

[54] **METHOD AND APPARATUS FOR
SEPARATING OPENED FIBER FLOCKS
FROM AN AIR STREAM**

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[58] Field of Search. **55/97, 99, 354, 432, 290, 317.8, 55/482, 466, 474; 210/73, 77, 84, 262, 260, 297, 316; 302/59, 63**

[56]

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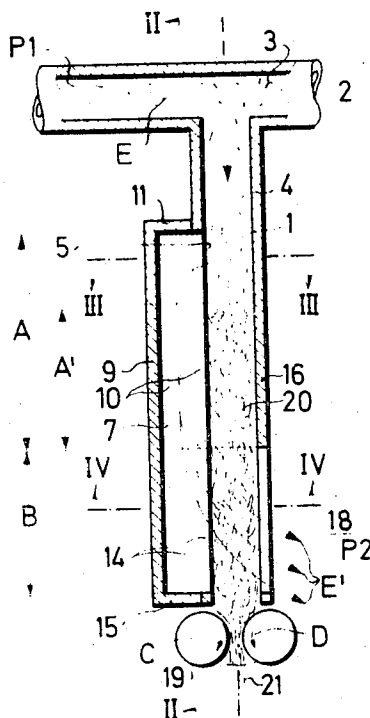
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[57]

ABSTRACT

The air stream which conveys the fiber flocks into the feed chutes is passed out of the chutes to permit deposition of the fiber flocks and thereafter is passed through the column of flock in the chutes or the flock layer pulled out of the chutes to filter out dust and other particles in the air.

25 Claims, 11 Drawing Figures



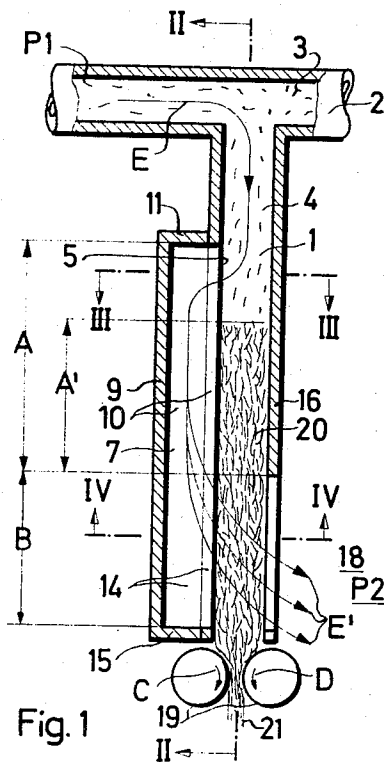


Fig. 1

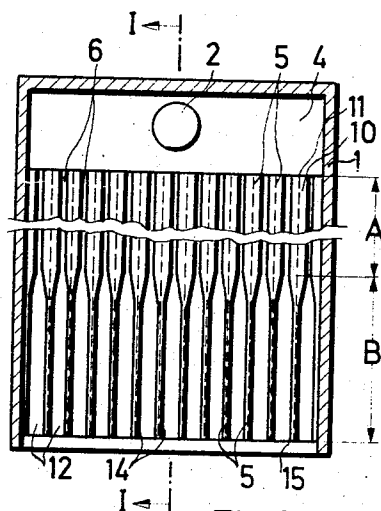


Fig. 2

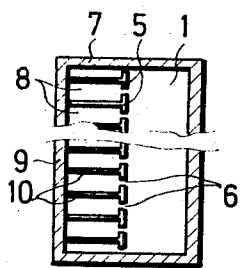


Fig. 3

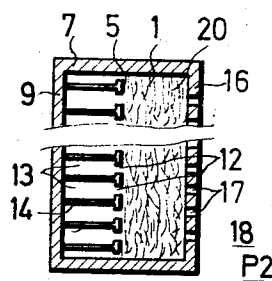
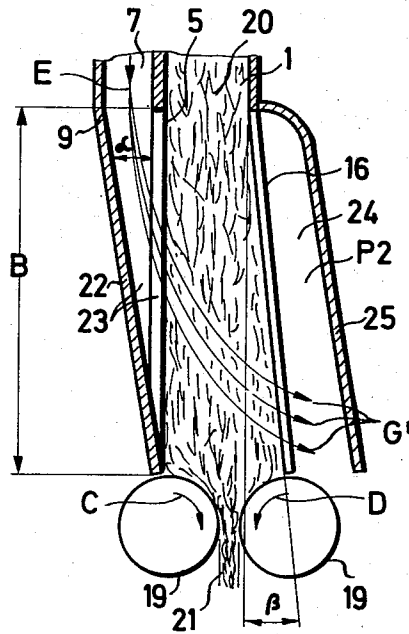
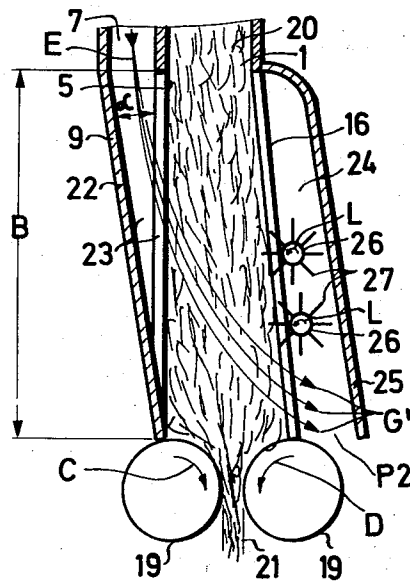


Fig. 4

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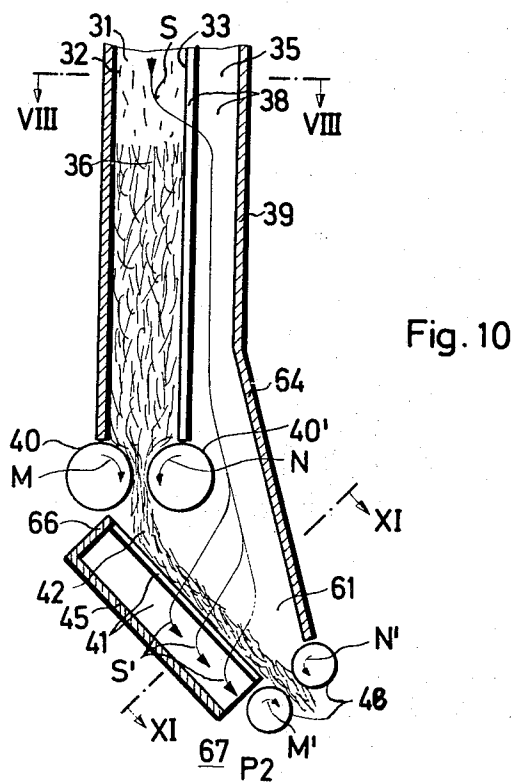


Fig. 10

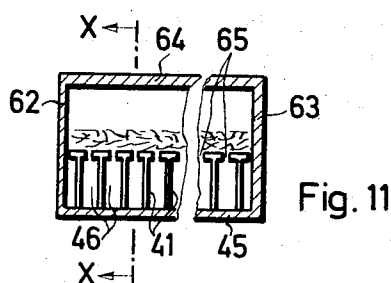


Fig. 11

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METHOD AND APPARATUS FOR SEPARATING OPENED FIBER FLOCKS FROM AN AIR STREAM

This invention relates to a method and an apparatus for separating opened fiber flocks from an air stream.

Heretofore, it has been known to guide a fiber flock carrying pressurized air stream into and through a feed chute while directing the air stream out of the feed chute under the influence of a pressure drop via air penetration openings as exhaust air into an exhaust duct. The feed chute has also been provided at the lower end with take-off rolls which form a fiber flock layer for taking off the separated fiber flocks. The fiber flocks in this process have been retained at the air penetration openings and have been deposited and condensed in the feed chute. To this end, the air penetration openings have been formed as small vertical slots, their width being smaller than the size of the fiber flocks to be separated so that the separated fiber flocks are lowered across the whole width of the feed chute and so that a fiber flock column builds up in the feed chute from the lower end towards the top.

However, this method has a disadvantage in that the exhaust air stream leaving the feed chute has carried fibers or fiber flocks and dust. If contamination of the surrounding air is to be avoided, these particles must be eliminated. Further, as these contaminating particles carried on with the exhaust air stream can represent considerable quantities, the exhaust air must be cleaned. In the known system, this is effected by transporting the dust carrying air into a dust cellar or into a filter room. This, however, implies an additional energy consumption.

Accordingly, it is an object of the present invention to create conditions for separating fiber flocks from an air stream under which fiber free exhaust air is obtained without special auxiliary means.

It is another object of the invention to filter the exhaust air from a feed chute in a simple efficient manner.

Briefly, the invention provides a method and apparatus by which an air stream which conveys fiber flocks into a feed chute for depositing therein passes out of the feed chute and is then redirected through the deposited fiber flock to filter out any particles therein.

The method guides a pressurized air stream into the feed chute, directs the air to flow through the feed chute and to leave the feed chute via air penetration openings as exhaust air. The fiber flocks are retained at the air penetration openings, and are deposited and condensed in the feed chute. Thereafter, the condensed flock is taken off from the feed chute. The exhaust air, upon leaving the feed chute, is guided back through the fiber material which has been separated from the air stream flowing into the feed chute.

The apparatus of the invention cooperates with a feed chute connected to a supply means for a pressurized air stream carrying opened fiber flocks, at least one separating wall of which feed chute is provided with air penetration openings and includes an exhaust air duct adjacent to the separating wall and extending outside the feed chute. The width of each air penetration opening in the feed chute is smaller than the size of the fiber flocks to be separated in order to guide the air quantities flown into the feed chute through the chute and to separate the fiber flocks from the air stream. The exhaust air duct is also connected via the fiber

material separated from the air stream with a room in which a lower air pressure prevails. Also, a take-off device is provided at the lower end of the feed chute to remove the fiber material separated from the air stream. The whole air quantity flown into the feed chute leaves the feed chute as exhaust air and enters the exhaust air duct. The air is guided through the separated fiber material so that particles can be filtered out in the separated fiber material before the air passes into the room to the other side of the material. Also, the feed chute can be connected to a pressurized transporting duct and the fiber flock carrying air stream can flow into the feed chute continuously or discontinuously.

In one embodiment, the fiber flocks and the air stream is supplied separately to the feed chute, the fiber flocks deposited being condensed by the pulsating air stream. Preferably, the exhaust air duct merges into the fiber material separated from the air stream, the fiber material being adjacent to a room under lower air pressure than the air stream located at the side opposite to the merging point of the exhaust air duct. The whole exhaust air leaving the feed chute via the separating wall, thus, can flow outside the feed chute towards and across the fiber material already deposited and escape into the room under lower air pressure. In another embodiment, the exhaust air can be guided either across the fiber material deposited in the feed chute or across the fiber material taken off from the feed chute, preferably, in the form of a fiber flock layer.

These and other objects and advantages of the invention will become more apparent from the following detailed description and appended claims taken in conjunction with the accompanying drawings in which:

FIG. 1 schematically illustrates a cross-sectional view of a feed chute according to the invention along line I—I of FIG. 2;

FIG. 2 illustrates a view taken along line II—II of FIG. 1;

FIG. 3 illustrates a cross-sectional view along line III—III of FIG. 1;

FIG. 4 illustrates a view taken along line IV—IV of FIG. 1;

FIG. 5 illustrates a cross-sectional view of a modified construction according to the invention;

FIG. 6 illustrates a cross-sectional view of a further modified construction according to the invention;

FIG. 7 illustrates a schematic view of another embodiment of a feed chute according to the invention along line VII—VII of FIGS. 8 and 9;

FIG. 8 illustrates a view taken along line VIII—VIII of FIG. 7;

FIG. 9 illustrates a view taken along line IX—IX of FIG. 7;

FIG. 10 illustrates a view of a further modified feed chute according to the invention along line X—X of FIG. 11; and

FIG. 11 illustrates a view taken along line XI—XI of FIG. 10.

Referring to FIG. 1, a feed chute 1 is connected to an air carrying duct 2 in which a pressure p_1 above atmospheric pressure prevails, and through which fiber flocks 3 supplied by a spinning preparatory machine e.g. by a bale opener or a picker (both not shown) are transported into an upper part 4 of the feed chute 1. As

also shown in FIGS. 2 and 3, the feed chute 1 is provided with a separating wall 5 with slots 6 each of which is of a width smaller than the size of the fiber flocks to be separated so that air penetration openings are provided along which fiber flock can be deposited and lowered uniformly across the full width of the feed chute 1. The slotted separating wall 5 separates the feed chute 1 from an adjacent exhaust duct 7 which is provided with individual ducts 8, each of which is connected via one of the slots 6 with the feed chute 1.

Referring to FIGS. 2 and 3, the slots 6 and the ducts 8 are formed by T-shaped profiles 10 which are arranged on an exterior wall 9 of the exhaust duct 7 at mutual distances corresponding to the width of the slots 6, e.g. 3 to 6 mm, and extend vertically over a height A. The ducts 8 and the exhaust air duct 7 are closed at the upper ends by a cover wall 11 and open at the lower end of the slots 6, as shown in FIG. 2.

Referring to FIGS. 2 and 4, the separating wall 5 has slots 12 which extend from the slots 6 down to the lower end of the feed chute 1. The width of each slot 12 is somewhat larger than the size of the flocks, i.e., larger than the width of the slots 6, and the ducts 8 merge into ducts 13 formed by T-shaped profiles 14 which are arranged on the exterior wall 9 at mutual distances corresponding to the width of the slots 12. The ducts 13 and the exhaust air duct 7 are closed at the lower end by a cover wall 15, so that the exhaust air duct 7 with the slots 12 merges into the feed chute 1.

Referring to FIG. 1, the feed chute 1 has a front wall 16 opposite to the separating wall 5 and the slots 12 front wall 16 can be made from glass over the height A. In addition, the feed chute 1 is provided over the height B and across the whole width with air penetration openings 17 which are formed as slots (not shown). The width of the openings 17 is smaller than the size of the flocks to be separated, i.e., smaller than the width of the slots 12. The air penetration openings 17 are connected to a room 18 in which a lower air pressure p_2 prevails than in the air stream in the duct 2. Take-off rolls 19 are arranged adjacent to the lower end of the feed chute 1 so as to be driven in the direction indicated by the arrows C and D.

The apparatus described with reference to FIGS. 1 through 4 functions as follows:

A part of the air stream carrying the fiber flocks 3, flowing through the duct 2, is guided into the feed chute 1. The whole quantity of air flowing into the feed chute 1 according to arrow E flows through the feed chute 1 and, via the slots 6 of the separating wall 5, penetrates into the exhaust air duct 7. The fiber flocks 3 are thus separated from the air stream at the separating wall 5 and a condensed fiber material column 20 is built up in the feed chute 1. The condensed material is then removed in the form of a fiber flock layer 21 from the feed chute 1 by the take-off rolls 19. When the filling level of the feed chute 1 extends higher than the height B of the larger slots 12, e.g., over an additional height A' within the plane of the smaller slots 6 and less than the height A of the slots 6, the air penetrates through the slots 6 into the exhaust air duct 7 outside the feed chute 1 and is guided down into the region of the slots 12. The whole exhaust air penetrated into the exhaust air duct 7 then flows in the direction indicated by the arrows E' via the slots 12 across the fiber materi-

al column 20 and escapes via the air penetration openings 17 into the room 18 in which the lower air pressure p_2 prevails. The exhaust air in this manner is filtered upon penetrating the fiber material column 20. Any exhausted fibers or fiber flocks and dust is thus directly re-fed by the exhaust air to the fiber material 20 and retained there.

It is noted that a minimum height of the fiber material column of a value of at least the height B is needed in order to ensure penetration of the air via the slots 6 into the exhaust air duct 7 and penetration of the air as exhaust air across the fiber material column 20.

The exhaust air flowing across the fiber material column 20 according to the direction indicated by the arrow E' can exert a pressure on the fiber material column 20 so that the fiber material can be pressed against the front wall 16. The width of the openings 17 for this reason is chosen such that penetration of fibers into the room 18 is prevented but such that the lowering of the fiber material column 20 in the feed chute 1 is effected without disturbances and without accumulation at the openings 17 not tearing under the influence of the take-off rolls 19.

Referring to FIG. 5 wherein like reference characters indicate like parts as above, the lower end of the feed chute 1 is constructed so as to ensure a lower contacting pressure. To this end, the exhaust air duct 7 is closed by a lower cover wall 22 extending over the height B and closing in on the feed chute 1 under an acute angle α . The wall 22 carries T-shaped profiles 23 having cross-sections which diminish towards the lower end. The front wall 16 of the feed chute 1 is inclined outwards over the height B under an acute angle β with respect to the vertical. The openings 17 in the wall 16 (FIG. 4) merge into a room 24 in which the lower air pressure p_2 prevails. A wall 25 is arranged in front of the front wall 16 and extends substantially parallel to the cover wall 22 downwardly.

In use, the exhaust air flowing through the exhaust air duct 7 according to the direction indicated by the arrow E is progressively diverted towards the fiber material column 18 by the inclined cover wall 22 closing in on the feed chute 1 so that, as the height B diminishes, the exhaust air is forced to flow through the fiber material 18 in air streams G' downward and outward. This is further aided by the inclination of the lower end of the front wall 16 and of the wall 25.

Referring to FIG. 6 wherein like reference characters indicate like parts as above, the feed chute 1 is provided with rolls 26 in the room 22 which have pins 27 which can be driven in the direction indicated by the arrows L in order to assist the lowering of the fiber material column 20 and to prevent blockage of the openings 17 (FIG. 4) formed as slots in the front wall 16. The pins 27 penetrate through the slots 17 so that the fiber material column 20 is pushed away from the slots 17 and is pushed downward.

Referring to FIGS. 7 and 8, a feed chute 31 to which fiber flocks 32 are supplied, e.g., as described with reference to FIG. 1, is provided with a separating wall 33 with slots 34, each of which is of a width smaller than the size of the flocks to be separated. The separating wall 33 extends down to the lower end of the feed chute 31 and separates the chute 31 from an adjacent exhaust air duct 35 so that the air quantity flown into

the feed chute 31 penetrates into the exhaust air duct 35 as exhaust air while the fiber flocks 32 are deposited and condensed in the feed chute 31 as a fiber material column 36. The exhaust air duct 35 is provided with ducts 37 (FIG. 8) extending down to the lower end of the feed chute 31. These ducts 37, together with the slots 34, are formed by T-shaped profiles 38 arranged on an outside wall 39 of the exhaust air duct 35 at mutual distances corresponding to the width of the slots 34 and extend vertically over the whole height of the exhaust air duct 35. The upper end of the exhaust air duct 35 is closed (not shown).

Take-off rolls 40 and 40' which can be driven in the direction indicated by the arrows M and N, respectively, are arranged at the lower end of the feed chute 31 adjacent to T-shaped profiles 41 (FIG. 9) which function as a supporting device for the fiber material 36 taken off from the feed chute 31 by the take-off rolls 40, 40' in the form of a fiber flock layer. The T-shaped profiles 41 extend in mutually parallel relation on an incline with respect to the vertical towards the outside, and are arranged between side walls 43 and 44 on a lower wall 45. The mutual distances between the profiles 41 are chosen such that ducts 46 and slots 47, the width of which are preferably somewhat larger than the size of the fiber flocks 32 and preferably larger than the width of the slots 34 are formed. A further pair of rolls 48 which can be driven in the direction of the arrows M' and N' is provided at the end of the profiles 41 opposite the pair of rolls 40, 40' in order to take off the fiber material 36 in the form of a fiber flock layer 42.

Referring to FIG. 7, a cover 49 is arranged above the profiles 41 between the side walls 43, 44 at a distance corresponding at least to the thickness of the fiber flock layer 42 and extends over the full width Q of all the T-shaped profiles 41 and over the whole length between the pairs of rolls 40, 40' and 48. This cover 49 is provided with air penetration openings 50 which merge into a room 51 in which a lower air pressure p_2 prevails under operating conditions than in the air stream in the feed chute 31.

The ducts 46 are provided at their end facing the pair of rolls 48 with a cover wall 52 and, at their open end facing the pair of rolls 40, 40', are connected with the exhaust air duct 35 via a by-pass duct 53. The by-pass duct 53 is placed outside the take-off roll 40 in such manner that the exhaust air duct 35 is connected via the fiber 36, flock layer 42 with the room 51 in which the lower air pressure p_2 prevails.

Under operating conditions, the whole exhaust air penetrates into the exhaust air duct 35 according to arrow R and flows through the fiber flock layer 42 according to the arrows R' and its filtered therein.

Referring to FIG. 10 wherein like reference characters indicate like parts as above, separating wall 33 and an exhaust air duct 35 arranged adjacent thereto are located, as seen in the direction of delivery of the fiber flock layer 42, in front of the feed chute 31. The exhaust air duct 35 merges directly into a room 61 located above the fiber flock layer 42, which room 61 is formed by sidewalls 62, 63 (FIG. 11) adjacent to the ducts 37 (FIG. 8) in the exhaust air duct and by a cover 64 adjacent to the outside wall 39 of the exhaust air duct 35. The profiles 41 (FIG. 11) are arranged at mutual distances chosen such that slots 65 are formed of a

width smaller than the fiber flocks 32. The ducts 46 are closed at their end facing the pair of rolls 40, 40' by a cover wall 66 and, at their end facing the pair of rolls 48, merge into a room 67 in which the lower air pressure p_2 prevails. In order to keep the contacting pressure exerted by the exhaust air onto the fiber flock layer 42 low, the T-shaped profiles are inclined less far, relative to the profiles 41 of FIG. 7, towards the outside with respect to the feed chute 31.

In operation, the whole exhaust air penetrates into the exhaust air duct 35 according to arrow S and is guided from above according to the arrow S across the fiber flock layer 42 and is filtered by the fiber material therein.

The constructions described above can be varied further. Thus, the slots 6 shown in FIG. 1 can be designed so that they do not merge directly into the slots 12, but so that they end at a wall of the feed chute 1 adjacent to which wall the slots 12 are arranged. Also, instead of the T-shaped profiles, L-shaped profiles can be used for forming the slots. In order to counteract the contacting pressure, it also is possible to arrange the rolls 26 provided with pins as shown in FIG. 6, at the air penetration openings 17 shown in FIG. 1. The cover wall closing in to the feed chute 1 as shown in FIGS. 5 and 6 under the acute angle α can also extend only over a part of the height B. In order to facilitate penetration of the exhaust air, the T-shaped profiles 41 according to FIG. 7 can also be replaced by plain flat bars.

The advantage of the inventive method is that no special measures must be taken for filtering the exhaust air so that fibers and dust carried on are eliminated. Exhaust ducts leading to sieves or through dust rooms can be dispensed with. The whole exhaust air guided through the separated fiber material can be recycled into the process again, immediately.

It is further noted that the openings in the feed chute for the passage of air can be of any suitable form. For example, instead of using vertical slots, a grid-like construction can be utilized where the depositing of the fiber flocks and movement of the fiber flocks through the feed chute is not inhibited. In a similar fashion, the openings for the passage of the exhaust air into and out of the feed chute or through the other constructions illustrated can be of any suitable shape which would not inhibit the movement of the fiber material.

What is claimed is:

1. In a process of separating opened fiber flock from an air stream wherein the flocks and air stream are guided into a feed chute and the air stream is directed out of air penetration openings in the feed chute as exhaust air while the fiber flock is separated at the air penetration openings and deposited in the feed chute as fiber material, the step of guiding the exhaust air through the separated fiber material to filter the exhaust air.

2. A method as set forth in claim 1 wherein the whole air quantity flown into the feed chute leaves the feed chute as exhaust air and is subsequently guided through the fiber material.

3. A method as set forth in claim 1 wherein the exhaust air is guided across the fiber material.

4. A method as set forth in claim 3 which further includes the step of transporting the exhaust air outside

the feed chute under an acute angle towards the fiber material prior to said step of guiding through the fiber material.

5. A method as set forth in claim 1 wherein the exhaust air is guided into the feed chute through the fiber material deposited in the feed chute.

6. A method as set forth in claim 1 wherein the fiber material is removed from the feed chute in the form of a fiber flock layer and wherein the exhaust air is guided through the fiber flock layer.

7. A method as set forth in claim 6 wherein the fiber flock layer is transported on a supporting device having air penetration openings therein below the transported layer and wherein the exhaust air is guided through the air penetration openings in the supporting device and subsequently through the fiber flock layer.

8. A method as set forth in claim 6 wherein the fiber flock layer is transported on a supporting device and having air penetration openings therein below the transported layer and wherein the exhaust air is guided through the fiber flock layer and subsequently through air penetration openings in the supporting device.

9. A method as set forth in claim 1 which further includes the step of guiding the exhaust air into a room in which a lower air pressure prevails after passing through the fiber material.

10. In combination with a supply means for supplying a pressurized air stream and opened fiber flocks; and a feed chute connected to said supply means, said feed chute having at least one wall provided with air penetration openings, each opening being of a width smaller than the fiber flocks to separate the fiber flock from the air stream; an exhaust air duct adjacent said separating wall and extending outside said feed chute, and a room at a lower pressure than the pressure of the pressurized air stream, said exhaust air duct communicating with said room through the separated material for passing the exhaust air through the separated material.

11. The combination as set forth in claim 10 which further includes a take-off means at the lower end of said chute for removing the separated fiber material therefrom.

12. An apparatus as set forth in claim 10 wherein said supply means includes a pressurized fiber flock carrying transporting duct connected to said feed chute.

13. An apparatus as set forth in claim 10 wherein said exhaust air duct has a lower end merging into said feed chute.

14. An apparatus as set forth in claim 13 wherein said lower end of said exhaust air duct is connected to openings into said feed chute arranged below said separating wall and wherein said feed chute has a front wall with air penetration openings therein opposite to said openings into said feed chute and of a width smaller than the size of the flocks.

15. An apparatus as set forth in claim 14 wherein the width of each opening arranged below said separating wall is larger than a width of said air penetration openings of said separation wall.

16. An apparatus as set forth in claim 14 wherein said exhaust air duct and said openings below said separating wall extend to the lower end of said feed chute.

17. An apparatus as set forth in claim 14 wherein said exhaust air duct below said separating wall closes in towards the lower end of said feed chute under an acute angle with respect to the vertical and said front wall and a wall arranged in front of said front wall extend inclined outwards with respect to the vertical.

18. An apparatus as set forth in claim 14 wherein said air penetration openings in said front wall are slots and which further includes at least one movable roll having pins extending therefrom through said slots into said feed chute.

19. An apparatus as set forth in claim 10 which further includes a pair of take-off rolls at the lower end of said feed chute for removing a fiber flock layer therefrom and a supporting device adjacent to said take-off rolls for receiving the fiber flock layer from said rolls, said supporting device having openings therein opposite said exhaust air duct to pass the exhaust air therethrough.

20. An apparatus as set forth in claim 19 wherein said exhaust air duct at a side opposite said supporting device communicates with said openings of said supporting device, said openings being of a width larger than the size of the fiber flocks.

21. An apparatus as set forth in claim 19 wherein said exhaust air duct at a side facing the fiber flock layer on said supporting device communicates with said openings, said openings being of a width smaller than the size of the fiber flocks.

22. In a fiber flock transporting system,

a feed chute for receiving an air stream and fiber flock, said feed chute having a separating wall including a plurality of openings therein for passage of the air stream out of said chute as exhaust air, each opening being sized to separate the fiber flock into said chute; and

means communicating with said feed chute to guide the exhaust air through the separated material to filter contaminants from the exhaust air.

23. In a system as set forth in claim 22 which further includes a take-off means for removing the deposited flock in a flock layer from said feed chute, said means being disposed with respect to said take-off means to guide the exhaust air through the flock layer.

24. In a system as set forth in claim 22 wherein said openings are vertical slots.

25. In a system as set forth in claim 22 wherein said means includes an exhaust duct adjacent said separating wall, and wherein said wall has a first set of vertical slots forming said openings and a second set of slots below said first set for passage of exhaust air into said feed chute through the separated material therein, and wherein said chute includes a front wall having a third set of slots therein, said second set of slots having slots of greater width than the slots of said first and third sets.

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