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[54] **METHOD FOR PNEUMATICALLY CLEANING
 OPEN-END SPINNING MACHINES**
5 Claims, 5 Drawing Figs.

[52] U.S. Cl. **134/21,**
15/301, 15/306, 57/58.89, 57/58.95, 134/37

[51] Int. Cl. **B08b 5/04**

[50] Field of Search **134/21, 37;**
15/301, 306; 57/56, 58.89-58.95

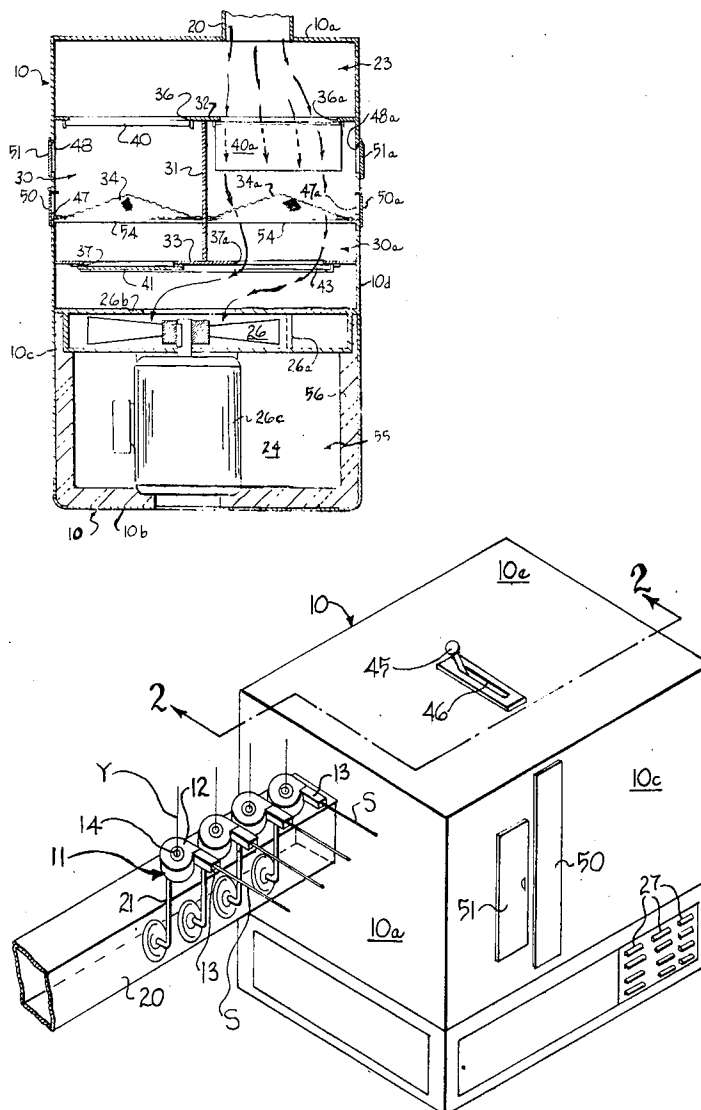
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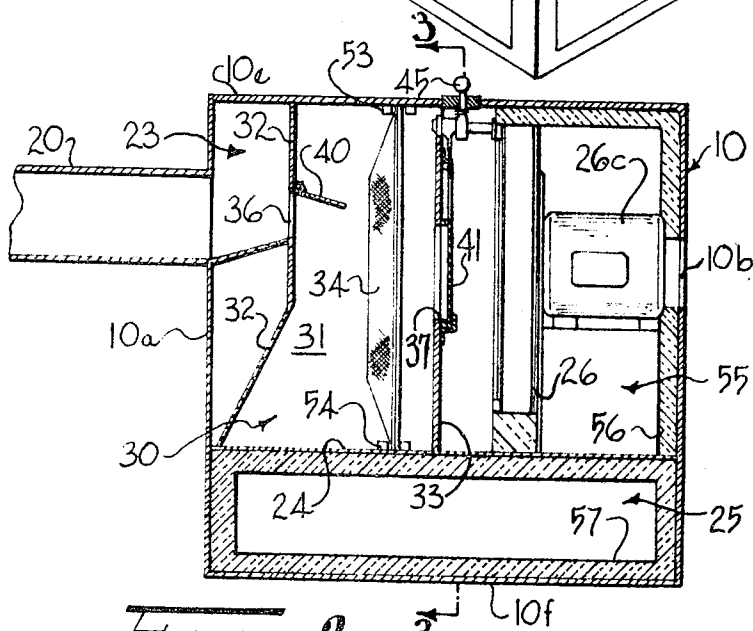
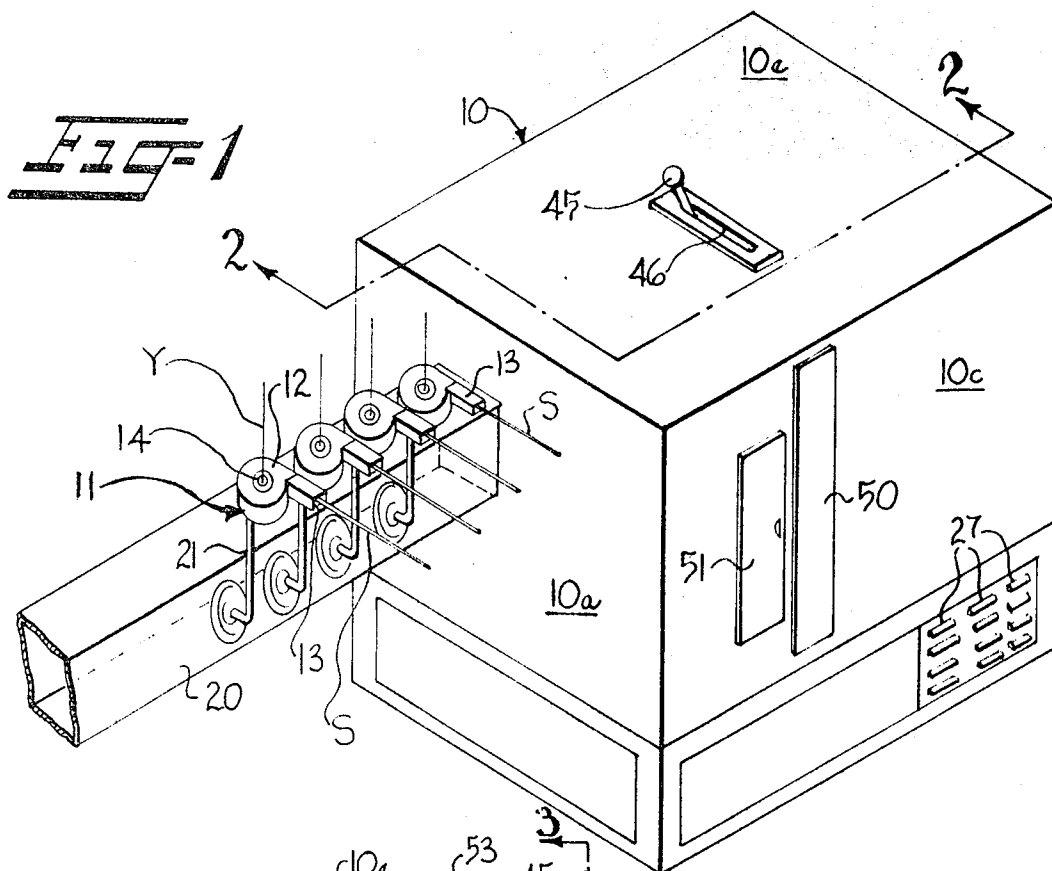
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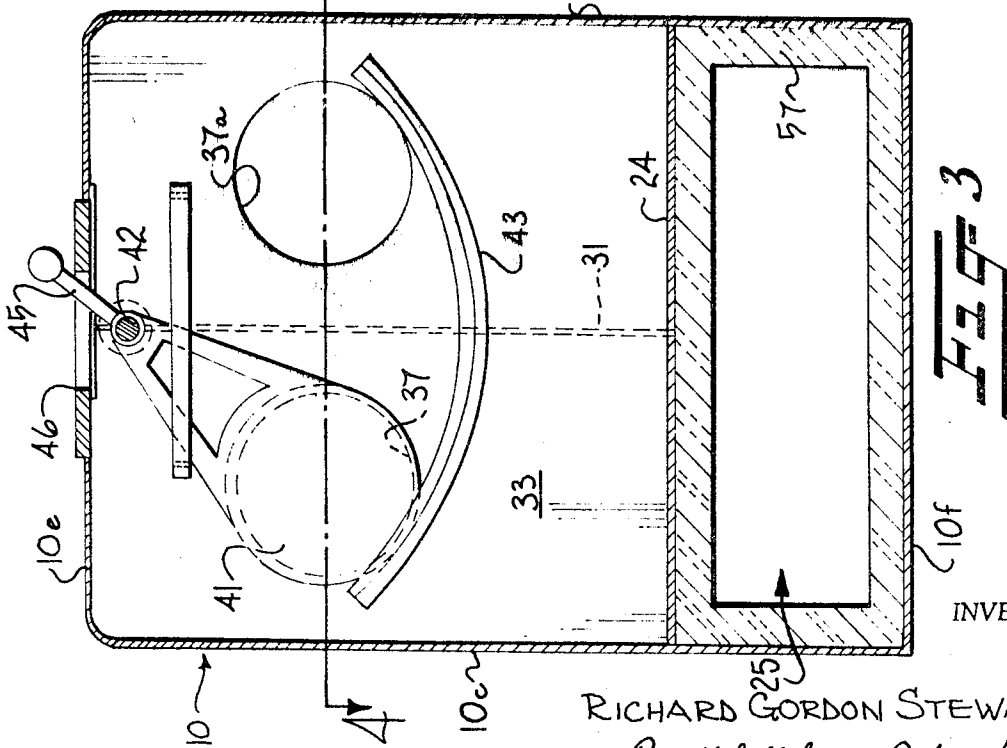
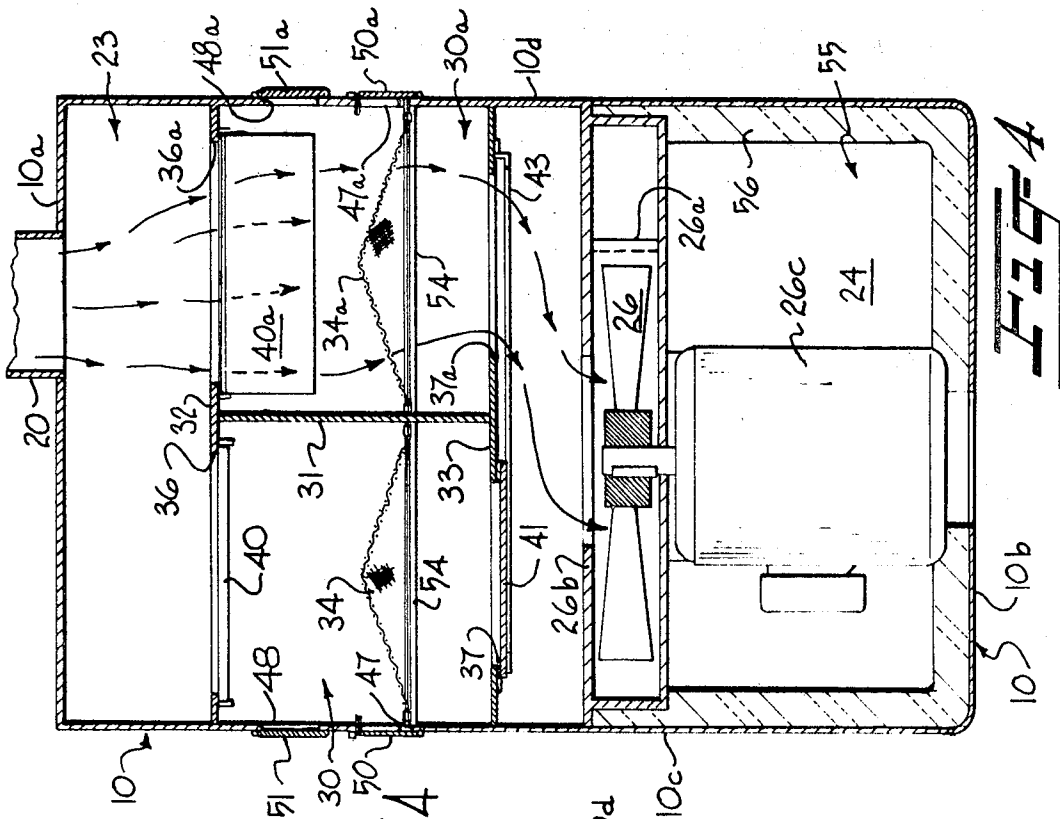
ABSTRACT: This invention is directed to the cleaning of the spinning heads or units of open-end spinning machines, and the apparatus for carrying out the instant method includes means for maintaining a substantially constant high-pressure suction airstream at a plurality of open-end spinning units while alternately filtering the airstream through a pair of generally parallel filter-containing airflow chambers in advance of a high-pressure suction fan whereby fiber waste may be removed from each chamber and its filter while the airstream flows through the other chamber without reducing the efficiency of the airflow at the spinning units as effected by the fan.





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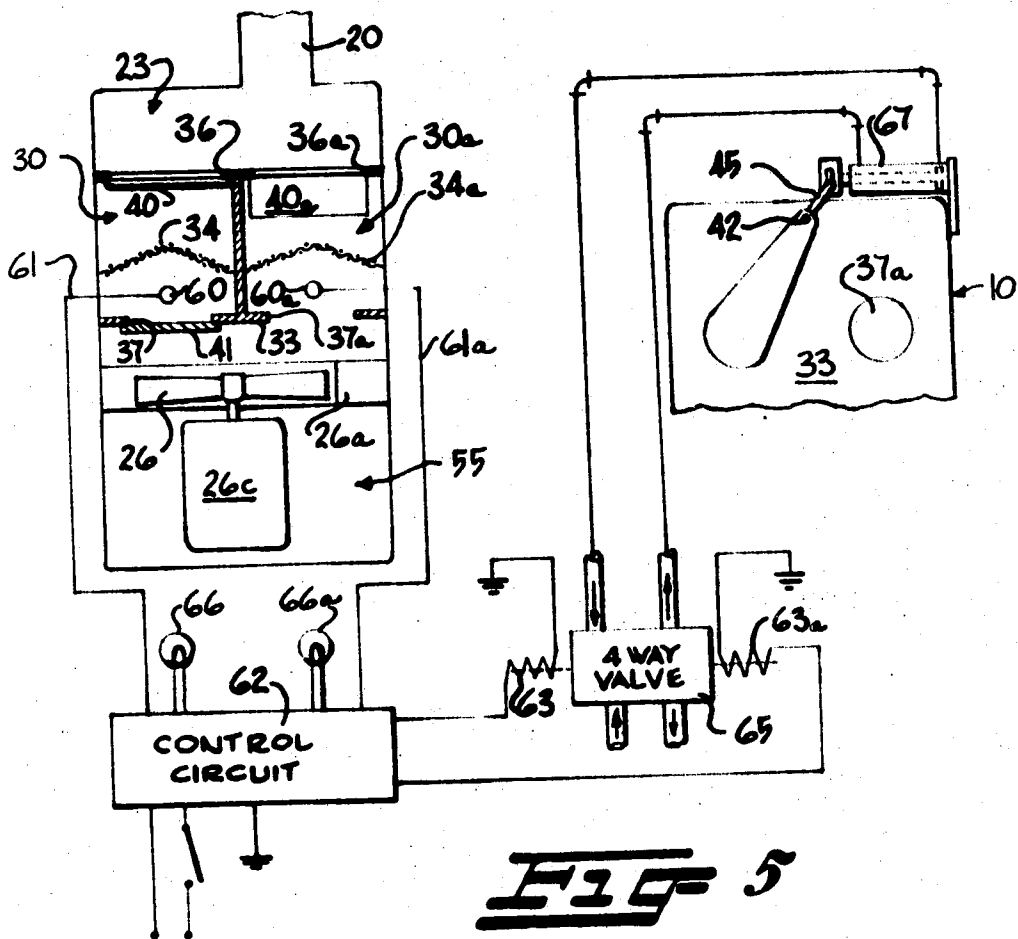
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METHOD FOR PNEUMATICALLY CLEANING OPEN-END SPINNING MACHINES

Recent advances in the technology of spinning textile fibers into yarn have resulted in the development of various types of open end spinning machines designed to form yarn without utilizing spinning rings, travelers or spindles. Generally, open end spinning units each include a hollow spinning rotor into which separated fibers are fed via a tube which discharges the fibers nearly tangentially onto the collecting surface of the rotor chamber where the fibers are subjected to centrifugal forces so they are pressed against the collecting surface. The fibrous strand thus formed is withdrawn from the chamber while twist is inserted therein to form the yarn. As the yarn strand is withdrawn, new fibers are introduced into the rotor chamber, making spinning continuous. An example of one type of open end spinning unit is disclosed in the U.S. Pat. No. 3,425,205 of Hans Landwerkamp et al. issued Feb. 4, 1969.

Dust and fly is produced by the spinning operation within the spinning rotors of open end spinning machines, and the formation of the yarn is detrimentally affected if such waste material is not continuously and promptly removed from each rotor under a high-pressure suction system. Therefore, it is very important that the high-pressure suction airflow be maintained substantially constant at all times adjacent the spinning units during the spinning operations. Also, it is important that the high-pressure system is designed so that the fiber waste does not reach the fan producing the high-pressure airstream, since materials handling fans, i.e., fans capable of propelling textile fibers efficiently, are inefficient at the high pressures required to effect prompt and efficient removal of waste material from the spinning rotors of open end spinning machines.

It is therefore the primary object of this invention to provide a method of and means for continuously removing fiber waste from the rotors of an open end spinning machine during operation thereof in which a substantially constant high-pressure suction airflow is maintained at the rotors by utilizing filters located between the rotors and a high-pressure suction air fan for fiber waste entrained in the air flowing through such rotors, and wherein the filters may be cleaned without interrupting the flow of air or adversely affecting the efficiency of the flowing airstream.

It is a more specific object of this invention to provide a method of and apparatus for maintaining a substantially constant high-pressure suction airflow through the rotors of an open end spinning machine for conveying fiber waste and separating such waste from the high-pressure flowing air in its course to an airflow producing means or fan wherein the airflow is directed alternatively in first and second paths; each bypassing the other, and wherein fiber waste is entrapped against first and second filters in the respective first and second paths. By directing the airstream in the first and second paths in alternation, the first filter may be cleaned while the airflows in the second path, and vice versa, without interrupting or reducing the efficiency of the airflow, and without fiber waste reaching the airflow producing means or fan downstream of the filters even though the filters may be removed alternatively from the two airflow paths.

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:

FIG. 1 is a perspective view of a preferred form of filter separator unit for carrying out the method of the present invention and schematically illustrating an open end spinning machine in association therewith;

FIG. 2 is a longitudinal vertical sectional view through the filter separator unit taken substantially along line 2—2 in FIG. 1;

FIG. 3 is a transverse vertical sectional view through the filter separator unit taken substantially along line 3—3 in FIG. 2 showing means for selectively closing the downstream walls of the airflow chambers;

FIG. 4 is a sectional plan view through the filter separator unit taken substantially along line 4—4 in FIG. 3; and

FIG. 5 is a schematic view illustrating mechanism for alternately closing the airflow channels or chambers of the filter separator unit automatically at predetermined intervals.

Referring more specifically to the drawings, the novel apparatus includes a filter separator unit for carrying out the method of the instant invention whose housing is broadly designated at 10 and is shown in FIG. 1 in association with an open end spinning machine having a plurality of spinning units 11 which may be of substantially the type disclosed in said U.S. Pat. No. 3,425,205, for example. Although a single row of spinning units 11 is shown in FIG. 1, the machine may include two substantially parallel rows of spinning units. Each spinning unit includes a stationary hollow casing 12 provided with a tubular feed guide 13 which discharges previously separated fibers of a textile sliver S into the strand-forming chamber of a rotor which rotates at high speed within the respective casing 12. The fibrous strand thus formed is withdrawn from the rotor chamber through a withdrawal tube 14 which is substantially concentric with rotor within casing 12 and, as the fibrous strand is withdrawn from the rotor chamber, twist is inserted therein to form the spun yarn Y. The spun yarn Y may be withdrawn from the spinning units 11 by suitable rolls, not shown, and may be wound into suitable packages for subsequent handling and processing.

As heretofore stated, dust and fly is produced continuously by the spinning operation within the spinning rotors and the casings 12 of the spinning units, and the formation of the yarn is detrimentally affected if such waste material is not continuously and promptly removed from each spinning unit by a high-pressure suction airstream. Also, the high-pressure flow of air through the spinning units 11 must be substantially constant within predetermined limits at all times during the spinning operation.

Accordingly, rotor casings 12 are connected to a common fiber waste conveying suction duct 20 by respective branch tubes 21 (FIG. 1). One end of duct 20 is connected to the rear wall 10a of filter separator housing 10 for communication with an expansion chamber 23 in the upper rear portion of housing 10. The other end of suction duct 20 may be closed by any suitable means, not shown. Housing 10 includes a front end wall 10b, opposing sidewalls 10c, 10d and top and bottom walls 10e, 10f. An intermediate or auxiliary bottom wall 24 is spaced above main bottom wall 10f and defines therewith an air exhaust chamber 25 through which the airstream, produced by an air impeller means or fan 26 thereabove, flows from fan outlet 26a (FIG. 4) to be exhausted from housing 10 through a suitable exhaust opening or outlet. By way of example, the outlet may be formed by louvers 27 provided in the lower portion of housing sidewall 10c (FIG. 1).

Fan 26 may be of the centrifugal type, and the volute casing 26b thereof is positioned between sidewalls 10c, 10d downstream of a pair of first and second generally parallel airflow channels or chambers 30, 30a (FIG. 4) located immediately forwardly of expansion chamber 23 and spaced rearwardly of fan 26. Fan 26 may be driven by an electric motor 26c. As best shown in FIGS. 3 and 4, airflow chambers 30, 30a are defined by a substantially vertical divider partition 31 located about midway between opposing housing sidewalls 10c, 10d and extending from top wall 10e to auxiliary bottom wall 24. Airflow chambers 30, 30a are also defined by rear and front transverse partitions 32, 33 extending between sidewalls 10c, 10d and between top wall 10e and auxiliary bottom wall 24. Spaced between transverse partitions 32, 33 and positioned within the respective airflow chambers 30, 30a are substantially upright filters 34, 34a which are preferably positioned more closely adjacent front transverse partition 33 than they are to rear transverse partition 32, so that a fiber waste collection chamber is defined between each filter 34, 34a and the rear transverse partition 32. It is preferred that the lower portion of transverse partition 32 extends downwardly and rearwardly at an angle as shown in FIG. 2 to provide an enlarged collection chamber area for the collection of fiber waste therein.

The rear and front transverse partitions 32, 33 are provided with respective air ingress openings 36, 36a and air egress openings 37, 37a for the respective airflow chambers 30, 30a. Closure flaps or one-way dampers 40, 40a positioned within the respective airflow channels 30, 30a are pivotally connected to rear transverse partition 32 immediately above ingress openings 36, 36a and are adapted to rest against the front surface of rear transverse partition 32 to close the respective ingress openings 36, 36a in alternation.

The closure flaps 40, 40a cooperate with a shiftable closure member 41 to serve as means for selectively, but alternatively, closing the airflow chambers 30, 30a to the flow of air therethrough, which means is operable to open the first chamber 30 whenever the second chamber 30a is closed, and to open the second chamber 30a whenever the first chamber is closed. Accordingly, closure member 41 is so constructed and arranged as to close the egress openings 37, 37a alternatively and so that, whenever it is closing one of said egress openings, the other of the egress openings will be opened.

As best shown, in FIGS. 3 and 4, closure member 41 is positioned within the space defined between the casing 26b of fan 26 and the front partition 33. The upper portion of closure member 41 is pivotally connected, as at 42, to the partition 33 at a point spaced substantially above egress openings 37, 37a and at a point about midway between egress openings 37, 37a. A suitable arcuate guide member 43 may be suitably secured to the front surface of front partition 33 for maintaining the lower portion of closure member 41 in close proximity to or against the front surface of front transverse partition 33 when closure member 41 is being shifted from either egress opening 37, 37a to the other. The upper end of closure member 41 is provided with an operating lever or arm 45 which, in the embodiment of FIG. 3, projects through a slot 46 provided in the upper wall 10e of housing 10 and which may be manipulated for shifting the closure member 41 from either egress opening to the other, as desired.

Upon substantial amounts of fiber waste being collected in the collection chambers defined between the lower portions of filters 34, 34a and rear transverse partition 32 and/or upon excessive accumulation of fiber waste or the upstream surfaces of filter 34, 34a, such collected fiber waste must be removed from the collection chambers and from filters 34, 34a. Accordingly, opposing sidewalls 10c, 10d of housing 10 are provided with respective pairs of access openings 47, 48 and 47a, 48a (FIG. 4) which are normally closed by respective movable closure plates or doors 50, 51, 50a, 51a. The openings 47, 47a provide access to the respective filters 34, 34a and are of such size that filters 34, 34a may be removed therethrough.

To facilitate insertion and removal of filters 34, 34a, the upper wall 10b and auxiliary bottom wall 24 are provided with respective transverse elongate guide members 53, 54 (FIG. 2) within each airflow chamber 30, 30a for receiving and guiding the upper and lower edge portions of filters 34, 34a as they are being inserted in and withdrawn from chambers 30, 30a. The access openings 48, 48a are especially provided to permit access to the collection chambers for removal of collected fiber waste therefrom.

The front portion of housing 10 is provided with a motor chamber 55 defined by portions of housing walls 10b, 10c, 10d, 10e and by the front wall of fan casing 26b. The inner surfaces of the housing walls 10b, 10c, 10d, 10e defining chamber 55 may be provided with a lining of acoustical insulation material 56 thereon so that the noise produced by the blowing airstream, the fan 26 and its motor 26c will not be audible exteriorly of the housing 10 to such extent as to be annoying to the operator of the open end spinning machine. It is apparent that fan motor 26c is positioned in chamber 55. The inner surfaces of those walls of housing 10 defining exhaust chamber 25 beneath auxiliary bottom wall 24 also may be provided with a suitable lining 57 of acoustical insulation material.

METHOD OF OPERATION

During operation of spinning units 11, motor 26c drives fan 26 continuously. Assuming that closure member 41 occupies the position of FIG. 3, in which egress opening 37 is closed and egress opening 37a is open, fan 26 produces a continuous high-pressure fiber waste conveying suction airstream within duct 20. The airstream is effective to produce a continuous high-pressure airflow through each rotor to draw fiber waste continuously from spinning units 11 through the respective branch tubes 21. It is essential that the fiber conveying airstream produces a relatively constant relatively high suction pressure in the branch tubes 21 and the fiber waste conveying duct 20. The pressure in the fan casing 26 should be on the order of about 22 to 30 inches water gauge pressure (w.g.p.) regardless of the type of staple fibers being spun. Generally, in open end spinning machines for spinning short staple fibers, such as cotton, into yarn, the airflow through each spinning unit 11 should be on the order of 4 cubic feet per minute (c.f.m.) at 24 inches w.g.p. In open end spinning machines for spinning long staple fibers, such as woolen and worsted fibers, into yarn, the airflow through each spinning unit 11 should be on the order of 22 c.f.m. at 18 inches w.g.p.

The airstream produced by fan 26 flows from duct 20 into expansion chamber 23 of the filter separator unit housing 10 and, since egress opening 37a is open and egress opening 37 is closed, the airstream impinges against and maintains open the closure flap 40a so the airstream flows freely through the second airflow chamber 30a. During flow of the airstream through chamber 30a the fiber waste is condensed on the fine mesh filter 34a and collected in the corresponding collection chamber. Due to the flow of air in vacuum expansion chamber 23 from the suction duct 20 into the ingress opening of the second airflow chamber 30a, a low-pressure area or suction area is produced at the air ingress opening which is effective to firmly hold the one-way flow damper or closure flap 40 in the closed position, thus creating a dead air zone in the first flow channel or chamber 30. Thus, doors 50, 51 may be opened for cleaning filter 34 and for removing fiber waste from the collection chamber rearwardly of filter 34 without causing any reduction in the efficiency of the airstream flowing through conveying duct 20, chambers 23, 30a and fan casing 26b to be exhausted therefrom through exhaust chamber 25 and louvers 27. If so desired, filter 34 may be removed from the first airflow channel or chamber 30 through access opening 47 to facilitate cleaning the filter. It should be noted that communication between chamber 30 and fan 26 then is interrupted by closure member 41 so that fiber waste in flow chamber 30 cannot then escape to the fan 26. Thereafter, filter 34, or a similar filter, is reinstalled in chamber 30 and doors 50, 51 and returned to closed position.

Since fiber waste is prevented from reaching fan 26, it is apparent that fan 26 may be designed for most efficient propulsion of the airstream, without being subject to limitations in design usually required to propel fiber waste therethrough efficiently.

When the collection chamber rearwardly of filter 34a is substantially full, and/or filter 34a has an excessive accumulation of fiber waste thereon such as to cause an undesirable reduction in the airflow through second airflow channel 30a, closure member 41 is then moved to open egress opening 37 and close egress opening 37a and to simultaneously divert the airstream from the second airflow channel into the first airflow channel 30 without loss of suction at the spinning units 11.

When closure member 41 is moved so that it closes egress opening 37a and opens egress opening 37, the airstream then impinges against and holds the closure flap 40 in open position as it flows through the first airflow chamber 30 to fan 26. At the same time, the relatively low pressure or suction pressure thus produced adjacent ingress opening 36a firmly holds closure flap 40a in closed position. The fiber waste then may be removed from within the second airflow chamber 30a and

from filter 34a in substantially the same manner as that described with respect to airflow chamber 30 and filter 34.

Closure member 41 may be arranged to operate automatically by means of a hydraulic or pneumatic ram actuated electrically through pressure switches located in the airflow channels or chambers 30, 30a. Alternatively, closure member 41 may be actuated from a suitable timing mechanism at periodic predetermined intervals. By way of example, there will be observed in FIG. 5 a suitable means for effecting automatic operation of closure member 41.

The parts shown in FIG. 5 will bear the same reference numerals as are applied in FIGS. 1-4, where applicable, to avoid repetitive description. As shown, suitable pressure detecting devices 60, 60a are suitably mounted in airflow chambers 30, 30a forwardly of filters 34, 34a and are operatively connected by lines (conduits or electrical conductors) 61, 61a to a suitable control circuit 62. Solenoids 63, 63a of a four-way valve 65 are electrically connected to control circuit 62 for alternatively effecting the flow of fluid pressure from a suitable source, not shown, into the two ends of the cylinder of a fluid-operated ram 67.

The piston rod of ram 67 is pivotally connected, by a suitable slot and pin connection, to operating arm 45 of closure member 41, and the cylinder is suitably secured to housing 10. Since control circuits which operate in response to pressure detecting devices are well known, as are solenoid-operated four-way valves, detailed illustrations and descriptions thereof are deemed unnecessary.

In operation, with closure member 41 occupying the position shown in the left- and right-hand portions of FIG. 4 and 5, upon the accumulation of fiber waste in airflow chamber 30a being such as to cause a predetermined pressure drop sensed by detecting device 60a, control circuit 62 energizes solenoid 63a to introduce fluid into the right-hand end of the cylinder of ram 67. Thus, ram 67 moves closure member 41 from left to right in FIG. 5 to open egress opening 37 and close egress opening 37a. As explained heretofore, the closing of egress opening 37a closes chamber 30a to the flow of air therethrough and opens chamber 30 to the flow of air therethrough, whereupon the collected fiber waste may be removed from airflow chamber 30a and its filter 34a.

Conversely when detecting device 60 senses a predetermined drop in pressure forwardly of filter 34, control circuit 62 energizes solenoid 63 to introduce fluid into the left-hand end of the cylinder of ram 67, thereby returning closure member 41 to the position shown in FIG. 5, thus completing a cycle in the operation thereof. Circuit 62 may be arranged to effect momentary energization of solenoids 63, 63a, or they may remain energized substantially throughout those periods during which the respective egress openings 37, 37a are closed, as desired.

If desired, control circuit 62 may be in the form of a timing device for alternatively actuating the solenoids 63, 63a at predetermined periodic intervals, in which case the lines 61, 61a may be disconnected from the control circuit, or the pressure detecting devices 60, 60a and their lines 61, 61a may be omitted.

Suitable audible and/or visual warning devices 66, 66a (FIG. 5) are provided exteriorly of housing 10 which respond to and indicate the detection of a predetermined pressure below the desired high pressure in the respective chambers 30, 30a to inform the attendant as to which chamber should be emptied and/or which filter should be cleaned. As shown, warning devices 66, 66a are in the form of electric lamps electrically connected to control circuit 62. Warning devices 66, 66a may be triggered to operate only during the periods of relatively low pressure or only during the periods of the desired relatively high pressure in the respective chambers 30, 30a, as desired, in accordance with air pressure variations detected by detecting devices 60, 60a. Similar warning devices also may be provided in instances in which the operation of closure member 41 is not automatic as in FIGS. 1-4.

It is thus seen that I have provided a novel method and means for continuously removing fiber waste from the interior areas or rotors of open end spinning units by high-pressure suction airflow and for directing the airstream in two different flow paths in alternation and wherein a filter is provided in each flow path or chamber for separating fiber waste from the airstream flowing therethrough. It can also be seen that I have provided means for closing either airflow chamber to the flow of air therethrough while the airstream is flowing through the other chamber so that collected fiber waste in the corresponding chamber, and/or fiber waste adhering to the corresponding filter, may be removed without reducing the efficiency of the flowing airstream and also without any fiber waste reaching fan 26, even though the corresponding filter may be temporarily removed from the closed chamber to facilitate cleaning the filter.

In the drawings and specification there have been set forth preferred embodiments 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.

I claim:

1. A method of continuously removing and collecting fiber waste from the rotors in the spinning units of an open end spinning machine which comprises effecting a substantially constant high-pressure suction airflow through the spinning units into a duct communicating therewith by producing a fiber conveying high-pressure suction airstream at an area downstream of the duct and directing the airstream along the duct toward such area through a first channel while entrapping fiber waste against a first filter in such channel as the airstream flows through the filter to said area, then diverting the airstream through a second channel while entrapping fiber waste against a second filter in said second channel as the airstream flows through said second filter to said area by opening opposite ends of the second channel while causing the airstream to bypass said first channel by closing the downstream end of the first channel and closing the upstream end of the first channel in response to the diverting of the airstream through the second channel, removing fiber waste from the first filter during the flow of the airstream in said second channel, then redirecting the airstream through said first channel by opening opposite ends of the first channel while causing the airstream to bypass said second channel by closing the downstream end of the second channel and closing the upstream end of the second channel in response to the redirecting of the airstream through the first channel, removing fiber waste from the second filter during the flow of the airstream in said first channel, and repeating the steps as prescribed whereby fiber waste may be removed from each filter without reducing the flow of the airstream.

2. A method according to claim 1, which includes automatically causing the diverting of the airstream through said second channel to occur upon a predetermined period of flow of the airstream in said first channel and automatically causing the redirecting of the airstream through said first channel to occur upon a predetermined period of flow of the airstream through said second channel.

3. A method according to claim 1, which includes detecting air pressure in each channel, causing the diverting of the airstream through said second channel to occur in response to the detection of a predetermined drop in air pressure in said first channel resulting from buildup of fiber waste against said first filter, and causing the redirecting of the airstream through said first channel to occur in response to the detection of a predetermined drop in air pressure in said second channel resulting from buildup of fiber waste against said second filter.

4. A method according to claim 1, wherein the step of removing fiber waste from said first filter includes removing said first filter from said first channel, and the step of removing fiber waste from said second filter includes removing said second filter from said second channel.

5. A method of removing and collecting fiber waste from spinning units of a textile machine which comprises effecting a

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suction airflow at the spinning units and into a duct communicating with the units by producing a high-pressure suction airstream at an area downstream of the duct and directing the airstream along the duct toward such area and alternately through one and then another of a pair of channels each having a filter therein for entrapping the fiber waste, and wherein the step of directing the airstream alternately through the channels comprises alternately isolating one channel from the other and from the area at which the suction airstream is being

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produced by closing the downstream end of one channel and causing the upstream end thereof to close in response to the diverting of the flow of the airstream from the one channel to the other channel whereby an access door to the isolated channel may be opened for removal of the entrapped waste therein without disturbing the flow of the airstream through the other channel.

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