apron and the cam raising means for shaking the apron.

The present invention will be described herein as utilizing chopped glass strands, however such description is for the purpose of illustrating one embodiment. It will become apparent that this invention may be employed equally well with blown staple glass fibers and with other fibrous materials.

Referring to FIG. 1, a source S of continuous strand is fed to a severing zone Z where the individual strands 10 are cut or chopped by suitable cutting means 12 into fibers 14. The fibers 14 are deposited in random fashion and form a layer 25 upon travelling apron 26, which may be in the form of an endless formaminous conveyor belt.

The cutting means 12 may be any suitable type but is illustrated to comprise a frame 16 in which shafts 18 and 20 are journaled. Shafts 18 and 20 support rolls 22 and 24, respectively. The roll 22 may be driven by a motor (not shown) through belt 28 and pulley 30. A plurality of cutters or knives 32 are spaced about and are supported by roll 24. The roll 24 may be adjustably journaled so as to provide means for adjusting its cooperative relation with the surface 34 of roll 22, which surface 34 is preferably yieldable. The roll 24 may be driven through gears 36 and 38. A third roll 39 may also be provided to assist in directing the strands 10 between rolls 22 and 24. While the fibers 14, or cut strands, are shown to pass downwardly by gravity onto apron 26 it will be understood that the fibers 14 may also be projected by a pressurized air stream, or other suitable means, to a mat forming station remote from the severing zone Z.

It will also be understood that any suitable number of cutting means 12 may be employed in connection with a single mat forming machine.

After the layer 25 is formed on apron 26, it is carried to further treating stations such as dry binder application station 40, forming rolls (not shown) to press the mat to the desired uniform configuration or thickness, and subsequently to oven 42 where the dry binder is activated or cured.

At the dry binder application station 40, a hopper 44 containing a supply of pulverulent dry binder 46 is positioned superjacent to the apron 26. At this stage the fibers as carried on apron 26 are in a dry fluffed bulk state. In connection with the hopper 44 is a rotating shaft 48 forming escapement means for feeding the binder 46 or other pulverulent material at preferred and controlled rates. As the shaft 48 rotates a small portion of the pulverulent material is picked up out of the hopper 44 by the grooves 50.

Spring-like fingers 52 scrape the material out of the grooves 50 as shaft 48 is rotated for gravity feed to the top surface 54 of the layer (FIG. 2).

Extending across the bottom surface 56 of the top flight 58 of apron 26 is a rod 60 of substantially square cross section forming eccentric means to intermittently jar or shake the apron 26 together with the layer 25 of fibers carried thereon. The corners 62 of the square rod 60 form cam surfaces 62 for engaging and raising the apron 26 upwardly as may be viewed in FIG. 4. During the intervals between cam surfaces 62 (FIG. 5) the apron 26 is permitted to fall by gravity to its neutral position which is normally horizontal (FIG. 3). The alternate raising and falling of the apron 26 shakes the fibrous layer 25 and causes the pulverulent binder 46 to filter downwardly through the layer 25.

The rod 60 is preferably rotated by a variable speed drive unit 64 through pulleys 66 and 68 and belt 70. The use of a variable speed drive provides control of the frequency at which the apron 26 rises and falls and hence of the depth to which the pulverulent material filters through the fibrous layer.

Alternatively, the depth to which the pulverulent material filters through the fibrous layer can be controlled by varying the size of the rod 60; i.e., with layers of increased thickness, rods of increased size can be provided to increase the magnitude of shaking action.

It will be apparent that eccentrics having cross sections other than a square and that a series of eccentrics in tandem may also be effectively employed.

It is important that the apron 26 be sufficiently heavy to overcome any tendency for harmonic motion to be transmitted throughout its length. With harmonic motion the layer would be unduly shaken and an excessive amount of the pulverulent material will filter completely through the fibrous layer and be lost or else provide a binder rich surface at the bottom of the layer.

To provide a further control of the filtering of the pulverulent material through the fibrous layer, it is preferred to grade the particle size of the pulverulent material and employ those sizes which are compatible with the sizes of the interstices of the fibrous layer. Different sizes may be advantageously employed together.

In order to provide a further disclosure of this invention, the following data is presented showing the number of revolutions of 1½ inch square cam which resulted in optimum dispersion of dry resinous binder for the indicated weights of mats being advanced at the indicated speeds. Because of the random dispersion of the fibers some areas are thicker than others; therefore, the size of mats are defined in ounces per square foot. However, a 1½ ounce per square foot mat has a nominal thickness of ⅜ inch and the other indicated sizes have a proportional nominal thickness.

Size, oz./ft. ²	Conveyor Speed, ft./min.	Cam, r.p.m.	Vib./ft. (4×r.p.m./ ft./min.)
¾	58	0	0
1	43.5	70	6.7
1¼	25	95	15.2
1½	31	105	13.1
3	17.4	130	29.8
1½	26	85	13.1
1½	22	80	14.5
1½	23.5	80	13.6
1½	25.5	90	14.1
1½	24	85	14.2
1½	30	110	14.7

It should be noted that the ¾ ounce mat having a nominal thickness of ⅜ inch did not require any shaking and that as the mat sizes increase the number of vibrations required to provide satisfactory dispersion of the binder substantially increased.

It will be understood that the details given are for the purpose of illustration, not restriction, and that variations within the spirit of the invention are intended to be included in the scope of the appended claims.

What I claim is:

1. In the method of treating glass fibers with binder material, the steps consisting essentially of:

(a) depositing a mass of glass fibers in dry layer form upon a traveling support;

(b) dispersing pulverulent dry binder material over the top of the formed layer;

(c) intermittently raising said support, with said layer thereon, from its neutral position and permitting said support and said layer to fall, thereby further dispersing the binder material through the thickness of said layer; and

(d) maintaining the integrity of said formed layer while it is further advanced to the step of curing the dry binder material contained therein.

2. The method as described in claim 1, wherein: the frequency of the rising and falling steps is controlled to preferentially control the extent of dispersion.

3. The method as described in claim 1 wherein: said pulverulent dry binder material comprises graded particles of various sizes.

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