Nov. 8, 1966 F. REITERER 3,284,140

SEPARATING-DISTRIBUTING DEVICE FOR TEXTILE FIBERS

Filed Dec. 18, 1964 4 Sheets-Sheet 1

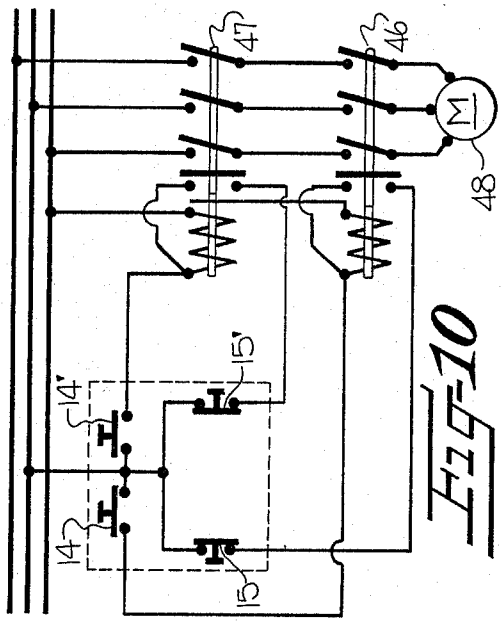


FIG-10

FIG-1

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SEPARATING-DISTRIBUTING DEVICE FOR TEXTILE FIBERS

Filed Dec. 18, 1964 4 Sheets-Sheet 2

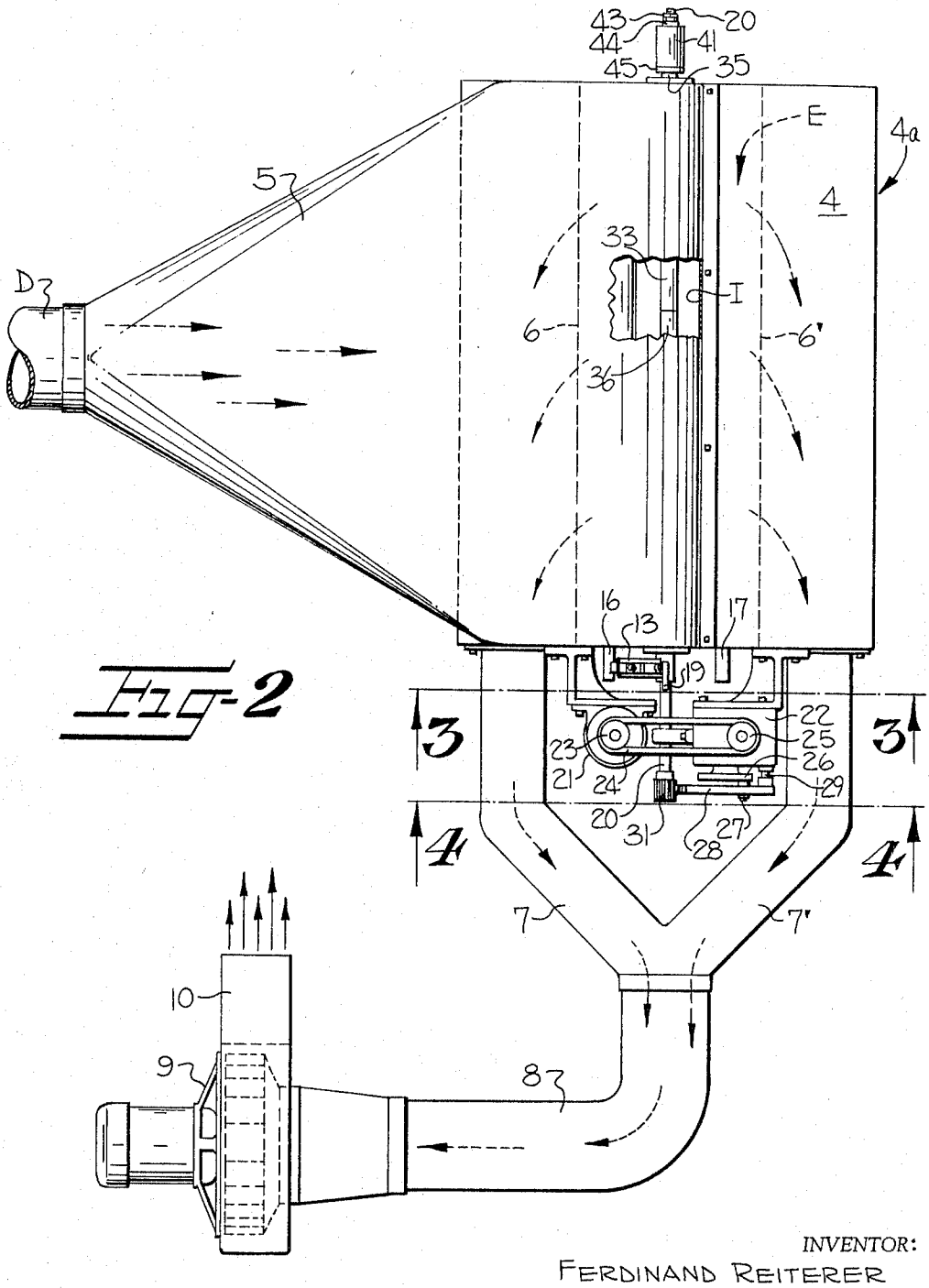


Fig-2

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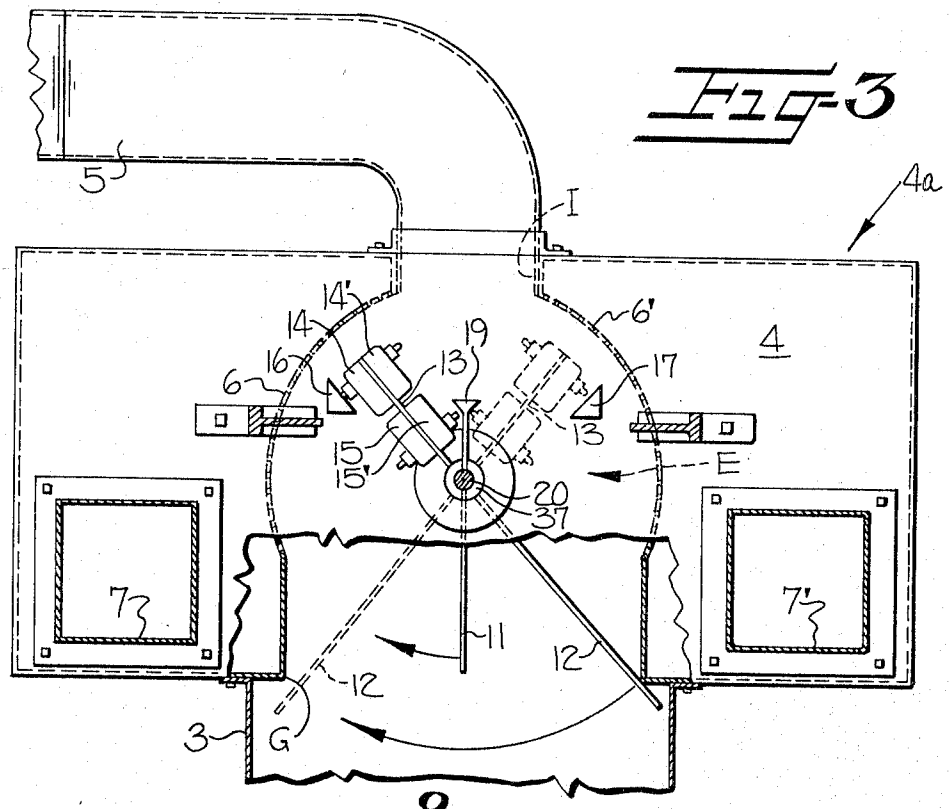
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SEPARATING-DISTRIBUTING DEVICE FOR TEXTILE FIBERS

Filed Dec. 18, 1964 4 Sheets-Sheet 3

Fig-3



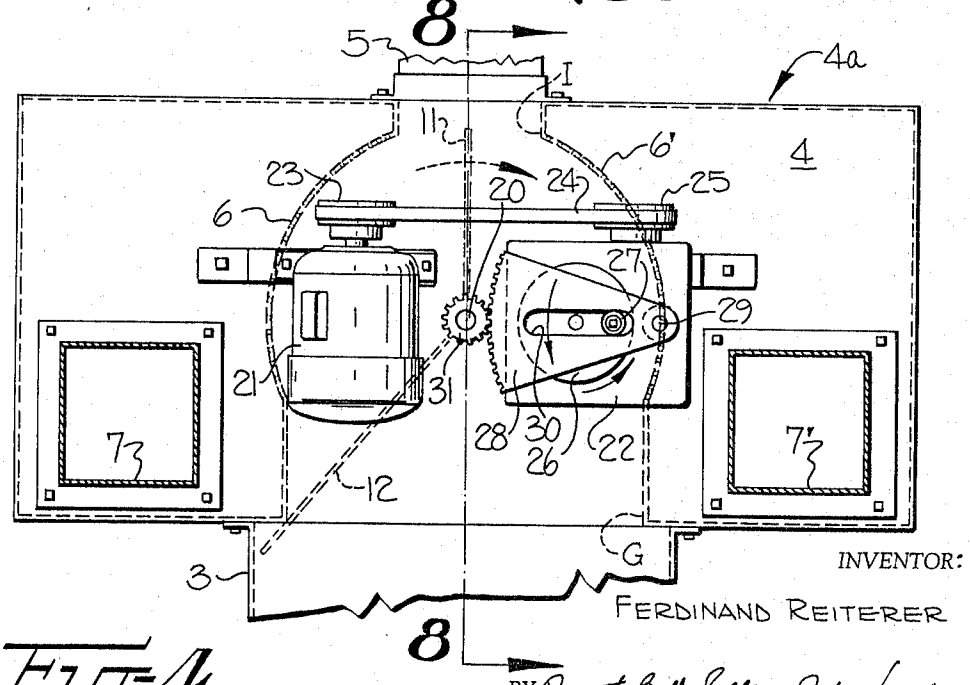


Fig-4

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SEPARATING-DISTRIBUTING DEVICE FOR TEXTILE FIBERS

Filed Dec. 18, 1964 4 Sheets-Sheet 4

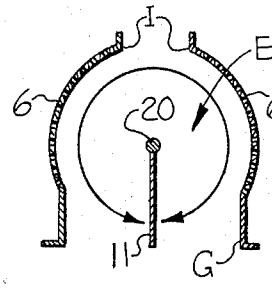


Fig-5

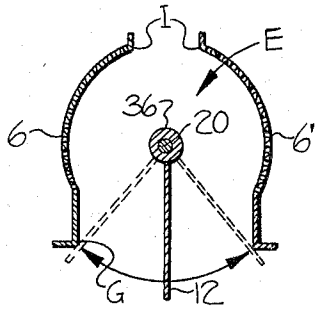


Fig-6

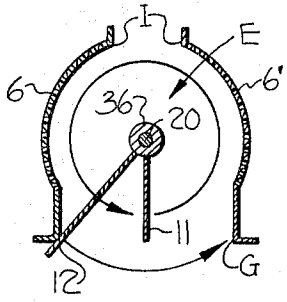


Fig-7

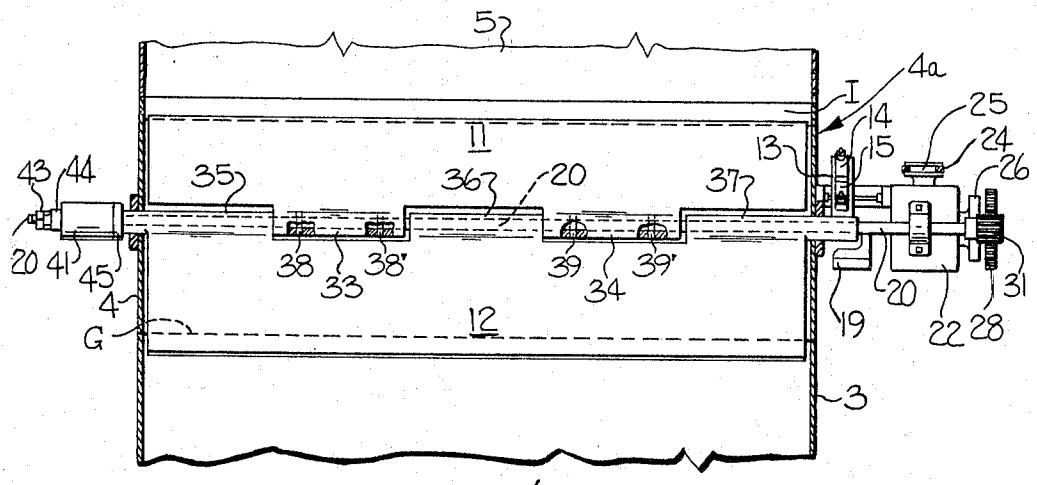


Fig-8

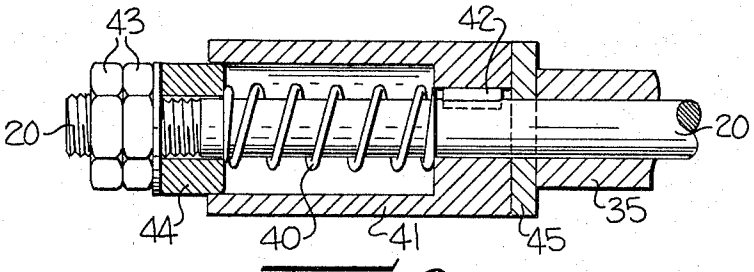


Fig-9

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United States Patent Office 3,284,140 Patented Nov. 8, 1966

3,284,140

SEPARATING-DISTRIBUTING DEVICE FOR TEXTILE FIBERS

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Filed Dec. 18, 1964, Ser. No. 419,301
Claims priority, application France, Dec. 21, 1963, 958,108
15 Claims. (Cl. 302—59)

The present invention relates to a pneumatic separating-distributing device for fiber tufts or flocks, the purpose of which is to separate air and dust from the fibrous material being transported by air and to unload the latter either into a container or any feeding device which may be a usual part of the equipment of textile machinery.

It is known that in the textile industry, the transportation of fibers under the form of flocks or tufts between different machines or groups of machines is effected pneumatically. At the end of the circuit there is usually a rotating separating-distributing device, because the direct unloading of the material from the conveying pipe is impossible in view of the violent air exhaust, as well as the violent release of the material and dust being conveyed.

For these reasons, the removal of the air which was used for conveying is usually effected by means of a rotating perforated drum, the internal portion of which is connected to a fan. In this case, the total flow of air goes through the drum surface located in front of the suction pipe, the opposite side being obstructed by a swivelling cover placed inside the perforated drum. It is clear that in this arrangement, on the one hand, the surface available for the passage of air is relatively small, and on the other hand, the depression which prevails thereat is very high. As a result, the conveyed tufts are violently sucked in against the surface of the drum under depression, and are therefore condensed into a compact mass, which is subsequently scraped off by means of an appropriate scraper or a pair of cylindrical removers, and finally discharged into a feeding device, such as a loader, which is a usual part of the equipment of textile machines, particularly cotton-openers and cotton-breakers.

This condensation of the tufts or flocks into a sheet or mass is a serious disadvantage, since the purpose of the machines or groups of machines between which the fibrous material is being carried is in fact the opening and disentangling of tangled fibers into lighter and lighter tufts, etc. The re-compressing of the fibers after each handling stage results in considerable reduction in the efficiency of the disentangling and combing actions of the machines provided therefor.

It is an object of this invention to provide method and apparatus to overcome the disadvantages described above by separating the fiber tufts and the air used for transporting the same, without condensing said tufts into a compact mass.

More specifically, the novel apparatus for carrying out the present method is characterized in that it comprises means which provide that the tufts originating from any picker, are sucked in and driven by a fan toward a separating-distributor device placed in the upper portion of a feeding conduit. In this manner, the tufts are forced into the separating-distributing device at a speed which practically corresponds to the speed of the outflow of air at the end of the conveying pipe. Preferably, the feeding conduit opens out above the highest portion of the machine.

The separating-distributing device is provided with an expansion chamber defined between two perforated metal screens or filters of large area and whose distal sides are subjected to suction by a second fan, the effective power

or strength of which is slightly less than that of the conveying fan so as to maintain a very slight overpressure in the vicinity of the screens. Thus, the reduction in the velocity of the air from the conveying fan as fiber-laden air enters the expansion chamber, and which reduction results from the abrupt increase in the area available for the passage of air through the wide-surface screens, produces a very strong braking action upon the movement of the fibers being conveyed.

A first shutter, called an "obturating shutter," has an angular reciprocating motion and closes and opens alternately the space in the expansion chamber located beneath the two perforated screens. As heretofore stated, the rate of flow of the air sucked in through the screens is slightly lower than the rate of flow of the air entering the expansion chamber, with the result that an overpressure exists in the zones defined by each movement of the shutter.

The successive formation of these overpressure zones in front of the screens has the effect that the fibers are held in suspension, so they will float until they are discharged, said discharge being effected by a second shutter, called a "removing shutter" or "discharge shutter," which has an angular reciprocating motion of approximately 360°. It is also to be noted that successive opening and closing of the lower portions of the screens by the obturating shutter prevents the driving of the fibers by the discharge shutter from one perforated screen to the other.

The feeding conduit advantageously may be provided with narrowing zones or an axial deflector, the purpose of which is to assemble the fibers and aline them parallel to the axis of the conduit, which improves the quality of the fabric obtained with said fibers. On the other hand, to avoid clogging the conveying circuit when the feeding stack or conduit is entirely filled with fibers, the separator-distributor is provided with an overflow detector, which permits the stopping or restarting of the machine which feeds the fibers to the conveying fan for the input of the separator-distributor.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which—

FIGURE 1 is a schematic longitudinal vertical sectional view of a preferred embodiment of the separating-distributing device which is shown discharging the fiber tufts into a feeding conduit placed behind a carding machine and with suction ducts being shown in cross-section;

FIGURE 2 is an enlarged plan view taken substantially along line 2—2 in FIGURE 1 with arrows showing the driving of the tufts into the separating-distributing device, as well as to the suction device through the filters;

FIGURE 3 is an enlarged end elevation taken along line 3—3 in FIGURE 2 and being partially broken away to show the arrangement of the two shutters, as well as the electric push-button switches of the overflow detector;

FIGURE 4 is an end elevation similar to FIGURE 3, taken along line 4—4 in FIGURE 2, showing means for actuating the shutters;

FIGURES 5, 6, and 7 are diagrammatic views illustrating the operation of the shutters;

FIGURE 8 is a vertical sectional view taken substantially along line 8—8 in FIGURE 4 and showing the manner in which the shutters are mounted on their actuating shaft;

FIGURE 9 is a detail view of the coupling arrangement between the removing shutter and the obturating shutter;

FIGURE 10 is an electrical diagram of the overflow detecting device.

In FIGURE 1, which shows, as an example, the adaptation of the separator-distributor of the present invention

on a feeding conduit 3 of a carding machine, 1 designates the main cylinder or swift, 2 the doffer cylinder, 3 the feeding conduit, 4 the housing of the separator-distributor 4*a*, and 5 the connecting means or fitting between the main conveying conduit D and the separator-distributor. Fibers are fed from a machine or fiber feeder F to a conveying fan C whose output air stream conveys the fibers along the conveying conduit D and fitting 5 to the inlet I at the top of an expansion chamber E in housing 4.

In FIGURE 2, showing the connection of the suction device to the separator-distributor, 6 and 6′ designate the perforated screens or filters, and 7 and 7′ designate the branch ducts to suction pipe 8 of a suction blower unit or suction device 9.

The dust sucked through filters 6, 6′, at the same time as the airflow of the conveying fan C, is forced through a pipe 10 connected to the outlet of fan 9 and toward a usual filtering plant (not shown).

In FIGURE 3, showing the arrangement of the movable shutters, as well as the electrical push-button switches of the overflow detector, the operation of which will be explained in detail below, 11 designates the removing or discharge shutter, 12 is the obturating shutter, which also acts as a "feeler" for the electrical overflow device, 13 is a support for push-button switches 14, 14′ and 15, 15′, and 16 and 17 are stops or abutments fixed on one end wall of housing 4. The bottom wall of housing 4 is provided with a large outlet or aperture G for communication with feeding conduit 3. Support 13 is integral with or fixed to a sleeve 37 which moves with shutter 12. A contacting finger 19 and removing shutter 11 are fixed on a shaft 20 journaled in housing 4.

FIGURE 4, which is a view similar to FIGURE 3, shows the actuating device for the removing shutter 11 and obturating shutter 12. In this figure, 21 designates a motor which drives the input of a speed reducing unit 22 by means of pulleys 23 and 25 and a belt 24. Motor 21 and speed reducing unit 22 are mounted on one end wall of housing 4. A disc 26 provided with an eccentric roller 27 is fixed on the output shaft of reducing unit 22. A cogged or toothed segment 28, pivoting on axis 29, is actuated in a reciprocable angular motion by eccentric roller 27 which moves inside a slot 30 under the effect of the rotation of disc 26. Segment 28 transmits its motion to a pinion 31 fixed on shaft 20 so as to reciprocate the removing shutter 11 and finger 19 with shaft 20.

The ratio between the number of teeth of segment 28 and pinion 31 is selected in such a manner that each movement of segment 28 corresponds substantially to a complete revolution of pinion 31 and removing shutter 11, the direction of the motion being inverted each time the removing shutter 11 occupies a position perpendicularly in the middle of the aperture G on the outlet side of the separator-distributor, as shown in FIGURE 3.

FIGURES 5, 6 and 7 show diagrammatically the operating principle of removing shutter 11 and obturating shutter 12.

The double-pointed arcuate arrow in FIGURE 5 shows how the removing shutter 11 may effect a complete revolution around its axis, with inversion of its direction of rotation occuring in the middle of the aperture or outlet G of the separator-distributor, as heretofore described.

The arcuate arrow in FIGURE 6 indicates the movement of obturating-feeling shutter 12. The amplitude of the angular motion of shutter 12 is limited by the width of the outlet G of the separator-distributor, since the shutter moves against the edges of the outlet G upon each change in the direction of its traveling motion.

FIGURE 7 shows the combined operation of the removing shutter 11 and obturating-feeler shutter 12.

FIGURE 8 shows the removing shutter 11 with its securing sleeves or casings 33 and 34, as well as the obturating-feeler shutter 12 with its sleeves 35, 36 and 37. FIGURE 8 shows also the actuating means of the removing shutter 11 and obturator 12. In this instance, sleeves or casings 33, 34, integral with or fixed to removing shutter 11, as well as sleeves 35, 36, 37, integral with or fixed to obturating shutter 12, are assembled in the form of a hinge on shaft 20. Sleeves 33, 34 are fixed by means of pins 38, 38′ and 39, 39′ on shaft 20, the driving of which is effected as has been explained with respect to FIGURE 4.

A coiled spring 40 (FIGURE 9) is mounted on shaft 20 inside a hollow sleeve 41, the latter being axially movable on shaft 20 by virtue of a key 42. Spring 40, compressed by a nut 43 against a sleeve 44, exerts its pressure against sleeve 41 which, through the intermediary of a ring or washer 45, presses against sleeve 35, which may be integral with shutter 12. Since sleeves 35, 36, 37 are free on shaft 20, their corresponding ends are obviously also pressing against sleeves 33, 34 pinned on shaft 20.

In this manner, the obturating-feeling shutter 12 is actuated by shaft 20 simultaneously with removing shutter 11, a yielding connection between the two shutters being obtained by the pressure of spring 40. It follows therefore that, each time obturating shutter 12 abuts against one of the edges of the outlet G of the separator-distributor, as shown in FIGURE 3, the removing shutter 11 continues its motion, while shutter 12 remains stationary until inversion of the angular motion of removing shutter 11 occurs. It is apparent that, during this stopped period of obturating shutter 12, there is some friction at the supporting points between the sleeves rigidly fixed on shaft 20 and those which are free on shaft 20 so as to maintain shutter 12 in the desired position.

FIGURE 10 shows the electrical overflow detector, which permits the stopping or restarting of the machine F which feeds the fiber tufts to the conveying fan C. The overflow detector comprises two electromagnetic relays or circuit-breakers 46, 47 serially connected for the control of motor 48 driving the machine F which feeds the tufts to the conveying fan C. The four push-button switches, of which 14 and 14′ are normally open and 15 and 15′ are normally closed (FIGURES 3 and 10) are fixed on the common support 13 which moves in fixed relation with obturating-feeler shutter 12. Switches 14′, 15′ are connected to the coil of circuit-breaker 47, while switches 14, 15 are connected to the coil of circuit-breaker 46.

As heretofore stated, the fixed abutments 16, 17 (FIGURE 3) are provided on one of the sides of the separator-distributor, for the purpose of actuating the normally open or "start" switches 14, 14′.

Contact finger 19 fixed at the end of the driving axis of removing shutter 11 cooperates with the normally closed or "stop" switches 15, 15′.

Normal operation

First, shutter-actuating motor 21 is energized and the "start" switches 14, 14′ may be closed manually to actuate and close circuit-breakers 46, 47 to start feeder motor 48. Alternatively, "start" switches 14, 14′ need not be closed manually, as will be explained later. When motor 21 is started, assuming shutters 11, 12 occupy the solid line position shown in FIGURE 3, shutter 11 will be positively driven clockwise and will yieldably move shutter 12 therewith until shutter 12 moves to the position of FIGURE 4, e.g., into engagement with the left-hand wall of opening G. Removing shutter 11 continues clockwise movement with its free edge moving against or closely adjacent the successive curved filters 6, 6′ until it returns to the position of FIGURES 5 and 7, whereupon segment 28 reverses its movement and removing shutter 11 moves counterclockwise. As shutter 11 starts counterclockwise movement, it moves obturating shutter 12 therewith to

return shutter 12 to a position against the right-hand lower edge of outlet G and, thereafter, shutter 11 returns to the position of FIGURES 3 and 5.

Since switches 14, 14', 15, 15' (FIGURE 3) are fixed on support 13 which moves with and follows the angular motion of obturating shutter 12, the length of said angular motion of said switches normally is limited by the width of the outlet G of the separator-distributor, as heretofore described. The distance between the fixed abutments 16, 17 is adjusted according to the amplitude of the angular motion of shutter 12, so that each time obturating shutter 12 moves toward the left, switch 14' is closed through contact with the right hand abutment 17. Conversely, when obturating shutter 12 moves to the right, the "start" switch 14 is closed by the left-hand abutment 16. It follows that "start" switches 14, 14' are closed in succession and, as long as "stop" switches 15, 15' remain closed thereafter, as is normal, both circuit-breakers 46, 47 remain closed and fiber feeder F is operating.

The reversing of the angular motion of removing shutter 11, which actuates obturating shutter 12, as explained, is always effected when it is positioned in the middle of the lower aperture G of the separator-distributor. Therefore, during normal operation, contacting finger 19 never touches the "stop" switches 15, 15', since at the moment of the reversal of the motion of removing shutter 11, there is always an angular displacement between contacting finger 19 and the "stop" switches 15, 15'. Since circuit-breakers 46, 47 are closed while the machine is operating, it is clear that the successive closing of the "start" switches 14, 14' by their contact with abutments 16, 17 will not have any effect as long as the travel path of obturating shutter 12 is not modified.

Stop of feeding

If the tufts being discharged through opening G are not absorbed or used as fast as they arrive, they will accumulate in front of outlet G of the separator-distributor 4*a*, which will prevent obturating shutter 12 from effecting its normal travel. Therefore, the angular distance between support 13 and contacting finger 19 will decrease progressively, and switches 15 or 15' will come nearer and nearer contacting finger 19, to be finally opened. Upon either switch 15 or 15' being opened, it is apparent by referring to FIGURE 11 that the circuit to the coil of the corresponding circuit-breaker 46, 47 is broken to break the circuit to motor 48 and stop the machine F which feeds the fiber tufts to the conveying fan C.

Re-starting feeder

The feeding of the tufts to the conveying fan C being stopped, obturating shutter 12 continues a reduced reciprocating motion, so as to avoid constant pressure upon the accumulated tufts and to facilitate their disengaging. During this time, of course, removing shutter 11 continues its complete circuit without interruption.

The level of the tufts is lowered little by little, which frees the space in the vicinity of shutter 12, and the latter, resuming its normal angular motion, engages, by means of the fixed abutments 16, 17, the "start" switches 14, 14', which again actuate the circuit-breakers 46, 47 and the motor 48 for the machine F which feeds the tufts to the conveying fan C to restart the flow of tufts through pneumatic conveyor or duct D and into separator-distributor 4*a*.

It is thus seen that removing shutter 11 removes fibers from filters 6, 6' and, with each downward stroke of shutter 11 past either filter, the space below the shutter 11 is open to permit the fibers to pass through aperture G into conduit 3. At the same time the obturating shutter is, in effect, closing the other filter to the fibers then beneath removing shutter 11 while serving also to deflect fibers being displaced by removing shutter 11 downwardly through discharge opening G. However, the large area of the filter then closed to the fibers being discharged is open to the inflowing air and fibers through the ingress opening I so the latter fibers are held in suspension in the air above obturating shutter 12 and small, light dust particles are drawn through the corresponding filter.

It is important to note that by providing suction or negative pressure at the distal sides of filters 6, 6', the rate of flow of the air and fibers toward the discharge opening G is much less than it is as the fiber-laden air enters chamber G, owing to the fact that most of the conveying air is absorbed or sucked through the filters. Thus, the fibers are permitted to move slowly toward the discharge opening G and are not compressed together by high-velocity or high-pressure air, as has been the case heretofore.

In the drawings and specification, there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. In a system for distributing fibers from a source to a location remote from said source including a pneumatic conveyor conduit and a fan for blowing fibers from the source along the conduit; the combination therewith of a housing having a pair of laterally spaced filters defining a chamber therebetween, said housing having an inlet at its upper portion communicating with said chamber for receiving fibers and air from said conduit and also having a discharge opening its lower portion communicating with said chamber, said inlet and discharge opening being arranged so that fibers fall through said inlet, said chamber and said discharge opening under the impetus of air flowing from said conduit, and means including an air impeller for sucking air out of said chamber and outwardly through said filters to relieve the fibers in the chamber from at least a part of the pressure of the air entering the chamber from said conduit whereby the fibers falling through said chamber and then through said discharge opening are subjected to lesser force of the air flowing from said conduit.

2. A structure according to claim 1, wherein the pressure of the air produced by said impeller means is slightly less than that of the air pressure in the chamber effected by said fan.

3. A structure according to claim 2, including an obturating shutter oscillatably supported in said chamber on a substantially horizontal axis in a medial portion of said chamber and extending substantially throughout the length of said discharge opening, means for oscillating said shutter, and said shutter depending from said axis toward said opening and being operable to close alternately the space below the two filters so as to cause an overpressure at each filter when the space therebelow is closed.

4. A structure according to claim 1, including a removing shutter journaled on a substantially horizontal axis in a medial portion of said chamber, means to oscillate said shutter through a sufficient angular motion such that said shutter alternately moves downwardly past the two filters to move corresponding fibers toward said discharge opening, and one edge of said shutter remote from said axis being movable in close proximity to said filters during oscillation thereof.

5. A structure according to claim 1, wherin said filters are curved about a common substantially horizontal axis located in a medial portion of said chamber, a pair of first and second shutters journaled on said axis, each shutter extending radially from one side of said axis, means to oscillate said first shutter angularly about 360° with its free edge remote from said axis moving alternately adjacent the proximal surfaces of said filters, said last-named means being operable to oscillate said second shutter on said axis from side to side of said discharge opening, the edge of said second shutter remote from said axis being

located a substantially greater distance from said axis than said edge of said first shutter.

6. A structure according to claim 1, wherein a feeding means is provided at said source for feeding fibers to said pneumatic conveyor, and wherein a duct communicates with said discharge opening for receiving fibers from said chamber; overflow detector means operable to detect an overflow of fibers in said duct adjacent said opening, and means responsive to detection of such overflow by said detector means for stopping said feeding means until an overflow is no longer detected by said detector means.

7. A structure according to claim 1, wherein said filters are curved about a common substantially horizontal axis located in a medial portion of said chamber, a pair of first and second shutters journaled on said axis, each shutter extending radially from one side of said axis, means to oscillate said first shutter angularly about 360° with its free edge remote from said axis moving alternatively adjacent the proximal surfaces of said filters, said second shutter extending downwardly from said axis through said opening and being of substantially greater radial length than said first shutter, and means yieldably interconnecting said shutters and being operable to oscillate said second shutter with said first shutter at times in which oscillation of said second shutter is unobstructed whereby said second shutter oscillates with an angular motion less than that of said first shutter.

8. A structure according to claim 7, wherein said first shutter occupies a substantially vertical position with its free edge adjacent said discharge opening at the end and start of each angular movement thereof in each direction.

9. In a system for distributing fibers from a source to a remote location including a pneumatic conveyor conduit, a fan for blowing fibers along said conduit, feeding means for feeding fibers from the source to said fan, and a duct for receiving fibers at said location; the combination therewith of a housing having a pair of laterally spaced filters therein defining a chamber therebetween, said housing having an inlet at its upper portion communicating with said chamber for receiving fibers and air from said conduit and also having a discharge opening in its lower portion establishing communication between said chamber and said duct, a second fan for withdrawing some of the air from said chamber through said filters, said filters being curved, at least in part, about a substantially horizontal axis located in a medial portion of said chamber, a shaft journaled in said housing on said axis, first and second shutters having relatively offset portions on corresponding edges thereof mounted on said shaft and serving to fix the first shutter on said shaft and to journal the second shutter on said shaft, means to repeatedly oscillate said shaft and said first shutter angularly about 360° with the free edge of said first shutter remote from said shaft moving alternately adjacent the proximal surfaces of said filters to and from a position adjacent the longitudinal center of said discharge opening, means yieldably interconnecting said shutters and being operable to transmit oscillation from said first to said second shutter whenever movement of said second shutter is unobstructed, and said second shutter extending downwardly through said opening and being adapted to alternately engage opposed edges of said opening during oscillation of said first shutter.

10. A structure according to claim 9, including means responsive to obstruction of angular movement of said second shutter into engagement with either of opposed edges of said opening, such as by an overflow of fibers in said duct, for stopping said feeding means.

11. A structure according to claim 10, wherein said responsive means is operable to start said feeding means upon said second shutter moving into engagement with said opposed edges of said opening.

12. A structure according to claim 10, wherein said feeding means is electrically operable, said responsive means including a first control element angularly movable in fixed relation to said first shutter, a second control element angularly movable with said second shutter and normally being out of engagement with said first element but being engageable by said first element upon obstruction of angular movement of said second shutter other than by engagement of said second shutter with either of said opposed edges of said opening, electrical connecting means being at least one of said elements and said feeding means, and interengagement of said elements being operable to break the circuit to said feeding means.

13. A structure according to claim 12, wherein said responsive means further includes switch means electrically connected in said electrical connecting means and movable in fixed relation with said second shutter, and stop means engageable by said switch means to actuate the same and start said feeding means when said second shutter engages alternately said opposed side edges of said discharge opening.

14. A structure according to claim 9, wherein said means to oscillate said shaft comprises a pinion fixed on said shaft, a cogged segment meshing with said pinion, and means operatively connected to said segment and imparting predetermined oscillating angular movement to said segment such as to impart a complete revolution to said first shutter during each angular movement of said segment in each direction.

15. In a system for distributing fibers from a source to a remote location including a pneumatic conveyor conduit, and a fan for blowing fibers from said source along said conduit; the combination therewith of a housing having a pair of laterally spaced side walls defining a chamber therebetween, said housing having an inlet at its upper portion communicating with said chamber for receiving fibers and air from said conduit and also having a discharge opening in its lower portion for discharging fibers therefrom, a shaft journaled in said housing on a substantially horizontal axis located in a medial portion of said chamber, first and second shutters having relatively offset portions on corresponding edges thereof mounted on said shaft and serving to fix the first shutter on said shaft and to journal the second shutter on said shaft, means to repeatedly oscillate said shaft and said first shutter angularly approximately 360° with the free edge of said first shutter remote from said shaft moving alternately adjacent the proximal surfaces of said opposed side walls and to and from a position adjacent the longitudinal center of said discharge opening, means yieldably interconnecting said shutters and being operable to transmit oscillation from said first to said second shutter whenever movement of said second shutter is unobstructed, and said second shutter extending downwardly through said opening and being adapted to alternately engage opposed edges of said opening during oscillation of said first shutter.

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