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[54] **WEIGHT BATCHING DEVICE FOR FIBROUS MATERIAL SUCH AS SHREDDED TOBACCO**

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[51] **Int. Cl.** **A24b 03/00**

[58] **Field of Search**.....131/22 A, 21 R, 21 A, 81 A, 131/112, 25; 109/1 R; 225/106

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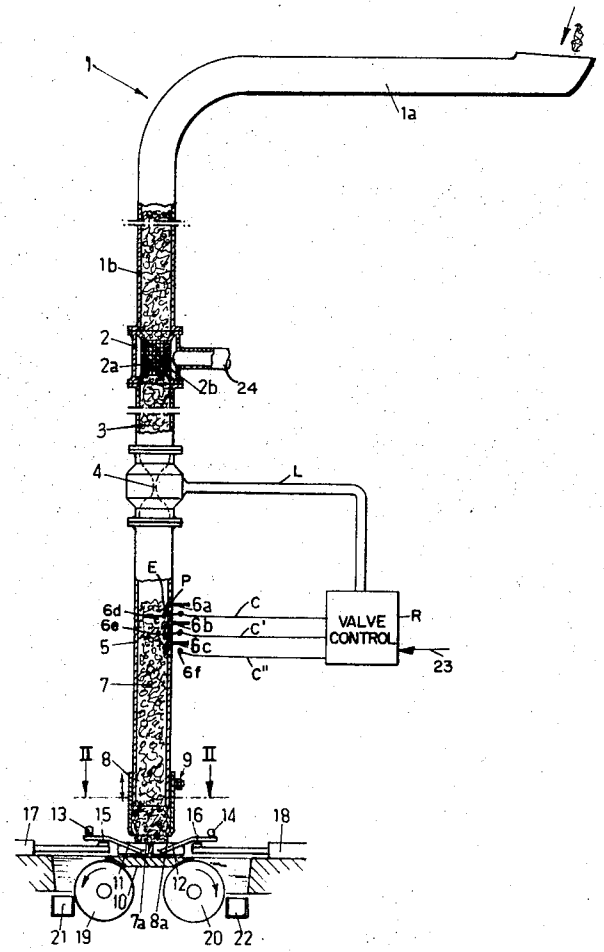
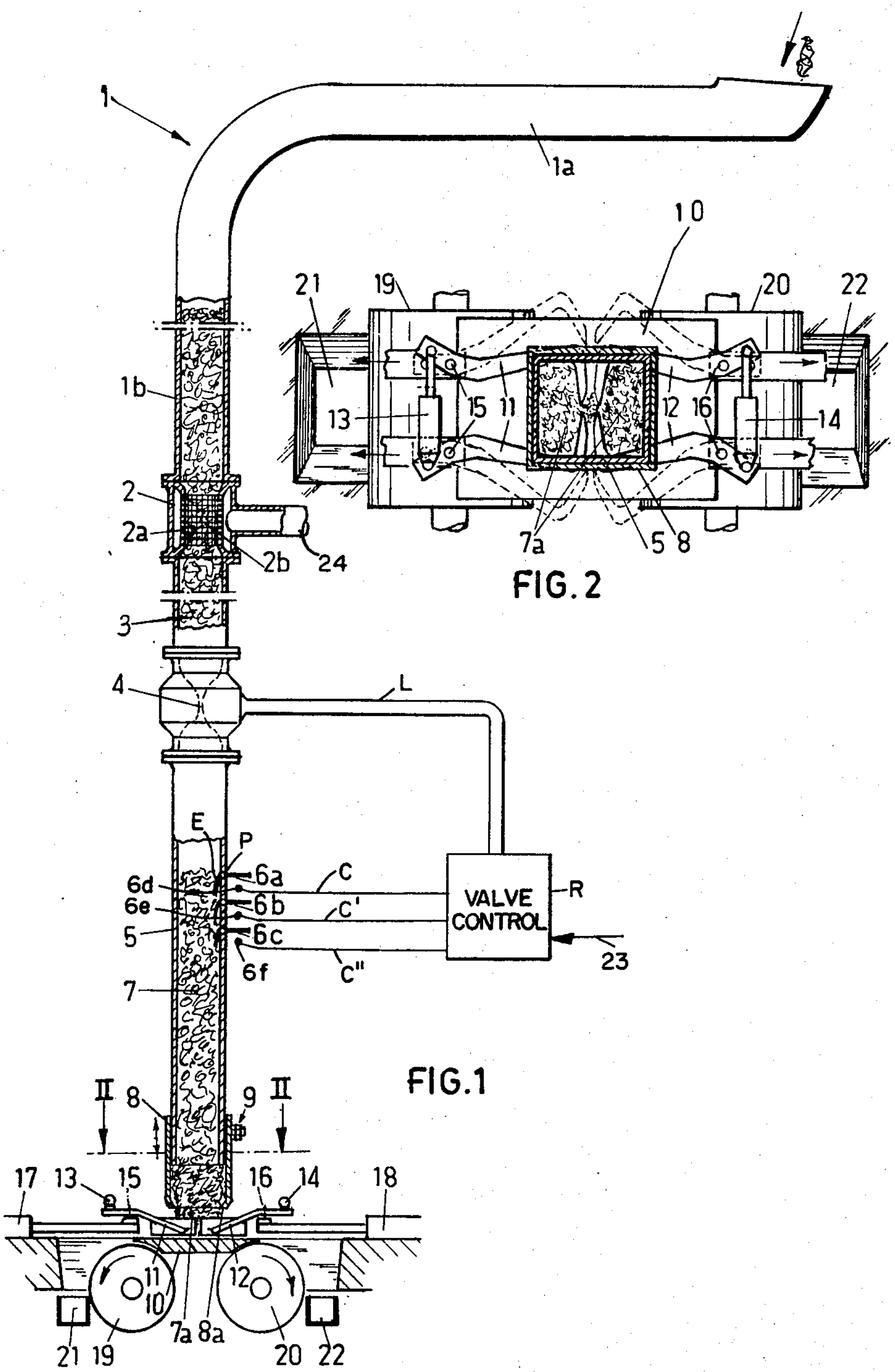
[57] **ABSTRACT**

Fibrous material such as shredded tobacco is first formed within a vertical tube into a coherent strand which possesses a uniform density and cross-sectional area as it emerges from the lower end of the tube so that the strand displays a uniform weight per unit of length. A selected length of the coherent strand is exposed below the tube and this exposed length is then evenly divided in two longitudinally divided parts which are pulled loose from the strand in opposite lateral directions to provide two substantially equal weight batches. As the batches are separated or pulled loose laterally, the coherent strand is restrained laterally just above the zone in which pulling apart is effected so that the weight of each batch is predictably related to the length of the exposed part of the strand which is below this restraining apparatus. After the batches are pulled away, the strand drops and presents a new exposed length and further batches are formed. Two or more batches may later be recombined to provide a desired-weight portion of the material.

32 Claims, 2 Drawing Figures





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WEIGHT BATCHING DEVICE FOR FIBROUS MATERIAL SUCH AS SHREDDED TOBACCO

BACKGROUND OF THE INVENTION

Considerable difficulty is encountered in processing fibrous material, particularly such material as shredded tobacco. It is necessary frequently that portions of this material must be formed which are of uniform and desired weight and although there are numerous ways of doing this, it may be stated in general that antagonistic factors are involved. First of all, the fibrous material has a tendency to intertwine so that separation of batches of identical weight tends to require multiple handling or contacting of the material. On the other hand, it is desirable that the material be handled as little as possible in order to avoid degradation of its quality which tends to occur due to damage suffered by handling or contacting. Of course, if the handling involves a cutting or severing, degradation of quality is a certainty.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, cutting of the material is avoided and handling thereof is minimized by virtue of an arrangement wherein the material is first formed, compacted or packed within a confining means so that a coherent strand of the material results. In this way, by forming the strand so as to have a substantially constant or uniform density and cross sectional area, a particular length of the strand will contain a particular weight of material. The strand is then exposed beyond the confining means for a selected or prescribed length thereof and the whole or portions of this exposed length are gripped and pulled loose from the remainder of the strand in a direction lateral with respect to the longitudinal direction of the strand while, at the same time, the strand closely adjacent the zone in which the pulling loose is effected is restrained in lateral opposition to the pulling loose action so that on successive pulling loose operations on identical lengths of exposed strand, substantially equal weight batches will be pulled loose.

To this point, then, the essential feature is that of providing a coherent strand of uniform density and cross-sectional area so that the weight per unit length of strand is uniform, and thereafter a selected exposed length of this strand is pulled loose in one or more batches. Because the weight per unit length of strand is uniform and because the length of exposed strand pulled loose is selected, the weight of material pulled loose each time is known and will be uniform so long as the selected length remains the same. An important feature here, of course, is the means by which it is assured that the selected exposed length is that which is pulled loose and not some more or less greater length due to the natural coherency of the fibrous material. To this end, the gripping means which pulls the material loose operates in conjunction with restraining means which opposes the pulling force of the gripping means. Specifically, the gripping means pulls in a direction normal to the longitudinal direction of the strand and the strand upstream of the gripping means is restrained from lateral movement by a sleeve or collar. This restraining means is longitudinally adjustable with respect to the gripping or pulling means and thereby

controls the length of strand which is pulled loose. A further restraining means may be located downstream of the gripping means for the purpose of limiting the longitudinal movement of the strand subsequent to a pulling loose operation and thereby limiting the length of a new portion of the strand which is exposed for a subsequent pulling loose operation.

In a preferred embodiment, there are two gripping means which longitudinally divide the exposed strand length and which pull loose the so-divided portions in opposite directions. By making the division equally, the two batches pulled loose are of substantially equal and uniform weight.

Once having obtained uniform batch weights, a further feature of the invention becomes apparent. This further feature has to do with the fact that the batch weights, although not exactly equal, will be uniformly of very nearly the same weight. Thus, by recombining two batches, for example, one of which is slightly underweight and the other of which is slightly overweight, recombined weight portions of very great accuracy may be obtained. Thus, the batches may be first graded (i.e., underweight or overweight) and then recombined on this basis, the accuracy of the final or recombined weight being dependent upon the fineness of gradation and the control effected with respect to these gradations in the recombination. It is also possible further to reduce the approximate basic batch weight, as by halving the batches followed by grading and then recombining two or more basic batch weight portions to obtain a highly accurate final weight.

A preferred embodiment of the invention will now be described in detail in the following description with reference to the accompanying diagrammatic drawings, wherein:

FIG. 1 is a side elevation, partly in vertical cross-section, of an apparatus for forming portions of shredded tobacco and adapted to perform the method according to the invention, and

FIG. 2 is a section, taken along the line II—II in FIG. 1.

Referring to FIG. 1, shredded tobacco is fed to the apparatus via a system of pipes 1 into which the tobacco is thrown manually, for instance, (cf. the arrow at the top right-hand side of FIG. 1) in a tobacco loft (not shown). The tobacco is conveyed by air suction from a conventional source and applied through the conduit 24, through a horizontal portion 1*a* of the pipe system 1 into a filter chamber 2 disposed in a vertical portion 1*b* of the pipe system 1, air and if necessary tobacco dust being drawn off via an inside filter wall 2*a*. The tobacco then passes via a tubular portion 2*b* of the filter chamber 2, having a peripheral filter wall 2*a*, into a buffer 3 whose bottom is founded by a regulating valve 4 controlling delivery from the buffer 3.

The regulating valve 4 discharges into a vertical conduit or shaft 5 of rectangular cross-section (see FIG. 2) within which a column or strand 7 of tobacco of substantially uniform height is maintained. Because the height of the column is maintained substantially constant, the density of the emergent or exposed lower end 7*a* of this strand is maintained at a substantially constant or uniform density.

A series of sensors is provided within the conduit 5 to maintain the desired height of the strand 7. These sen-

sors may be simple grounding switch devices having movable contacts 6*a*, 6*b* and 6*c* cooperable with corresponding fixed contacts 6*d*, 6*e* and 6*f*. These movable contacts are pivoted horizontally as at P to the conduit 5 and have downturned inner ends E adapted to be engaged by the tobacco of the strand 7 so as to be moved thereby out of contact with their fixed contacts when the strand is of such height as to counterbalance the movable contacts and pivot them out of engagement with their fixed contacts as shown in FIG. 1.

The fixed contacts are connected by suitable conductors C, C′ and C″ to a suitable control device R which regulates fluid pressure within the pipe L from a conventional source indicated by the arrow 23 in FIG. 1 and leading to the control valve 4. This control valve may be, as shown, of the type in which a resilient sleeve (i.e., rubber) is subjected to greater or lesser surrounding pressure correspondingly to "neck down" and "open up" the passage through the sleeve and thereby to control the amount of material passing through the valve 4. It will be understood that as the switches of the sensors successively are closed, the opening through the valve 4 progressively increases in area. The net result is to maintain a substantially uniform height of the strand 7. It will be seen that the material of the strand 7 moves downwardly as a result of the intermittent removal of the exposed strand end 8*a*. If the time periods between successive removals are made long, the strand material will feed downwardly in step-by-step fashion. However, it is preferred that the removals be effected at sufficiently short time periods so as to allow the strand to move continuously and at a substantially uniform rate.

Disposed at the open lower end of the shaft 5 is a bush 8 extending downwardly outside the shaft. The lower edge 8*a* of the bush 8 forms a restraining member whose function will be explained in greater detail hereinafter.

The length to which the sleeve 8 extends outside the end of the shaft 5, and therefore the height of the bush edge 8*a* acting as a restraining member above the members of the apparatus to be described hereinafter, can be regulated for purposes to be described in greater detail hereinafter by an adjusting mechanism shown diagrammatically at a place 9.

The part of the apparatus described hereinbefore ensures that a flow of shredded tobacco of substantially uniform composition emerges from the bush edge 8*a* in the form of a vertical column or strand at substantially constant speed.

Disposed at a distance below the bush edge 8*a* adjustable by means of the adjusting mechanism 9 is inter alia a gripper mechanism having two double grippers 11, 12, in this embodiment of the apparatus according to the invention. FIG. 2 is a partial plan view of the grippers 11, 12, the chain lines indication the grippers in their open condition, while the solid lines indicate the grippers in their closed position, in which they seize batches of tobacco from the strand end 7*a*. The grippers 11, 12 can move transversely of the longitudinal axis of the bush 8. First, an associated hydraulic actuator 13, 14 moves the grippers out of their open position (chain lines in FIG. 2) into their closed position (solid lines in FIG. 2), in which they each seize a batch of tobacco from the strand end 7*a*, the grippers swivelling around pivots 15, 16 respectively. Hydraulically driven actuators 17, 18, then move the grippers 11, 12, each holding a batch of tobacco, outwards and precisely radially of the longitudinal axis of the bush 8, the seized batches of tobacco being pulled away from the strand end 7*a*. The "free" strand end 7*a*, and therefore the size of the batches of tobacco pulled loose, are determined by the height of the bush edge 8*a* above the grippers 11, 12 and baseplate 10, such height being adjusted by means of the adjusting mechanism 9.

The edge 8*a* of the bush 8 acts as a restraining member which exerts restraining forces on the strand end 7*a* above the batches of tobacco pulled loose in the outward direction and therefore prevents the strand 7 in the shaft 5 from being subjected to excessive longitudinal forces which would disturb the constant feed of tobacco.

The baseplate 10 acts as a retaining member preventing the excessive longitudinal movement of the strand end.

The adjusting mechanism 9 therefore adjusts not only the distance between the bush edge 8*a* and the grippers 11, 12, but also the distance between the bush edge 8*a* and the baseplate 10.

The adjusting mechanism may be a simple hand-operated lever mechanism which raises and lowers the bush 8. Since the total weight of material removed by the grippers 11, 12 is a function of the length of the exposed portion 8*a* of the strand 7, it is obvious that the position of the bush 8 regulates batch weight. The inward inclination of the edge 8*a* of the bush 8 shown in FIG. 1 is not critical, and the edge can have some different outline.

On completion of their outward loosening movement, the grippers 11, 12 are opened by their actuators 13, 14 respectively and the released batches of tobacco drop on to conveying rollers 19, 20 respectively which are rotated in a manner not shown in detail and drop the batches of tobacco into separate receiving bins or the like 21, 22 where they are collected and may be recombined for a purpose appearing below. The actuators 17, 18 then move the grippers 11, 12 respectively back into their starting position shown in chain lines in FIG. 2,and the afore-described cycle starts all over again. The bins or the like 21, 22 are replaced by empty bins in the manner not shown in detail for each cycle.

In the embodiment as shown, there are two gripping means which longitudinally divide the exposed strand length and which pull loose the so-divided portions in opposite directions. By making the division equally, the two batches pulled loose are of substantially equal and uniform weight. The batch weight, although not exactly equal, will be uniformly of very nearly the same weight. Thus, by recombining two batches, for example, one of which is slightly underweight and the other of which is slightly overweight, recombined weight portions of very great accuracy may be obtained. Thus, the batches may be first graded (i.e., underweight or overweight) and then recombined on this basis, the accuracy of the final or recombined weight being dependent upon the fineness of gradation and the control effected with respect to these gradations in the recombination. It is also possible further to reduce the approximate basic batch weight, as by halving the batches followed by grading and then recombining two or more basic batch weight portions to obtain a highly accurate final weight.

The foregoing description of the drawings has made no mention of the batch size. Although the fed strand end of tobacco can always be pulled apart in one or more (in the embodiment illustrated always two) batches of different size or weight, it is precisely an object of the invention to produce portions of tobacco of constantly identical or substantially identical weight. To this end, the members 11 – 22 of the apparatus disclosed are identical in construction with the members 11–22 and are also disposed and move in mirror symmetry (in a laterally inverted manner) in relation to the longitudinal axis of the bush 8 at each instant during the working cycle of the apparatus. Consequently, the forces exerted on two batches of the strand end 7*a* are always identical (and as a rule opposite), with the result that when a strand of tobacco of continuously constant density and cross-section is fed, two batches of identical or substantially identical weight are always seized and pulled loose.

What I claim is:

1. A method of forming portions of substantially equal weight of a fibrous material such as shredded tobacco comprising feeding the fibrous material so as to form an elongated, coherent and confined strand of material of substantially constant density and cross-sectional dimension moving in a longitudinal direction and including an exposed end portion, and forming said portions by intermittently engaging said exposed portion of the strand and pulling the exposed end portion of said strand of material away from the remainder of the strand while exerting a restraining force on the strand in a zone upstream from the engaged part of the strand so as to oppose said pulling and prevent the strand upstream of said zone from being subjected to excessive longitudinal forces which would disturb either the feed of fibrous material or the amount of material pulled away.

2. A method as defined in claim 1 including the step of moving said strand in said longitudinal direction at a substantially constant speed and forming said portions at time intervals which are substantially identical.

3. A method as defined in claim 1 including the step of controlling the length of the portions pulled away from the strand by applying a restraining force to the exposed end portion of said strand downstream from the engaged part of the strand for limiting movement of said strand in said longitudinal direction.

4. A method as defined in claim 1 including the step of adjusting the distance between said engaged part of the strand and the zone where a restraining force is exerted on the strand in accordance with the desired size of the formed portions.

5. A method as defined in claim 3 including the step of adjusting the distance between said engaged part of the strand and the point of application of said restraining force to limit further longitudinal movement of the strand in accordance with the desired size of the formed portions.

6. A method as defined in claim 1 wherein said exposed end portion of the strand is pulled away from the remainder of the strand in a direction substantially perpendicular to said longitudinal direction.

7. A method as defined in claim 1 wherein the exposed end portion of said strand of material is pulled away from the remainder of the strand in a plurality of directions substantially perpendicular to said longitudinal direction.

8. A method as defined in claim 1 wherein a plurality of portions of the end portion of said strand are pulled away simultaneously from the remainder of the strand.

9. A method as defined in claim 1 wherein the portions pulled away from said strand are of substantially the same size.

10. A method as defined in claim 1 wherein the pulling applied to the exposed end portion of said strand material and the restraining forces applied to the strand are applied in a symmetrical manner.

11. A method as defined in claim 10 wherein said pulling forces are applied in a plurality of directions substantially perpendicular to said longitudinal direction and angularly displaced with respect to one another.

12. Apparatus for forming portions of substantially equal weight of a fibrous material such as shredded tobacco comprising an elongated hollow material-feeding member having an open end for discharging fibrous material in a direction longitudinal thereof, means for feeding fibrous material through said member such that the material emerges in an exposed end portion thereof from said open end in said direction in the form of a coherent strand of material of substantially constant density and cross-sectional dimension, movable gripper means disposed downstream of said open end for intermittently engaging the exposed end portion of the strand and pulling said exposed end portion of the strand away from the remainder of the strand, and restraining means disposed adjacent said open end for exerting a restraining force on the strand opposing the pulling of said gripper means to prevent the strand within said material-feeding member upstream of said restraining means from being subjected to excessive longitudinal forces.

13. Apparatus as defined in claim 12 wherein said restraining means comprises wall means at said open end of the material-feeding member.

14. Apparatus as defined in claim 12 including means for adjusting the distance between said restraining means and said gripper means.

15. Apparatus as defined in claim 12 including further restraining means disposed downstream of said gripper means to limit longitudinal movement of the exposed end portion of said strand.

16. Apparatus as defined in claim 15 including means for adjusting the distance between said gripper means and said further restraining means.

17. Apparatus as defined in claim 12 wherein said gripper means includes a plurality of gripper portions which are disposed symmetrically with respect to said open end of the material-feeding member.

18. Apparatus as defined in claim 12 wherein said material-feeding member is disposed substantially vertically adjacent the open end thereof and opens in a downward direction, the means for feeding fibrous material through said member comprising sensing means for sensing the fibrous material above said open end and regulating means connected to said sensing means to regulate the quantity of material fed to said open end.

19. Apparatus as defined in claim 18 wherein said sensing means comprise at least one feeler member extending into said hollow material-feeding member above the open end thereof, said regulating means comprising a regulating valve controlling the amount of

material passing downwardly into the portion of said material-feeding member having said sensing means therein.

20. The method of producing substantially equal weight portions of a fibrous material such as tobacco, which comprises the steps of:

a. forming a coherent strand of the fibrous material in which the strand is of substantially constant density and cross section;

b. periodically seizing and pulling loose batches of material from said coherent strand while restraining the strand adjacent the region of seizing and pulling loose so that the batches are of substantially uniform but of less weight than said substantially equal weight portions; and

c. collecting and recombining material obtained from batches pulled loose in step (b) to form said substantially equal weight portions.

21. The method according to claim 20 wherein step (b) includes packing a mass of the fibrous material within the confined space of a confining means and feeding the strand so-formed longitudinally beyond the confining means to expose an end portion of the strand, and wherein step (b) is performed on the exposed end portion of the strand.

22. The method according to claim 21 wherein the strand is fed at a substantially uniform rate and wherein the periodicity of step (b) is also substantially uniform.

23. The method according to claim 21 wherein step (a) also includes feeding said strand against a stop spaced from the end of the confining means whereby said exposed end portion of the strand is of selected length.

24. The method according to claim 23 including the step of adjusting the spacing between the stop and the end of the confining means to vary the weight of said batches.

25. The method according to claim 24 wherein step (b) is effected by pulling loose in a direction substantially perpendicular to the longitudinal direction of the strand.

26. The method according to claim 21 wherein step (b) comprises simultaneously seizing and pulling loose two batches from said end portion of the strand, the pulling loose of each such two batches being effected in relatively opposite directions substantially perpendicular to the longitudinal direction of the strand.

27. The method according to claim 26 wherein each such two batches are substantially one-half the exposed end portion of the strand.

28. The method according to claim 20 wherein step (a) also includes feeding said strand against a stop spaced from the end of the confining means whereby said exposed end portion of the strand is of selected length.

29. The method according to claim 28 including the step of adjusting the spacing between the stop and the end of the confining means to vary the weight of said batches.

30. The method according to claim 28 wherein each such two batches are substantially one-half the exposed end portion of the strand.

31. The method of obtaining substantially uniform weight batches of fibrous material such as shredded tobacco while minimizing injurious bundling and avoiding cutting thereof, which comprises the steps of:

a. metering the fibrous material into a vertical tube to maintain a selected height of material therein forming a coherent strand of the material which is of selected density and cross-sectional area at the lower end of the tube;

b. supporting the coherent strand in spaced relation below the lower end of the tube to expose a selected length of the lower end of the strand;

c. longitudinally dividing the exposed length of the strand and pulling loose the so-divided portions in relatively opposite lateral directions to (1) obtain two batches of separated fibrous material and (2) permit the strand to drop by gravity and present a new, exposed lower end thereof; and

d. repeating step (c) after each new, exposed lower end of the strand has been presented.

32. The method according to claim 31 including the step of collecting and recombining material obtained from selected batches of the fibrous material to obtain composite portions of specified weight.

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