Dec. 17, 1957 W. A. HUNTER ET AL 2,816,327

BLENDING OF TEXTILE FIBROUS MATERIALS

Filed Aug. 6, 1952 4 Sheets-Sheet 1

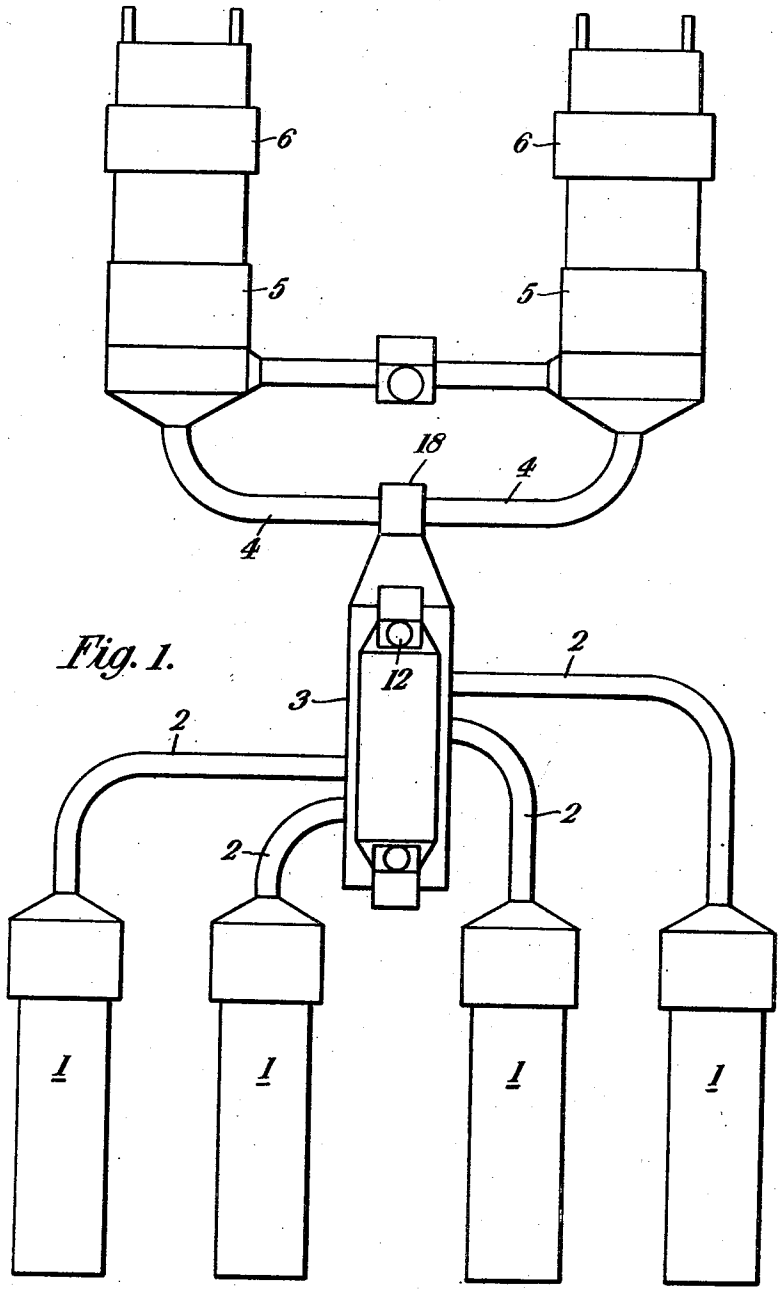


Fig. 1.

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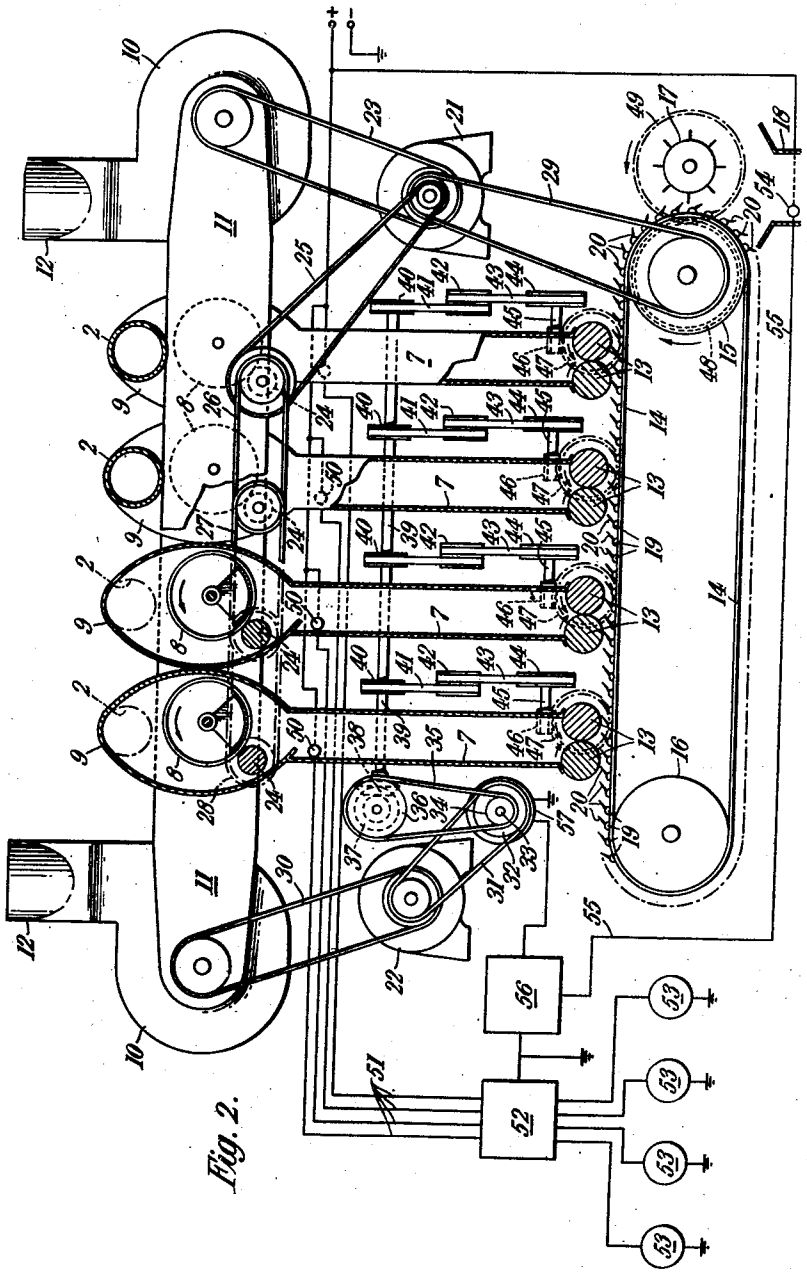

Fig. 2.

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BLENDING OF TEXTILE FIBROUS MATERIALS

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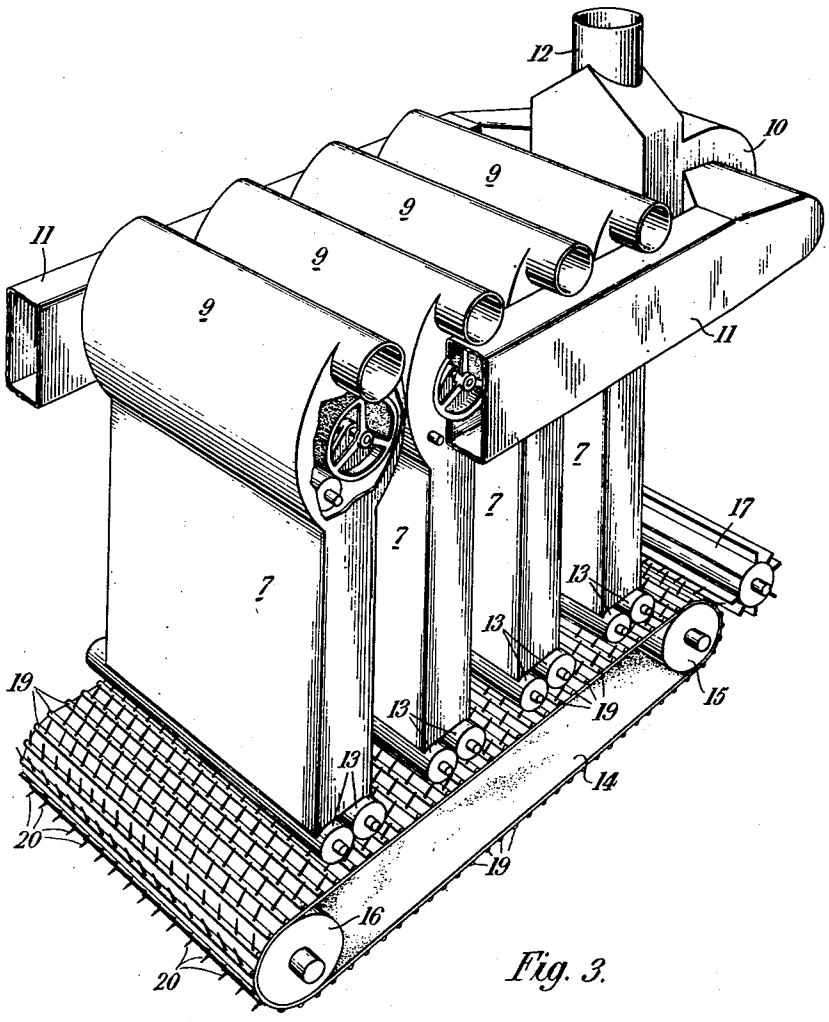


Fig. 3.

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BLENDING OF TEXTILE FIBROUS MATERIALS

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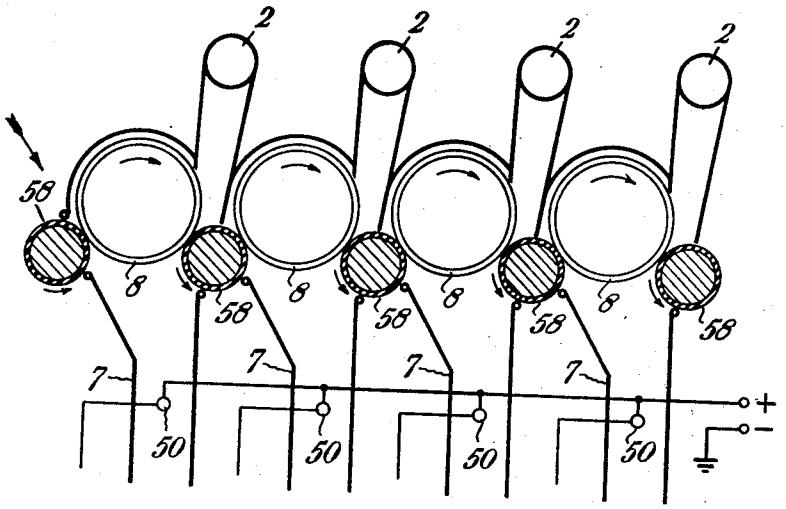


Fig. 4.

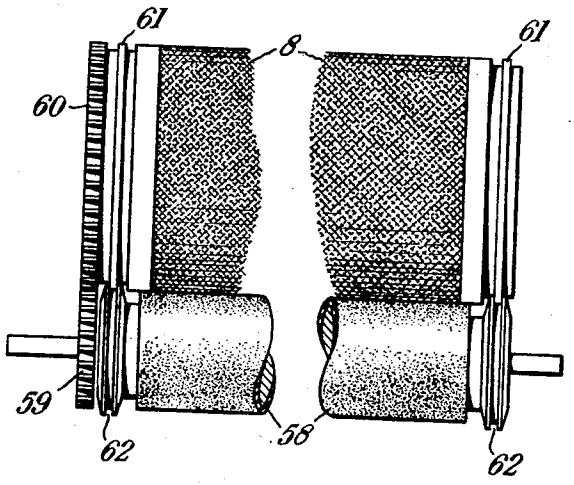


Fig. 5.

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2,816,327

# BLENDING OF TEXTILE FIBROUS MATERIALS

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Claims priority, application Great Britain August 16, 1951
9 Claims. (Cl. 19—14.6)

The invention is concerned with the blending of textile fibrous materials, i. e. the intimate mixture of fibres of different kinds, grades, qualities or other characteristics, as may be required to suit specific manufacturing requirements. Heretofore it has been customary to produce a particular blend of fibres by the so-called batch method, according to which a measured quantity of each of a number of different ingredients (which term is employed herein to denote fibers of different kinds, grades, qualities or the like) is delivered separately into a mixing chamber either so that they occupy successive layers or are piled in adjacent masses, whereafter the contents of the chamber are mixed together until the whole mass is adjudged to have been sufficiently thoroughly intermingled. Where the mass is piled in layers it is in some instances considered that a satisfactory blend can be obtained by raking fibre from top to bottom of the front of the pile so that a section is obtained. Such methods of blending are necessarily imperfect in that the production of anything approaching a homogeneous mixture of fibres cannot be assured, with the result that a large number of sliver doublings on subsequent machines is essential to produce yarns and fabric in which the blend is of satisfactory evenness. Another serious disadvantage of the "batch" method of blending arises from the fact that it is by its very nature intermittent and is therefore unsuited to a continuous mode of yarn production.

The present invention is directed to the provision of an improved method of, and apparatus for, blending different fibrous ingredients with an intimacy of admixture such that in the resultant blend the several ingredients are dispersed throughout the mass so nearly homogeneously that their individual characteristics are incapable of being detected save by careful analysis, thereby producing a yarn or fabric possessing a very high degree of uniformity. It is a further object of the invention to provide homogeneous blending at such an early stage in the processing of the fibers that much less sliver doubling (for the purpose of blending) on subsequent machines is necessary and so that in some instances the number of subsequent machines may be reduced.

The method of blending textile fibrous materials in accordance with this invention consists in feeding a plurality of ingredient materials to individual stations, at each such station feeding the ingredient forward at a measured rate in sheet formation, subjecting the leading fringe of each sheet to an operation which is effective to detach therefrom finely divided tufts of ingredient, the detaching operation being performed by means of a succession of elements acting on each fringe in turn so that the ingredients respectively composing said fringes are received by the detaching elements and fed forwardly thereby in the form of superposed tenuous layers of tufts.

The invention also provides a method of processing textile fibrous material, which method consists in subjecting a plurality of ingredient materials individually to a preliminary opening operation, feeding each opened



ingredient to a separate station, delivering the ingredient from each such station in sheet formation at a measured rate, subjecting the leading fringe of each emergent sheet to a combined impaling and detaching operation performed by a succession of elements acting upon each fringe in turn, and conveying the resultant mass of superposed tenuous layers of detached tufts to a further opening stage.

A blending apparatus according to the invention comprises, in combination with a conveyor, an assembly of a plurality of measured-rate delivery units respectively adapted successively to feed to said conveyor a metered output of an ingredient supplied to each thereof, said conveyor having spikes which cooperate with the metering elements of each unit in detaching the output thereof in the form of finely divided tufts, and the arrangement being such that the conveyor spikes are charged with the total output of the units in the form of tufts collected in turn from said units.

The invention further provides an assembly of gravity feed-trunks, means for delivering each ingredient of the blend to one of such trunks, means for progressively discharging the contents of each trunk in sheet formation, means for controlling the rate of such discharge and means operating upon the emergent fringe of each ingredient in turn to execute an impaling action thereon and to detach the fibres thereof, as they are discharged, in the form of finely divided tufts, such last-mentioned means also serving to receive the tufts in layer formation and to convey the same to a receptacle.

In a preferred embodiment of the invention the metering elements of each unit consists of a pair of rollers and the conveyor takes the form of a lattice bearing closely spaced upstanding spikes which execute an impaling action upon the fibrous material as it is nipped by said rollers and which are effective to detach the material therefrom in finely divided tuft formation.

Such an apparatus is capable of being operated continuously although it is equally applicable to an intermittent process, and it will be evident that where a different kind, grade or quality of textile fibre is supplied to each of the measured-rate delivery units, the effect of the apparatus is to produce a blend in which the several ingredients will be substantially homogeneously dispersed throughout the same, a result which is attributable to the minuteness of the component tufts which are detached by the lattice spikes and the layered disposition of such tufts upon the lattice as it travels past the delivery units.

The nature of the invention and the manner of carrying the same into effect is hereinafter more fully described with reference to the accompanying diagrammatic drawings, of which Fig. 1 is a schematic representation of a possible lay-out of a blending apparatus in relation to the apparatus by which it is supplied with different ingredient materials and the processing apparatus to which the blended mixture is delivered. Fig. 2 is a partly sectional elevation of one form of blending apparatus according to the invention, and Fig. 3 is a perspective view thereof, the several driving gears and control circuits being omitted. Fig. 4 is a fragmentary sectional elevation depicting the upper parts of the measured-rate delivery units in a modified form of blending apparatus, and Fig. 5 is a detail view (drawn to a larger scale), illustrating the means employed to support and drive the condenser cages in the embodiment shown in Fig. 4, when viewed in the direction of the arrow, the surrounding case being removed.

In the lay-out illustrated in Fig. 1, each of the elements designated with the reference numeral 1 is a hopper feeder apparatus conveniently of the kind which forms the subject of United States Patent No. 2,666,956. Each such hopper feeder 1 is fed with one of the different ingredients of textile fibre which it is desired to blend, and each dis-

charges its output into a pneumatic delivery duct 2 by which the fibres are conveyed in well-known fashion to the inlet of one of the measured-rate delivery units of the blending apparatus, which apparatus is indicated in Fig. 1 by the general reference numeral 3. The blend produced by said apparatus 3 is conveyed by pneumatic feed ducts 4 to one or more combined sets of hopper feeders 5 and intensive opening machines 6, preferably of the kind described in British Patent No. 650,157. The several hopper feeders 1, 1 should be adjusted so that the respective outputs discharged to the blending apparatus are of a uniform degree of openness, and thus in the most suitable condition for accurate metering.

Referring now to Fig. 2, it will be seen that the blending apparatus, indicated in Fig. 1 by the reference numeral 3, comprises a gang or assembly of measured-rate delivery units each of which includes a vertical gravity-feed trunk 7 at the head of which is a conventional rotary condenser cage 8. Said cage 8 is enclosed in a casing 9 which is entered by one of the pneumatic feed ducts 2 at the delivery end thereof, and all the cages 8 are aspirated by means of fans 10, 10 to which connection is made with said cages by manifolds 11, 11, and the outlets of which are seen at 12, 12.

The otherwise open aperture at the base of each gravity-feed trunk 7 is controlled by a pair of metering rollers 13, 13, which are arranged to rotate in contrary directions so as to discharge the contents of the trunk at a rate governed by the speed of rotation of the rollers.

The several trunks 7 are assembled with their respective discharge points side-by-side in alignment, so that their respective metering rollers 13 are contained in a common horizontal plane and located at equally spaced intervals, above the upper horizontal course of a high-speed lattice conveyor 14, which is trained over driving rollers 15, 16, and with which there is associated a stripper element 17 by which material conveyed on the lattice is removed and directed into a receptacle which may take the form of the two-way distributor 18 shown in Fig. 1, which delivers to the hoppers 5 through the ducts 4. Said lattice bears closely-spaced cross-members 19 which are furnished with rows of spikes 20 inclined in the direction of travel of the lattice. Said spikes 20 should be disposed over the lattice surface in a uniformly staggered formation so as to avoid an unduly marked tracking effect. Furthermore, said spikes are set with their tips so close to the metering rollers 13 that by the impalement by the former of the fringe of material which projects between said rollers (as will be understood from the following description), said spikes are individually charged with minute tufts of fibres collected in turn from the fringe at the metered discharge point of each trunk 7.

The several moving parts of the apparatus are driven from two electric motors 21, 22. The shaft of the motor 21 is geared to one of the fans 10 by the belt 23, to the condenser cage driving rollers 24, 24 by the belts 25, 26, 27 and 28, and to the roller 15 of the conveyor lattice 14 by the belt 29. The shaft of the motor 22 is geared to the other of the fans 10 by the belt 30 and to one of each of the pairs of metering rollers 13, 13 through the belt 31, a pulley 32, a shaft 33, a pulley 34, a belt 35, a pulley 36, bevel gears 37, 38, a shaft 39 and individual belt-drives each of which includes a pulley 40, a belt 41, a variable-speed gear 42, a belt 43, a pulley 44, a shaft 45, and worm and worm-wheel gears 46, 47. The stripper 17 is conveniently geared to the roller 15 by spur-gearing 48, 49.

The delivery rate of the metering rollers 13, 13, may be regulated separately at each unit by suitable adjustment of the variable-speed device 42.

The ingredient fibre received from the relative duct 2 by each cage 8 is condensed thereon and caused to be deposited within the trunk 7, where a substantially constant head is maintained by a photo-electric detector cell 50 which is sensitive to the instantaneous quantity of material in the trunk and which is connected by the line 51 to suitable electronic apparatus 52 serving to control a speed regulator (indicated conventionally at 53) associated with the delivery element of the hopper feeder 1, the arrangement being such that the rate of output of the hopper feeder is adjusted in accordance with the rate at which the fibre in the trunk 7 is being discharged by the metering rollers 13.

As has already been explained, the ingredient of each trunk 7 is discharged by the rollers 13 (at a rate determined by the setting of the variable speed device 42) so that it emerges in the form of a downwardly-depending sheet the fringe whereof is continuously combed by the tips of the spikes 20 of the lattice 14. The tufts of fibre which are impaled upon the lattice spikes 20 at each successive pair of metering rollers 13 compose a tenuous layer, so that when the spikes reach the stripping point at the conveyor roller 15 the lattice is carrying as many superposed layers of different ingredients as there are delivery units in the blending apparatus.

The composite mass of layered tufts is removed from the lattice by the stripper 17 and discharged into the distributor 18, whence the blended material is conducted to the hopper feeders 5 and intensive opening apparatus 6. (If desired, the hopper feeders 5 may be omitted, in which case the apparatus 6 is fed directly from the hopper 18.) It is convenient to provide in the distributor 18 an electrical contact 54 which is connected by a line 55 to electronic apparatus 56 serving to control a clutch 57 which is included in the shaft 33 between the pulleys 32 and 34 in the drive of the metering rollers 13, 13, the arrangement being such that in the event of the contact 54 being operated, e. g. in the manner hereinafter described, the metering rollers 13, 13 in each trunk 7 will be arrested to discontinue delivery of material to the lattice. A photo-electric cell situated in each hopper feeder 5 is arranged to actuate suitable mechanism in the distributor 18 when the desired level of material in a feeder is reached, so as automatically to cut off delivery from the distributor to that feeder. Actuation of both photo-cells is arranged to operate the contact 54 and to discontinue the supply to the distributor. The mechanism in the distributor 18 may be of known form incorporating electrically-controlled doors connected in circuit with the photo-cells in the hopper feeders.

The adjustment of the variable-speed units 42, by which it is possible to effect a variation in the gear-ratio between the pulleys 40 and 44 in the metering roller drive, enables the rate of delivery of each ingredient to the blending lattice 14 to be determined as may be necessary to provide any desired proportional admixture in the blend of materials discharged into the distributor 18. The several metered delivery units 7 may be calibrated for use with specific kinds of fibre, so that irrespective of its density the required proportion of an ingredient in a given blend may be achieved merely by regulating the speed of the metering rollers 13, 13 of the trunk 7 in question, by an adjustment of the relative unit 42.

In the modified embodiment illustrated in Figs. 4 and 5, the condenser cage 8 of each of the gravity-feed trunks 7 is arranged to float upon the surfaces of a pair of rubber-covered rollers 58 which impart the appropriate direction of rotation to the cage through spur gearing 59, 60 (Fig. 5). Said rollers 58, of which the inner ones each serve partially to support two adjacent cages 8, constitute means for sealing the spaces between the cages and those parts of the casings lying between the ducts 2 and the trunks 7. The cages are provided with circumferential tongues 61 which are received in grooved rims 62 upon the shafts of the rollers 58 and which thereby serve to prevent endwise movement of the cages during their rotation.

With regard to the circuit of the photo-electric detector cells 50, and also that of the photo-electric cells 54 in the feeders 5, which are employed in both the aforedescribed embodiments, it is desired to employ circuit

apparatus in each case which will provide an asymmetrical delay in the operation of the control mechanism, in order (*a*) that by ensuring a rapid action of the control when the level of the material in the trunk or hopper falls, hunting may be prevented, and (*b*) to avoid the operation of the control merely by reason of the intermittent interruption of the energising light beam by the material falling into the trunk or hopper.

If desired, the hopper feeders **1** may be replaced by other appropriate opening machinery having a feed component which can be stopped and started intermittently by the photo-electric apparatus which is associated with the gravity-feed trunk **7** of the blending apparatus for the purpose of regulating the head of material in said trunk.

It should be understood that the term "tenuous layers of tufts," employed herein with reference to the formation of the material received upon the spiked lattice **14**, is not intended to imply that the tufts form a continuous sheet or mat of uniform thickness or density. It will be appreciated that the action of detaching very fine tufts from a fringe drawn from an irregularly disposed mass or random arrangement of fibres is by its very nature incapable of producing a uniformly thick layer of material. It is permissible for the effective operation of the invention and the production of a satisfactory blend for the layers to include occasional regions in which the fibres are very sparsely distributed. As will be evident, the approach to an unbroken sheet in the layer of tufts depends essentially upon the fineness of pitch of the spikes **20**.

What we claim as our invention and desire to secure by Letters Patent is:

1. In apparatus for blending textile fibrous materials, the combination of a plurality of containers, one for each ingredient material to be blended, each having a delivery opening, means adjacent to said openings for firmly gripping and advancing the contained material therefrom at measured rates, in sheet form, a conveyor, means for progressing the same past said openings and the leading edges of sheets of material emerging therefrom, successively, and means on said conveyor for impaling and detaching material in finely divided form from the leading edge of the first such sheet and depositing it upon a portion of said conveyor as the same passes adjacent to the first of said openings, and for thereafter detaching material in finely divided form from the leading edges of succeeding sheets and depositing the same upon said conveyor, upon material already carried thereby, as portions of said conveyor carrying such material pass adjacent to said openings after the first, successively.

2. In apparatus for blending textile fibrous materials, the combination of a plurality of containers, one for each ingredient material to be blended, each having a delivery opening, means adjacent to each of said openings for firmly gripping and advancing the contained material therethrough in sheet form, one edge foremost, at measured rates, a conveyor, means for progressing the same past said openings and the leading edges of sheets of material emerging therefrom, successively, spikes carried by said conveyor positioned to engage and impale the leading edges of such sheets successively and to detach therefrom finely divided tufts of material, impaled successively upon said spikes, as said spikes pass said openings, and means for stripping such tufts from said spikes after the passage thereof past all of said openings.

3. In apparatus for blending textile fibrous materials, the combination of a plurality of gravity feed trunks, means for delivering each ingredient of the blend to one of said trunks, means for continuously compressing the contents of each trunk into sheet formation therein and discharging the same therefrom, means for controlling the rate of such discharge from each trunk, a conveyor, means for progressing the same past the discharge points of said trunks, and means carried thereby for impaling and detaching material in finely divided form from the emergent fringes of ingredients from each trunk, in turn, and receiving the same in layered formation upon said conveyor.

4. In apparatus for blending textile fibrous materials, the combination of a plurality of containers, one for each ingredient material to be blended, each having a delivery opening, means adjacent to said openings for advancing the contained material therethrough at measured rates, in sheet form, a conveyor, means for progressing the same past said openings and the leading edges of sheets of material emerging therefrom, successively, means for regulating the rates of advance of material from each of said containers, independently, and means carried by said conveyor for impaling and detaching material in finely divided form from the leading edges of the sheet material emerging from said containers in turn, and receiving the same in layered formation upon said conveyor.

5. In apparatus for blending textile fibrous materials, the combination of a plurality of gravity feed trunks, means for delivering each ingredient of the blend to one of said trunks, discharge means for each trunk comprising a pair of rollers in the outlet thereof, means for rotating the rollers of each pair in opposite directions, means for regulating the speed of rotation of said pairs of rollers, independently, a conveyor, means for progressing the same past the outlets of said trunks successively, and means carried thereby for detaching material in finely divided form from the ingredients discharged from each trunk by the rollers thereof, successively.

6. In apparatus for blending textile fibrous materials, the combination of a plurality of gravity feed trunks, means for delivering each ingredient of the blend to one of said trunks, means for maintaining a substantially constant head of material in each of said trunks, means for discharging the contents of each trunk, means for controlling the rates of such discharge, a conveyor, means for progressing the same past the discharge points of said trunks, successively, and means carried thereby for impaling and detaching the material emerging from said trunks and receiving finely divided portions thereof.

7. In apparatus for blending textile fibrous materials, the combination of a plurality of gravity feed trunks, means for delivering each ingredient of the blend to one of said trunks, means for continuously compressing the contents of each trunk into sheet formation therein, firmly gripping the same and advancing the same therefrom, means for controlling the rate of such discharge from each trunk, a conveyor, means for progressing the same past the discharge points of said trunks, forwardly-inclined spikes carried by said conveyor, positioned to impale the leading edges of said sheets successively and to detach therefrom finely divided tufts of material impaled successively upon said spikes as said spikes pass the discharge points of said trunks, means for maintaining a substantially constant head of material in each trunk, and means for stripping said tufts from said spikes after each passage thereof past all of said discharge points.

8. In apparatus for blending textile fibrous materials, the combination of a plurality of gravity feed trunks, means for delivering each ingredient of the blend to one of said trunks, discharge means for each trunk comprising a pair of rollers in the outlet thereof, means for rotating the rollers of each pair in opposite directions, means for regulating the speed of rotation of said pairs of rollers, independently, a conveyor, means for progressing the same past the outlets of said trunks successively, means carried thereby for detaching material in finely divided form from the ingredient emerging from each trunk, successively, a light-sensitive cell in the upper portion of each trunk, and means operated by the cell in any of said trunks for reducing the rate of delivery of ingredient to that trunk whenever the level of material therein has risen above the cell.

9. In apparatus for blending textile fibrous materials, the combination of a plurality of containers, one for each ingredient material to be blended, each having a delivery opening, a conveyor, means for progressing the same past said openings successively, and cyclically, means on said conveyor for impaling and detaching material from said openings in finely divided form at measured rates as the conveyor passes adjacent to said openings, in each cyclical operation, a receptacle, means for delivering the material carried by said conveyor into said receptacle, means for conveying the material in said receptacle to further devices, and means for discontinuing the delivery of ingredient material from said containers to said conveyor when the delivery of material to said receptacle exceeds a desired rate.




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