UNITARY BLOWING AND SUCTION TRAVELING CLEANER FOR TEXTILE MILLS

INVENTOR:
ROBERT L. BLACK, JR.

ATTORNEYS
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Robert L. Black, Jr., Charlotte, N.C., assignor to Parks-Cramer Company, Fitchburg, Mass., a corporation of Massachusetts

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This application is a continuation-in-part of my copending application Serial No. 360,201, filed April 16, 1964 and entitled, Traveling Cleaner for Textile Mills, now abandoned.

This invention relates to an improved unitary overhead mounted pneumatic traveling cleaner combining in a single unit means for blowing fiber waste off of textile machines and means for sucking fiber waste off of the floor, supporting the machines.

Pneumatic traveling cleaners for cleaning machines and floors in textile rooms have been well accepted by the textile industry in most industrial countries of the world. Among the better known and most efficient types of traveling cleaner arrangements currently in use is the type disclosed in U.S. Patent No. 3,055,038, wherein separate traveling blowing and traveling suction cleaners are arranged in tandem. While cleaner arrangements of this type have been very successful, it will be recognized that advantages can be obtained if the suction cleaning and blowing cleaning means could be combined into a single unit, if this could be accomplished without reducing the efficiency of either means.

It has been suggested heretofore that a combined suction and blowing cleaner would be advantageous, but the problems involved in making such a cleaner are such that previous combined cleaners have had numerous defects and have lacked some of the advantages and effectiveness obtained with separate blowing and suction cleaners.

A number of problems must be overcome in creating a combined sucking and blowing cleaner. Perhaps the most difficult problem arises from the fact that the preferred requisites for cleaning by the use of blowing air are substantially and inherently different from the requisites or characteristics of cleaning by the use of suction air. For example, the blowing air should be kept clean and flow in a multiplicity of air streams of sufficient areas and velocities to penetrate and clean various areas of the textile machinery. A relatively large total air volume is necessarily required for best results. On the other hand, floor cleaning requires sustained strong suction at relatively few suction inlets, thus requiring strong forces, but with considerably less total air volume, to pick up lint and the like from the floor on each side of the machines and convey it to the collection chamber of the traveling cleaner. Sustained operation requires dependable filter cleaning in either case. The dual problems of different air volume requirements and filter cleaning have limited the effectiveness of prior art types of combination traveling blowing and suction cleaners.

There is also the problem of fan design. A fan having the most efficient design for producing the blowing air velocities and volumes required for blowing cleaning must be modified if it is to be used to produce the suction air streams for floor cleaning as well. When a single fan has been used for both floor sucking and blowing, material sucked off of the floor has been collected in a receptacle on the suction side of the fan, but this complicates the problems of filter cleaning and automatic removal of collected waste. If lint and the like picked up by the suction air stream flows through the fan, the fan must be designed to handle the flow of such material, with resulting decrease in the efficiency at the blowing side of the fan. Regardless of the location of the filter, unless some means is provided to keep it clean, the fan and motor must be designed for extra power to produce adequate conveying velocities after the filter becomes partially clogged. When a single fan is used to produce both the suction-cleaning air flow and the blowing-cleaning air flow, the result is reduced effectiveness of both cleaning functions and with substantially greater horsepower usually required than would be required for independent air systems of equivalent velocity and volume characteristics.

The problem of providing suitable means for filtering lint and the like from the air streams of a combination suction and blowing traveling cleaner has been considerable. Where a single fan is used to produce the suction cleaning air and the blowing cleaning air, the inlet for such fan will be the suction nozzle which passes along the floor and picks up lint (which is relatively dirty and sometimes oily), as well as dust and other dirt from the floor. This relatively dirty material will increase the problem of filtering. Some fine particles of dust, oil or the like pass through the filter to collect on the fan, reducing its efficiency and sometimes changing its air flow characteristics. Material which goes through the fan will be discharged by the blowing air stream onto the textile manufacturing operation, which is of course undesirable. Cleaning of the filter in this type of arrangement is more difficult.

Another problem is that, if the filter becomes clogged, the air flow is reduced which reduces the efficiency of both the suction and blowing cleaners. Frequently, in known single fan cleaners, as the filter progressively clogs up, there is a rapid reduction in the velocity of the suction air stream to the point that it is no longer sufficient to convey anything but the very smallest particles or fibers, with the result that heavier or grouped particles of lint and other debris remain on the floor and are not picked up by the suction cleaner. The problem of maintaining a clean filter is considerably greater in a combined suction and blowing cleaner than in separate cleaners of the type heretofore mentioned.

Another problem in the design of a unitary blowing and suction cleaner is the limited space available for the cleaning units. For example, the aisle space between rows of spinning machines is often 30 inches or less in width, thus barely allowing space for machinery, repairmen, supply trucks, etc. It is therefore desirable that the flexible cleaning tubes which are moving in this space be as small as possible. There is also a trend toward larger overhanging creels which limits the size of equipment which can be present in this area. Since traveling cleaners are self-propelled along tracks extending over rows of machines and curving at the end of each row, it is important that the weight of the cleaner be held to a minimum and that the weight be centered over the track to avoid unnecessary swaying and unbalance. In a known type of combined cleaner utilizing a single fan, the requirements for the blowing air and for the discharge side of the fan were such that a much larger suction tube than otherwise desirable had to be used on the intake side.

Previous proposals for a combined suction and blowing cleaner have been of two types. One called for a single fan positioned over the tracks to provide blowing cleaning functions on the discharge side of the fan and floor cleaning functions on the inlet side of the same fan. This type of arrangement has resulted in bulky suction tubes, and low efficiency relative to horsepower, and the effectiveness of both the suction and blowing units has been impaired because of the problems set forth
Another suggestion has been to provide an outrigger type of arrangement utilizing two motors and two sets of blowing and suction fans arranged on horizontal axes with one set on each side of the machine extending over and into the aisle space. This has resulted in a heavy cantilever type of arrangement which is relatively unbalanced and inefficient. Moreover, no satisfactory filter arrangement has been provided on this type of cleaner.

It is therefore the main object of this invention to provide an improved unitary traveling overhead-mounted pneumatic cleaner utilizing a single motor and two separate air systems. The two separate air systems comprise superposed non-communicating blowing and suction devices each having its own fan or air impeller means.

It is another object of the invention to provide a combined suction and blowing traveling cleaner having superposed non-communicating blowing and suction fans mounted on a vertical axis for travel above and along the longitudinal center of rows of textile machines. The suction fan has at least one dependent flexible suction tube extending into the aisle space on each side of the machines and the blowing device also has at least one dependent flexible blowing tube which depends into the aisle space on each side of the machines, but the weight of the unit is substantially centered over the machines and no motors or fans are positioned in or above the aisle space.

It is another object of this invention to provide a unitary combined blowing and suction cleaner of the type described wherein the inlet for the blowing cleaner is spaced above the floor and is provided with means for filtering the incoming air and means for maintaining the filter in a clean condition.

It is another object of the invention to provide a combined unitary traveling cleaner of the type described wherein the blowing and suction sections are movable relative to each other about a vertical axis and, if desired, means may also be provided for automatically effecting such relative movement.

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

FIGURE 1 is a top plan view of a first embodiment of the traveling cleaner mounted on an overhead track and including a blowing housing and a suction housing arranged in vertically stacked and relatively angularly movable relationship with the blowing and suction tubes thereof being shown in spread-apart positions at opposite sides of the traveling cleaner;

FIGURE 2 is a schematic plan view illustrating, in the left-hand portion thereof, how the housings are moved from open to closed position and illustrating, in the right-hand portion thereof, how the housings are returned from the closed to the open position;

FIGURE 3 is an end elevation of the traveling cleaner shown in FIGURE 1 showing the track and the housings above a row of textile machines with the suction nozzles positioned adjacent the floor and blowing nozzles directing air currents toward various parts of the textile machines;

FIGURE 4 is a top plan view similar to FIGURE 1 showing the housings of the traveling cleaner in closed position;

FIGURE 5 is an enlarged fragmentary vertical sectional view taken substantially along line 5—5 in FIGURE 4;

FIGURE 6 is a fragmentary vertical sectional view through one of the follower devices taken substantially along line 6—6 in FIGURE 4;

FIGURE 7 is a fragmentary elevation looking at the left-hand side of FIGURE 1;

FIGURE 8 is an enlarged fragmentary vertical sectional view taken substantially along line 8—8 in FIGURE 1;

FIGURE 9 is a second embodiment of the traveling cleaner of the present invention similar to that shown in FIGURE 1, but wherein the traveling cleaner is especially constructed to be mounted on an overhead crane, portions only of the overhead crane being shown in FIGURE 9;

FIGURE 10 is an end elevation of the traveling cleaner looking upwardly from the bottom of FIGURE 9 showing the housings thereof positioned above a spinning frame representing a row of textile machines, but with the lower portions of the dependent tubes broken away;

FIGURE 11 is an enlarged fragmentary vertical sectional view taken substantially along line 11—11 in FIGURE 9;

FIGURE 12 is a somewhat schematic plan view of a portion of a room or bay showing rows of textile machines therein with the crane mounted traveling cleaner in closed position adjacent one end of one of the machine rows;

FIGURE 13 is an enlarged fragmentary plan view similar to FIGURE 9 showing the traveling cleaner in closed position;

FIGURE 14 is a fragmentary elevation, partially in section, taken substantially along line 14—14 in FIGURE 13;

FIGURE 15 is a side elevation, partially in section, taken substantially along line 15—15 in FIGURE 9 with the lower portions of the dependent tubes and adjacent textile machine being broken away, and showing the traveling cleaner in closed position;

FIGURE 15A is an electrical diagram for controlling the closing and opening of the traveling cleaner of FIGURES 9—15;

FIGURE 16 is a top plan view of a third embodiment of the traveling cleaner of the present invention similar to that shown in FIGURE 9, but wherein the traveling cleaner is particularly adapted for use in a weave room and includes a stationary or non-adjustable blowing cleaning section and a pair of relatively angularly movable suction cleaning sections;

FIGURE 17 is a view looking up from the bottom of FIGURE 16 and showing the third embodiment of the traveling cleaner in association with a row of looms;

FIGURE 18 is an enlarged fragmentary vertical sectional view taken substantially along line 18—18 in FIGURE 16;

FIGURE 19 is a top plan view of a fourth embodiment of the invention in which the vertically stacked blowing and suction housings and the collection chambers are maintained in fixed relationship at all times during operation thereof;

FIGURE 20 is a side elevation of the cleaner of FIGURE 19, but omitting the lower portions of the blowing and suction tubes;

FIGURE 21 is an enlarged, fragmentary, partially sectional view taken substantially along line 21—21 in FIGURE 19 showing a preferred form of filter cleaning means for the blowing cleaning section;

FIGURE 22 is a perspective view looking in the direction of the arrow 22 in FIGURE 19 and showing means for moving the filter past the filter cleaning means, but omitting the suction section; and

FIGURES 23 and 24 are top and bottom perspective views of the respective suction and blowing fans or impellers of FIGURE 21.

Four embodiments of the invention are illustrated in the accompanying drawings, all of which are directed to a combined unitary traveling cleaner having at least two independent but superposed air flow systems driven by a common motor. The housings and the respective air impeller means of both systems are mounted to travel
over the longitudinal center of one or more rows of textile machines. One of the air flow systems has flexible tube means thereon for sucking fiber waste from the aisle space at both sides of the machines, and the other air flow system has tube means thereon for blowing lint and other light material off the machines at both sides thereof and of other surfaces in the mill.

The first, second, and third embodiments include superposed relatively adjustable non-communicating suction and blowing housings movable about a common vertical axis, and the fourth embodiment also includes superposed non-communicating suction and blowing housings, but the latter housings remain in fixed relationship. Also, different features are shown in the different embodiments. However, it is to be understood that certain features which may not be shown in association with any one of the embodiments but are shown in association with another or other embodiments may be combined with said one embodiment, if desired.

First embodiment of traveling cleaner

The first embodiment of the traveling cleaner of the present invention is particularly devised for use in rooms having spinning frames, twisters and/or roving frames therein and is shown in FIGURES 1 through 8 mounted for movement along a track 20 extending above rows of spinning frames or similar textile machines, such as are indicated at 21, 22 in FIGURE 2, and wherein the portions of track 20 extending over adjacent machine rows 21, 23 are shown interconnected by a track bend 23, as is usual.

The first embodiment of the traveling cleaner is generally designated at A and generally comprises a blowing cleaning section B and a suction cleaning section S including respective blowing and suction housings 25, 30, 26, 30, 27, 30 sealed against intercommunication and between which the volatile suction fan portion 27 of the suction housing is positioned. An annular filter-carrying or blowing air inlet housing 30 is provided beneath blowing housing 25 and includes filter means embodied in an annular screen or filter 31 whose lower portion is carried by a plate 32 (FIGURE 5) which encircles and is suitably secured to brackets 33 projecting outwardly from a fan-driving means in the form of an electric motor 34. It is to be noted that filter 31 separates lint and the like from the air before the air flows past the fan in blowing housing 25 so the fan moves clean air only through the outlet of the blowing housing. Further, filter 31 is located above the textile machines so that the air passing through blowing housing 25 is free from oil and most other impurities normally encountered near the floor. This is in contradistinction to prior art traveling cleaners which utilize the same air for blowing cleaning as is drawn into suction nozzles at the floor. The filter also may be kept clean, to avoid impeding the flow of air through the blowing housing 25, by means of suction and blowing filter-cleaning devices such as will be later described in connection with the fourth embodiment of the invention.

Electric motor 34 is mounted on and serves as a part of a carriage means 35 for the traveling cleaner A. Mounting means for carriage means 35 may include wheels 36 engaging track 20 (FIGURE 8). Carriage drive means is provided and comprises a relatively small electric motor 37 mounted on carriage means 35 in fixed relation to motor 34 and driving one or more of the wheels 36 to propel traveling cleaner A along track 20. Motor 37 may be of the reversible type, and suitable controls well known in the art may be provided for controlling electric motor 37 to propel traveling cleaner A in either direction along track 20, as desired.

Shaft 39 of electric motor 34 extends upwardly in a substantially vertical position and drives separate impeller means in the form of a pair of rotary impellers or fans 41, 42 fixed on shaft 39 and positioned within the respective housings 25, 27. The lower wall of blowing housing 25 is provided with air inlet means including a central opening 43 therethrough of substantially larger diameter than motor 34 and providing communication between annular filter 31 and the interior of housing 25. Housing 25 may be supported for angular movement or adjustment about motor shaft 40 by a support ring 44 fixed to the upper ends of a plurality of posts 45 whose lower ends are suitably secured to bottom plate 32 and brackets 33 (FIGURE 8). Suitable annular bearing races 46, 47 may be provided between the proximal surfaces of housings 25, 30 and support ring 44. Races 46, 47 may be made from any suitable plastic or non-ferrous bearing material such as Teflon, brass, bronze, or the like.

To facilitate rotating annular filter 31, the frame thereof may be retained in substantially concentric relation to motor shaft 40 by suitable annular, flanged retaining rings 50, 51 fixed to bottom plate 32 and support ring 44, respectively, and whose outwardly projecting flanges engage annular frame members 52, 53 to which filter 31 may be suitably secured. A suitable annular, flanged retaining ring 54 may be provided between annular frame member 52 and bottom plate 32. Means is provided for maintaining blowing housing 25 in substantially concentric relation to shaft 40, comprising an anti-friction bearing 60 (FIGURES 5 and 8) whose inner race may be positioned between and encircle the hubs of fans 41, 42. The upper wall of blowing housing 25 fits around and in sealing engagement with the outer race of anti-friction bearing 60. In this instance, the upper wall of the central portion of housing 25 is in the form of a removable cover 61 which closes a corresponding opening sufficiently large to permit installation of fan 41 in housing 25. However, there is no communication between the interiors of housings 25, 27.

Housings 26 and 27 form a single suction housing which may be separated into the two sections 26 and 27 as illustrated, with section 26 being stationary with respect to motor 34 and serving also to maintain the lower, blowing housing 25 in substantially horizontal position. As best shown in FIGURE 5, suction fan housing 27 may be maintained in fixed relation to and supported by motor 34 by means of laterally opposed substantially C-shaped brackets 65, 66 whose lower portions are suitably secured to motor 34 beneath filter housing 39, whose substantially vertical portions are positioned outwardly of housings 25, 30, and whose upper portions are suitably secured to opposed portions of the side wall of housing 27.

The bottom wall of suction fan housing 27 loosely encircles bearing 60 in close proximity thereto. Since housing 27 is stationary and housing 25 may be angularly adjustable relative to housing 27, a suitable annular bearing race 67 fixed to one or the other of housings 25, 27 may be positioned therebetween. If desired, race 67 may be made in two parts positioned in sliding engagement with each other with one part being secured to housing 27 and the other part being secured to wall 61 of housing 25.

The proximal walls of suction fan housing 27 and suction housing 26 have an air inlet opening 70 therethrough through which air is caused to flow by rotation of suction fan 42 for producing suction, or negative pressure, within housing 26. Housing 26 also may be termed as a "suction inlet housing." The upper wall of suction fan housing 27 may be in the form of a removable cover 71 normally closing an opening sufficiently large to permit installation of fan 42 in housing 27. The lower wall of suction housing 26 is suitably secured to an annular retaining member 72, L-shaped in cross-section (FIGURE 8), and whose lower flange engages the lower surface of the upper wall 71 of suction fan housing 27 for maintaining housing 26 in a substantially horizontal position upon housing 27. Annular retaining member 72 may be made from a suitable plastic or non-ferrous bearing ma-
material, since it serves to maintain housing 26 in substantially concentric relation with housing 27 and motor shaft 46. While peripheral angular adjustment of housing 26 relative to housing 27. Suitable annular bearing means 55 may be provided between the proximal surfaces of the housings 26, 27.

It is thus seen that housings 25, 26, 27 and 30 are supported in stacked relationship by carriage 35; that housings 25, 27 are out of fluid communication with each other; and that housings 25, 26, as well as housing 30, if desired, may be adjusted or moved angularly about the axis of motor shaft 40 while fans 41, 42 are rotated independently of the housings. Therefore, blowing fan 41 may be substantially larger than suction fan 42 and it may be designed to move more air than suction fan 42.

This is desirable because considerably more air is usually required to efficiently blow fiber waste off the many machine surfaces than is required to suck fiber waste off the floor.

It is apparent that blowing fan 41 draws air from overhead and side areas through filter 31 and exhausts it from housing 25 in a manner to be described, while suction fan 42 draws air from suction inlet housing 26 and exhausts it from housing 27. This arrangement obviates the necessity of designing blowing fan 41 as a material handling fan, which is necessary in the case of the suction fan 42, since the air entering blowing housing 25 is filtered by filter 31 and is substantially free of lint, thus substantially eliminating the possibility of lint, oil, etc. adhering to or clogging blowing fan 41. This also facilitates balanced airflow through the housings at all times. It is important to note that fans 41, 42 and their housings 25, 27 are arranged in axial superposed relationship, thus facilitating compact balanced positioning of the fans and housings above the central portions of the machine rows so blowing and suction tubes may communicate therewith and extend past opposed sides of the textile machines, as will be later described, and so both fans may be driven by the single motor 34 forming part of carriage 35.

Blowing air inlet housing 20 and its filter 31 are preferably of circular configuration in plan, although housing 20 and filter 31 may be of any desired configuration provided that they encompass the vertical plane of opening 43 in the lower wall of blowing housing 25. It is to be noted that filter 31 is located above the textile machines, away from the areas at which most of the fiber waste is generated, so that only relatively clean fibers fly through against filter 31, as best shown in FIGURE 40. Fan housings 25, 27 are of volute form in plan. Suction housing 26 has a pair of elongate, substantially laterally opposed, offset and rigid hollow arms or ducts 86, 81 projecting outwardly therefrom whose outer ends curve downwardly and have respective dependent suction tubes 82, 83 connected thereto. The lower ends of suction tubes 82, 83 have respective floor cleaning suction nozzles 84, 85 (FIGURES 1, 3 and 4) connected thereto whose inlets or nozzle openings move in close proximity to the surface of the floor F which supports the textile machines. Suction tubes 82, 83 are preferably of flexible construction, and the nozzles 84, 85 may be of the type disclosed in U.S. Patent No. 3,036,525, dated May 29, 1962, for example. Nozzles 84, 85 may have suitable spacers 86 thereon for sliding against the floor F and maintaining the nozzle openings in closely spaced relation above the floor P at all times when the blowing housing 25 also has rigid hollow arms or ducts 90, 91 projecting outwardly therefrom in laterally opposed offset relationship and curving downwardly at their outer ends for supporting the upper ends of dependent blowing tubes 92, 93, which, like suction tubes 82, 83, are adapted to straddle and move along beside the rows of textile machines. The lower portions of blowing tubes 92, 93 have corresponding vertically arranged and inwardly projecting nozzles 94, 95 thereon adapted to direct streams of air inwardly toward the bobbins and lower parts of the textile machines.

The lower ends of blowing tubes 92, 93 also may terminate in close proximity to floor F and may have respective pairs of nozzle openings 96, 97 therein for directing corresponding streams of air along the floor beneath the machines and also along the floor toward the corresponding suction nozzles 84, 85. In so doing, the air flowing from the nozzle openings 97 preferably forms an air shield or barrier extending generally longitudinally with respect to the path of travel of corresponding suction and blowing tubes while the air flowing from nozzle openings 96 directs fiber waste across the floor under the machines and toward the air barriers adjacent the sides of the machines opposite therefrom. Thus, the air barriers then may direct fiber waste toward the corresponding suction nozzles, as is fully disclosed and claimed in my copending application Serial No. 307,769 filed September 6, 1963, and entitled Floor Cleaning Method for Textile Mills. The downwardly curved outer ends of blowing ducts 90, 91 may have respective rigid auxiliary blowing tubes 102, 103 communicatively connected to the side walls thereof, which extend downwardly and then inwardly at an angle so that they move in paths closely adjacent the back of drafting zones of the textile machines. If desired, additional blowing nozzles or blowing tubes may be connected to ducts 90, 91 for directing streams of air toward other parts of the machines, such as the creel, and toward track 20.

During normal operation of the blowing chamber A as it moves along the corresponding row of textile machines, the blowing and suction sections B, S may occupy substantially the positions shown in FIGURE 1 so the blowing and suction tubes 82, 92 and 83, 93 at each side of the textile machines are spaced a considerable distance apart from each other. It is apparent that the disadvantage of which direction traveling cleaner A moves along track 20, the nozzles of blowing tubes 92, 93, 102, 103 remove lint and other fiber waste from various parts of the textile machines, which fiber waste settles on floor F and is sucked into suction nozzles 84, 85.

As fiber waste is sucked into suction housing 26 and suction fan housing 27, the fiber waste and air is exhausted from suction fan housing 27 through an outlet port 110 communicatively connected to housing 27 in offset relationship thereto. The outlet port 110 of suction fan housing 27 has a waste collection chamber 111 connected thereto in which the waste is collected as it flows from housing 27 while the air is exhausted from the collection chamber 111 through filter means, such as a filter 112 (FIGURE 5), and into the atmosphere. Thus, collection chamber 111 is at least partially foraminous.

Filter 112 may be in the form of an automatically operable discharge door which may be opened at predetermined intervals for discharging collected fiber waste from chamber 111 into a suitable receptacle or suction mouthpiece positioned adjacent the path of travel of the traveling cleaner. Collection chamber 111 may be constructed and operated substantially as disclosed in U.S. Patent No. 3,011,205, dated December 5, 1961, for example. Therefore, a further description of chamber 111 and its filter means is deemed unnecessary.

With suction and blowing tubes 82, 83 and 92, 93 occupying the spread-apart or open condition shown in FIGURE 1 and in solid lines in the left-hand portion of FIGURE 2, traveling cleaners 111 will operate satisfactorily when it is propelled to and fro along straight sections of overhead track. It will also operate satisfactorily in textile rooms where the aisles at the ends of rows of textile machines are sufficiently wide to permit the traveling cleaner to revolve on its own axis as it moves around bends in the track so that the traveling tube at the inside of the bend would not engage or be obstructed by the last machine in a row and so the leading tube on the inside
of the bend would not engage or be obstructed by the first machine in the next succeeding row.

However, it is desirable, in most instances, to position the track bends, such as the bend 23 shown in FIGURE 2, as close as possible to corresponding ends of the machine rows, and this is necessary in instances wherein the space between the ends of the machine rows and the adjacent wall of the textile room is quite limited. Therefore, means now will be described for automatically varying the relative positions of the blowing and suction tubes at each side of the traveling cleaner with respect to track 20. In this instance, tubes 82, 83, 92, 93 are moved with the corresponding blowing and suction housings 25, 26 between the spread-apart position shown in FIGURE 1 and a close-together position (FIGURE 4) adjacent an imaginary line extending transversely through the axis of housings 25, 26, 27 and motor shaft 40, which imaginary line may be termed as the "mean lateral axis" of the traveling cleaner. Accordingly, tubes 80, 90 of the respective housings 25, 26 have the distal ends of extensively adjustable composite links 120, 121 (FIGURES 1, 4 and 7) pivotally connected thereto. Links 120, 121 extend toward each other and their proximal ends are pivotally connected to a further element 122 extending through a slot 123 in an elongate guide bar 124 suitably secured to or formed integral with C-shaped bracket 65 (FIGURES 1, 4, 7 and 8). Links 120, 121 may each include two threaded parts interconnected by a turnbuckle 126 (FIGURES 1 and 4) to provide for adjusting the desired displacement between suction tubes 82, 83 and the respective blowing tubes 92, 93 when blowing and suction sections B, S occupy open position.

In order to prevent the tubes adjacent the inside of a bend 23 in track 20 from being obstructed by the machines at the ends of the rows 21, 22, for example, when the bend is close to the ends of the machines, the blowing and suction sections B, S are moved from the open position shown in FIGURE 1 to the contracted or closed position shown in FIGURE 4 before the traveling cleaner starts around bend 23 after leaving machine row 21. Conversely, the blowing and suction sections B, S are returned to the open position shown in FIGURE 1 at or about the time that traveling cleaner A leaves the bend on commencing the cleaning of the succeeding machine row 22.

To this end, a cleaner closing cam means 130 may be carried by and project outwardly from a point adjacent the bend 23 with respect to the direction of travel of traveling cleaner A, and a cleaner opening cam means 131 may project inwardly from track 20 adjacent the terminal end of bend 23 with respect to the travel of cleaner A. Each cam means 130, 131 may be of rigid construction, and so positioned as to be engaged by respective followers 132, 133 (FIGURE 1) depending from ducts 90, 91 of blowing housing 25. Each follower 132, 133 may be constructed in the manner in which follower 133 is illustrated in FIGURE 6, wherein follower 133 is shown in the form of a roller on the lower portion of a substantially vertical shaft 135 which extends upwardly through a slotted support 136 and is attached to a plunger 137 guided for sliding movement in support 136. Support 136 may be attached to the bottom wall of duct 91. Follower 133, shaft 135 and plunger 137 are normally biased outwardly by a spring 138. Corresponding parts associated with follower 132 are biased inwardly toward track 20.

In FIGURE 2, ducts 80, 81, 90, 91 are shown as straight interconnected lines so the closing and opening of traveling cleaner A may be clearly understood. In the left-hand portion of FIGURE 2, tubes 82, 83, 92, 93 are shown in solid line position not being occupied thereby during movement of the traveling cleaner. After the portions of track 20. As traveling cleaner A moves toward track bend 23 in the direction of the arrows in FIGURE 2, cam follower 132 is moved against cam means 130, thereby restraining follower 132 from further movement so carriage 35, represented by a circle in FIGURE 2, moves forwardly relative to ducts 90, 91 of the swing blowing duct 91 forwardly at a faster rate than the speed of movement of carriage 35.

At the same time, the proximal ends of the links 120, 121 move outwardly from the position of FIGURE 1 to that of FIGURE 4, thus swinging ducts 80, 81 angularly about the axis of carriage 35 to contact or close the spacing between the traveling cleaner ducts as shown in broken lines in the left-hand portion of FIGURE 2 and in solid lines in FIGURE 4 and in the right-hand portion of FIGURE 2. The contracted position of the ducts may be limited by means, such as a set screw 141 in the outer end of the respective ducts 90, 91 so that the contracting action not only swings tubes 82, 83, 92, 93 outwardly but is further apart laterally of the path of travel of traveling cleaner A, but also positions tubes 82, 83, 92, 93 in close proximity to the mean lateral axis of the traveling cleaner so the tube 93 inwardly of bend 23 will not be swung rearwardly excessively with respect to the path of travel of the traveling cleaner as it revolves about its own axis in traversing the bend 23.

This permits the bend 23 to be positioned closely adjacent corresponding ends of the machine rows without the inner tube 93 being obstructed by the last machine in row 21. When the ducts have been contracted substantially as shown in FIGURE 4, and as shown in broken lines in the left-hand portion of FIGURE 2, follower 132 will have moved outwardly with the corresponding duct 90 so that it will snap past the rounded outer end of cleaner closing cam means 130. The weight of the various parts of traveling cleaner A serves to maintain the cleaner in contracted position during movement thereof along track bend 23.

After traveling cleaner A has moved around track bend 23 sufficiently so that the leading tube 83 inwardly of track bend 23 will not be obstructed by the first machine in row 22, follower 133 engages cam means 131 to return the traveling cleaner to the open position shown in dotted lines in the right-hand portion of FIGURE 2 in substantially the same manner that cam means 130 moved the traveling cleaner to contracted position as heretofore described.

Second embodiment of the invention

The second embodiment of the invention shown in FIGURES 9 through 15A is quite similar to the first embodiment with the exception that traveling cleaner A' is particularly arranged to be carried by a crane C movable in a reciprocatory manner above a plurality of rows of textile machines. As shown in FIGURES 9, 10, 12, 13, 14 and 15, crane C may be constructed and operated in substantially the manner described in U.S. Patent No. 2,812,251, issued November 5, 1957. Also, traveling cleaner A' may be indexed to travel over successive rows of textile machines by means such as is disclosed in the latter patent. Accordingly, only a general description of crane C will be given herein and the latter patent may be referred to for further details of the same.

Cranes, which may also be termed as a bridge, comprises transverse I-beams or bridge tracks 150, 151 (FIGURE 12) suitably rigidly interconnected, as by braces 152. Opposed ends of bridge tracks 150, 151 are suitably suspended, as by tracks 156 and 157, below runway rails 153, 154 extending longitudinally of the bay or room substantially parallel to the rows of textile machines. In this instance, five rows of textile machines are shown in FIGURE 12 indicated at R-1, R-2, R-3, R-4 and R-5. Each trolley 156 may include wheels 157 running on the lower flanges of the corresponding runway rails 153, 154 (FIGURES 9, 10 and 15). A crane drive shaft 160, suitably journaled on the outer portion of bridge track 151, has traction wheels 162 near
its ends to engage the undersides of runway rails 153, 154, only one of the traction wheels 162 being shown in FIGURES 9 and 15. A crane propelling means comprises a motor 163 carried by and projecting outwardly from bridge track 151 and being connected to crane drive shaft 160 for rotating the same to propel crane C from one end of the crane runway to the other. Electrical energy may be supplied to motor 163 by means not shown in the present application but being fully disclosed in said Patent No. 2,812,251.

Traveling cleaner A' may be supported for movement longitudinally of crane C and transversely of the rows of textile machines by suitable carriage means, such as a carried rigid frame or a carriage built 160 and including suitably interconnected frame members 166–169 arranged in a rectangular form. Frame members 160, 168, 169 extend upwardly from opposed ends of frame members 166, 167 and straddle the lower portions of bridge tracks 150, 151. Opposed ends of frame members 160, 169 (FIGURES 9 and 10) may have respective pairs of wheeled trolleys 174, 175 attached thereto and running on the lower flanges of bridge tracks 150, 151. Carriage 165 is provided with a carriage drive shaft 176 which extends forwardly and rearwardly, substantially parallel with and adjacent sides of member 167, and has traction wheels 177 secured thereto near its ends to engage the undersides of bridge tracks 150, 151.

A carriage drive motor 180, suitably secured to the end frame member 169 of carriage 165, is connected to one end of shaft 176 for driving the same. Carriage drive shaft 176 may be journaled in a pair of bearing blocks 182, each of which is attached to a pair of posts 183 (FIGURES 10 and 15). One of the pairs of posts 183 extends upwardly and loosely penetrates frame member 168 and the other pair of posts 183 loosely penetrates frame member 169. Each post 183 may be encircled by a compression spring 184 which bears against a washer 185 held in adjacent position by a lock nut 186 on the upper end of the corresponding post 183. Thus, springs 184 yieldably maintain the traction wheels 177 in engagement with the undersides of bridge tracks 150, 151.

Traveling cleaner A' differs primarily from cleaner A in that the housings and motor of traveling cleaner A' may be inverted with respect to the housings 25, 26, 27, 30 and motor 34 of FIGURE 8. Thus, where applicable, those parts of traveling cleaner A' corresponding substantially to parts of traveling cleaner A may be substantially greater than the distance between endmost machines in the rows all bear the same reference characters with the prime notation added.

As best shown in FIGURE 11, electric motor 34' is positioned above housing 25' of blowing cleaning section B'; and a single suction housing is positioned beneath housing 25' and includes a section or housing 26' and a fan section or housing 27'. Otherwise, housings 25', 26', 27', 30' are carried by the motor 34' in substantially the same manner as and serving the same purpose as tubes 82, 83, 92, 93 of the first embodiment of the invention.

The reason why the housing arrangement of traveling cleaner A' is inverted with respect to that of cleaner A is so that the ducts 89, 91, 90, 91' may clear the frame of carriage 165 while maintaining the central portion of traveling cleaner A' on a high level sufficient to clear the upper portions of the textile machines, even though the textile room may have a relatively low ceiling. It may be observed in FIGURES 10 and 11, for example, that although the ducts 89, 91, 90, 91' are substantially straight, the medial portions of ducts 90, 91' curve downwardly and then outwardly so the outer portions and downwardly curved outer ends thereof may be positioned below frame members 166, 167. Also, outlet port 110' of suction fan housing 27 curves downwardly and then outwardly so collection chamber 111' is positioned on substantially the same level as suction housing 26. The downwardly curved outer end portions of ducts 90, 91' may be provided with auxiliary blowing tubes 102, 103' which are similar to auxiliary blowing tubes 102, 103 of FIGURE 9.

Electrical energy may be directed to motors 34', 180 by means such as is disclosed in said U.S. Patent No. 2,812,251 for supplying electrical energy to and controlling the operation of the respective electric motors 29 and 30 disclosed therein. Accordingly, details of the electrical circuits for electric motors 34', 180 will not be described herein.

In operation, ducts 89, 91, 90, 91' occupy the spread apart or open position shown in FIGURE 9 as crane C is propelled along runway rails 153, 154, and during which the traveling cleaner moves along the path substantially as indicated by the arrows in FIGURE 12. As crane C reaches either end of the machine rows R–1 through R–5, crane propelling motor 163 (FIGURE 9) stops driving shaft 160 so crane C comes to rest momentarily. While crane C is at rest at either end of the machine rows, carriage indexing motor 180 may be energized to move carriage 165 from the end of one collection chamber 111 to a position adjacent the end of another row preparatory to another movement being imparted to the crane C longitudinally of the machine rows.

Since the distance between the suction and blowing tubes at each side of traveling cleaner A' may be substantially greater than the distance between endmost machines in the rows all bear the same reference characters with the prime notation added. The method of using and described heretofore for contracting and opening traveling cleaner A. However, in the second embodiment of the invention, the opening and contracting of traveling cleaner A' is effected by electrically operable means in the form of a pair of solenoids 200, 201 whose coils are secured, in longitudinally aligned spaced relationship, to carriage plate 150 (FIGURES 9, 13, 14 and 15).

The plungers of solenoids 200, 201 may have the distal ends of respective pairs of diverging links a, b pivotally connected thereto whose proximal ends are pivotally connected to crank ends of respective main frame members 204, 205. One of the pair of links a, b is connected to crank 204 and the other pair of links a, b is connected to crank 205. Cranks 204, 205 extend outwardly and are fixed on respective stub shafts 206, 207 journaled in and extending downwardly through carriage plate 150. The lower ends of stub shafts 206, 207 have the proximal ends of respective cranks 210, 211 fixed thereon and extending outwardly in diverging relation therefrom. As best shown in FIGURE 15, the outer ends of cranks 210, 211 are pivotally mounted on the upper ends of respective posts c, d which extend downwardly and are fixed to the respective ducts 89, 90.
Solenoids 200, 201 may be operated by any suitable control means to contract or close the spacing between the driving means for the carriage A' as crane C approaches or reaches the end of each row of machines and before or shortly after the traveling cleaner starts to traverse each succeeding row of textile machines. By way of example, it will be observed in FIGURE 9 that one wall of the bay or room has a double-throw switch 220 suitably mounted thereon which may be engaged by a yeldable switch actuator 221 carried by crane C. The side of crane C opposite from switch actuator 221 also has a switch actuator 222 throncon which is adapted to engage and activate a switch 223 which may be carried by the opposite wall of the room when crane C moves to the closed end of the machine row (FIGURES 12 and 15A).

Referring to FIGURE 15A, it will be observed that normally closed sides of switches 220, 223 are in series with solenoid 200 and both of them normally maintain energization of solenoid 200. However, when either switch 220 or 223 is engaged by switch actuator 221 or 222 respectively, the circuit to solenoid 200 is broken and the circuit to solenoid 201 is completed. Since solenoid 200 is normally energized, the ducts of traveling cleaner A' normally occupy the wide open position shown in FIGURE 9. Conversely, whenever solenoid 201 is energized, the plunger thereof pulls the cranks 204, 205 from the right to the left in FIGURE 9 to the position shown in FIGURES 13 and 15, thus contracting the ducts of traveling cleaner A'.

Since crane C remains in either of its endmost positions with respect to the machine rows during operation of in-dexing motor 188, solenoid 201 remains energized until the traveling cleaner has moved out of alignment with one row, such as row R-1, and into alignment with another row, such as row R-2 in FIGURE 12. Crane drive motor 163 is then energized to cause crane C to move downward on the sheet in FIGURE 12, thus moving actuator 221 out of engagement with switch 220 and effecting energization of solenoid 200 to return the traveling cleaner A' to the open position shown in FIGURE 9 for cleaning the textile machines and the floor adjacent the machine row R-2. The cycle in the operation of the apparatus is repeated in the aforementioned manner when the crane C reaches the other end of the rows of textile machines.

Third embodiment of the invention

The traveling cleaner A" of the third embodiment of the invention shown in FIGURES 16, 17 and 18 is particularly devised for removing fiber waste from rows of looms in a weave room and picking up and collecting fiber waste remaining on the floor adjacent the rows of looms. Traveling cleaner A" includes a blowing cleaning section B", a pair of suction cleaning sections S", S-a, a suction housing 27", 26" and 26a and a filter housing 30". Housing 27", 26" and 26a comprise sections of the suction housing and are vertically stacked beneath an electric motor 34" and housing 25" of blowing section B" is positioned above electric motor 34".

Traveling cleaner A" may be carried by a carriage broadly designated at 165" mounted for lateral movement with respect to the rows of looms on a crane or bridge C" movable above and longitudinally along the rows of looms along runway rails, only one of which is shown in FIGURE 16, indicated at 153". Crane C" and carriage 165" may be constructed, mounted and operated in the manner of crane C of the second embodiment of the invention. Therefore, a detailed description of crane C" and carriage 165" will not be given, although reference characters will be applied to all the parts thereof, where applicable, corresponding to the reference characters applied to crane C, with the double-prime notation added, for purposes of orientation.

Traveling cleaner A" differs further from traveling cleaners A, A' in that blowing cleaning section B" may be non-adjustable with respect to carriage 165" and both suction cleaning sections S", S-a are relatively adjustable about their substantially vertical axis, and the tubes and nozzles of blowing cleaning section B" depend between the ducts and dependent tubes of the two suction cleaning sections S", S-a, as will be presently described. Therefore, the fixed anular lower wall 32" of filter housing 30" is attached to electric motor 34" by brackets 33" and is spaced a substantial distance above top wall 71" of suction fan housing 27". The lower portions of substantially C-shaped brackets 65", 66" are suitably secured to the casing of motor housing 34" and extend upwardly past housings 50", 25" and then inwardly and are suitably secured to carriage plate 190", as by screws 191", which may loosely penetrate plate 190" and may be threaded into or through top wall 61" of blowing cleaning section B".

Frame 52, 53 of filter 31 (FIGURE 8) and, therefore, further description thereof is deemed unnecessary.

Blowing fan or air impeller means 41", positioned within blowing housing 25" and fixed on shaft 49" of electric motor 34", draws air through filter 31" and opening 43" into housing 25". Motor shaft 40" extends through the projects outwardly from both the upper and lower ends of motor 34". The lower end of shaft 40" has a suction blowing impeller means or fan 42" fixed therein and positioned within suction fan housing 27".

The upper wall 71" of suction fan housing 27" is suitably secured to bearing race 72" so the housing 26" is suspended from housing 27". The lower wall of housing 26" also has an externally flanged bearing race 72a therein defining an opening 76a in the bottom wall of housing 26" communicating with and extending through the top wall of the lower suction cleaning section S-a. The flange of bearing race 72a engages the upper surface of the bottom wall of suction housing 26" and the upper wall of lower suction housing 26a is suitably secured to bearing race 76a.

Housings 25", 27" each of vulcan form in plan. The two suction housings 26", 26a have respective pairs of laterally opposed suction ducts 80", 81", and 80a, 81a projecting outwardly therefrom which correspond to ducts 80, 81 of FIGURE 1. The downwardly curved distal ends of ducts 80", 81", 80a, 81a have respective dependent flexible suction tubes 82", 83", 82a, 83a thereon whose lower ends have respective suction nozzles 84", 85", 84a, 85a connected thereto which function in the same manner as suction nozzles 84, 85 of FIGURE 3, for example. Suction fan housing 27" has an outwardly extending duct or outlet 110" thereon which curves downwardly and outwardly and has a collection chamber 111" fixed thereon and projecting outwardly therefrom. As shown in FIGURE 17, the outer end of collection chamber 111" has filter means in the form of a filter or filter 112" therein which may be in the form of a door operable in the same manner as the filter 112 of FIGURE 3 for periodically removing fiber waste from the collection chamber 111".

It will be observed in FIGURES 16 and 17 that housing 25" of stationary blowing cleaning section B" is provided with a pair of substantially laterally opposed and relatively short ducts or hollow arms 240, 241 whose ends
curve downwardly and have the upper ends of cup-shaped cuff members or manifolds m, n communicatively and pivotally connected thereto for oscillatory movement about axes extending substantially parallel with the path of travel of the traveling cleaner A" along the rows of looms. Cuff members m, n may be connected to the downwardly curved ends of ducts 240, 241 in substantially the manner in which nozzles are connected to the blowers in Holztlaw's U.S. Patent No. 2,695,039, dated November 23, 1954, for example.

Cuff members m, n have the upper ends of respective relatively small tubes 242, 243, 244, 245 communicatively connected thereto and depending therefrom, which tubes are preferably of rigid material of relatively small diameter and have small constricting nozzles 246, 249 on their lower ends positioned at different levels for directing high velocity streams of air onto various parts of the looms in each row, such as the warp yarns, the drop wires, the harnesses and the cloth being woven, to thereby dislodge and prevent accumulation of lint on the aforementioned parts of the loom so the lint will settle upon the floor to be picked up by the suction nozzles 84a, 85a, 84", 85", and conveyed to collection chamber 111". Any suitable means may be provided for oscillating cuff members m, n and/or corresponding tubes 242, 243, 244, 245 and since such means is not part of the present invention, a description thereof is deemed unnecessary.

Ducts 80", 81" 80a, 81a and corresponding suction tubes and nozzles are shown in open or spread-apart condition in FIGURE 16 in solid lines. When traveling cleaner A" reaches or approaches the end of a corresponding row of looms, the latter ducts are moved to the broken line position shown in FIGURE 16 by substantially the same means as, and for the same reasons as, have been described heretofore with respect to traveling cleaner A.'

Accordingly, it will be observed in FIGURES 16 and 17 that posts c", d", corresponding to posts c, d of traveling cleaner A' in FIGURE 15, are suitably secured to arms or ducts 80", 81" and project upwardly therefrom. Posts c", d" are operatively connected to a pair of solenoids 200", 201" in the same manner as, and in which posts c, d of FIGURES 9 and 15 are operatively connected to the solenoids 200, 201. Therefore, a further description of the connections between the solenoids 200", 201" and posts c", d" for opening and closing the traveling cleaner A', is deemed unnecessary. However, those parts associated with solenoids 200", 201" corresponding to like parts associated with solenoids 200, 201 will have the same reference characters applied thereto as are applied in FIGURES 9 and 15, with the double-prime notation added for purposes of orientation only and to avoid repetitive description.

Fourth embodiment of the invention

The combined, unitary, traveling cleaner A'' shown in FIGURES 19-24 is principally directed to the stacked, superposed arrangement of blowing and suction cleaning units whose respective housings and dependent tubes occupy substantially fixed relative positions, as opposed to the relatively angularly movable housings of the three traveling cleaners A, A', A'' previously described. Traveling cleaner A'' also differs from those previously described as to the type of collection means for collecting fiber waste sucked from the floor by suction nozzles, and also includes details of pneumatic filter cleaning means which also may be used for cleaning the filters for the air inlets of the blowing sections of all the cleaners previously described.

Traveling cleaner A'' comprises superposed non-communicating blowing and suction housings 325, 326. The suction housing 326 includes a portion or fan housing 327 which communicates with the portion 326 through an inlet opening 370. Housings 325, 326, 327 may be suitably secured together and suitably propelled along a track 320. As shown, the bottom, blowing housing may be secured in fixed relation to an electric fan motor 334 and carriage 335 in the same manner as described with respect to blowing housing 25, motor 34 and carriage 35 of FIGURES 3, 5, 7 and 8. Carriage 335 is provided with wheels 336 which ride upon track 320 and one of which may be driven by a small carriage propelling motor 337 mounted on carriage 335. Track 320 extends over a row or rows of spinning frames, or other textile machines, not shown.

Separate air impeller means are provided for housings 325, 327. Accordingly, as is the case in the first embodiment of the invention, the shaft 340 of fan motor 334 extends upwardly in a substantially vertical position and has a pair of rotary air impellers or fans 341, 342 fixed thereon and positioned within respective housings 325, 327. Since suction fan 342 is a material handling fan, to the extent that it must convey fiber waste in addition to producing suction in the suction tubes 380, 391, the blades of suction fan 342 (FIGURE 23) extend outwardly of the bottom plate of the fan and extend all the way laterally to a point closely adjacent the upwardly projecting frusto-conical hub of fan 342. On the other hand, blowing fan 341 (FIGURE 24) is only required to move air and therefore may be designed for the most efficient movement of air without regard to volume and velocity of suction and material handling.

Accordingly, it will be noted that the blades of fan 341 extend inwardly and have a back angle with respect to their direction of rotation and the corresponding radius lines of the plate on which they are mounted. In addition, the inner ends of the blades of blowing fan 341 terminate a substantial distance short of the hub of fan 341. This effects a more efficient air flow with rotation of fan 341 than is the case with respect to suction fan 342, because it is well known that it is essentially the tip portions of the blades of the fan which produce the air velocity and, by spacing the inner portions of the blades from the hub of the fan 341 as shown in FIGURE 24, there is less turbulence of the air effected in this area and the air is not held back, in effect, by the inner portions of the blades of blowing fan 341.

In FIGURE 21, it will be observed that the proximal portions of the hubs of fans 341, 342 loosely extend through the proximal walls of housings 325, 327. However, it is apparent that the hubs of fans 341, 342 may be journaled in the proximal walls of housings 325, 327 in the same manner as that described with respect to the central upper portion of FIGURE 5.

An annular filter-carrying or blowing-air-inlet housing 330 is provided beneath blowing housing 325 and includes filter means in the form of an annular screen or filter 331 whose lower portion is mounted for rotation on a plate 332 (FIGURE 21) which encircles and is suitably secured to electric motor 334 by brackets 333. The upper edge portion of annular filter 331 is suitably guided for rotary movement about the outer periphery of an annular plate 347 fixed to the lower wall of blowing housing 325 and forming with it an air inlet opening 344 (FIGURE 21).

Suitable means are provided for rotating filter 331, comprising an annular rack wheel 350 fixed to and projecting radially outwardly from a lower portion of annular filter 331 and successive teeth of which are engaged by a reciprocating ratchet paw 351 (FIGURE 22) for imparting stepwise rotational movement to filter 331 relative to blowing housing 325 and plates 332, 347 (FIGURE 21). Paw 351 may be reciprocated by means of a relatively small electric motor 352 carried by blowing housing 325 (FIGURE 22). To this end, the shaft of motor 352 has a link 353 eccentrically and pivotally connected thereto which extends downwardly and has an adjustable pivotal connection with an arm 354 fixed on
one end of a jack shaft 355. Jack shaft 355 is suitably journaled on blowing housing 325 and has a crank 356 fixed thereon and depending therefrom, to which the upper portion of pawl 351 is pivotally connected. It is thus seen that rotation of the shaft of motor 352 imparts reciprocating motion to ratchet pawl 351 to, in turn, impart stepwise rotational movement to fiber 331.

An outwardly extending relatively small air outlet member 357 (FIGURE 19) on blowing housing 325 has a ceiling cleaning device 360 journaled therein which is provided with a pair of generally upwardly directed blowing nozzles 361 for cleaning the ceiling and other areas above the traveling cleaner A’’. Device 360 also has a downwardly directed blowing nozzle 362 thereon for cleaning the track 320 over which the traveling cleaner A’’ is propelled. The ceiling cleaning device 360 may be oscillated by a connecting rod 363 extending between and being pivotally connected to a pair of arms 364, 365, one of which is attached to ceiling cleaning device 360, and the other of which is attached to shaft 355.

As shown in FIGURES 19 and 20, suction fan housing 327 is provided with four offset air discharge portions 371, 372, 371’, 372’ through which air is discharged from suction fan housing 327 into respective substantially cylindrically defined collection chambers 373, 373’, 374, 374’ which are preferably constructed in accordance with the disclosure of my Patent No. 3,188,680 issued June 15, 1965. Although four such collection chambers are shown it is apparent that a single collection chamber may be used, if desired. In this instance, two of the collection chambers 373, 374 depend from suction fan housing 327 adjacent one side of track 320 and the other two collection chambers 373’, 374’ depend from suction fan housing 327 adjacent the other side of track 320. Each collection chamber has a filter means 400 in its upper wall and a filter means 401 at one or more locations in its cylindrical side wall. In this instance, the lower end of each collection chamber is provided with a pivoted door means 402 which may be releasably secured in closed position by a suitable latch 403 (FIGURE 20).

Preferably, the discharge portions 371, 372, 371’, 372’ of suction fan housing 327 are arranged so as to discharge air and collected lint against and substantially tangent to the cylindrical side wall of each collection chamber, thus causing the air to move in a generally helical path within each collection chamber so as to form a relatively low pressure area in the center of each chamber toward which the collected fiber waste tends to merge, thus keeping the filter means 400, 401 substantially clean and free of lint or the like so as not to impair the efficiency of suction fan 342.

As best shown in FIGURES 19 and 20, fan housings 325, 327 are of volute form in plan. Suction housing 326 is positioned above fan housing 327 and has a pair of elongate, substantially laterally opposed, offset and rigid hollow arms or ducts 380, 381 projecting outwardly therefrom whose outer ends curve downwardly and have respective dependent suction tubes 382, 383 connected thereto. The lower ends of suction tubes 382, 383 may be provided with respective floor cleaning suction nozzles and which may be identical to nozzles 84, 85 of FIGURES 1, 3 and 4. Accordingly, the suction nozzles have been omitted from the fourth embodiment of the invention in FIGURES 19–22.

Blowing housing 325 is also provided with rigid hollow arms or ducts 390, 391 projecting outwardly from housing 325 in laterally opposed, offset relationship and whose downwardly curved outer ends support the upper ends of respective dependent blowing tubes 392, 393. Blowing tubes 392, 393 may be provided with nozzles or outlet openings such as shown at 94, 95, 96, 97 of the first embodiment of the invention and, therefore, such nozzles or outlet openings are not shown in association with the fourth embodiment of the invention in FIGURES 19–22.

It should be noted that the traveling cleaner A’’ as thus far described includes suction and blowing nozzles both of which straddle and move along opposite sides of the rows of textile machines positioned beneath the track 320.

As heretofore stated, traveling cleaner A’’ is provided with pneumatic filter cleaning means of a type which also may be used for cleaning the filters for the air inlets of the blowing sections of all the cleaning sections previously described. In this instance and as best shown in FIGURE 21, the pneumatic filter cleaning means for annular filter 331 comprises a blowing nozzle 410 and a suction nozzle 411 whose aligned respective air outlet and air inlet openings are disposed closely adjacent the inner and outer peripheral surfaces of filter 331. Nozzles 410, 411 occupy fixed positions with respect to the housings and carriers of the traveling cleaner A’’ so that, during operation of the traveling cleaner, filter 331 moves between nozzles 410, 411, in an intermittent manner, substantially through-out operation of the traveling cleaner A’’. Thus, each nozzle 410, 411 assists the other in removing lint from the outer surface of annular filter 331.

In this instance, filter cleaning blowing nozzle 410 is suitably secured to and extends through bottom plate 332 of filter-carrying housing 330 and has a hose or conduit 412 connected to the other end thereof and then curving upwardly and being connected to a single filter cleaning air discharge outlet 413 in the lower wall of blowing housing 325 and at the discharge side of fan 341. Filter cleaning suction nozzle 411 is suitably suspended from the lower wall of blowing housing 325 and has one end of a suction hose or conduit 415 connected thereto. Suction hose 415 extends outwardly past one side of blowing housing 325 and suction fan housing 327, and upwardly over a portion of suction fan housing 327, and is connected to a small air inlet port 416 protruding outwardly from suction housing 326. It is thus seen that the impeller 341 directs the flow of air which is exhausted through filter cleaning blowing nozzle 410 outwardly through filter 331, while suction fan 342 produces the suction in housing 326 which, in turn, is effective through conduit 415 to produce a suction area against the outer surface of filter 331 and substantially directly opposite from the blowing current of air being exhausted from filter cleaning blowing nozzle 410, thus keeping filter 331 clean at all times during operation of traveling cleaner A’’.

It is thus seen that there are provided several embodiments of a traveling pneumatic cleaner including vertically stacked blowing and suction cleaning sections with respective air impeller means, each section having one or more dependent tubes thereon for removing fiber waste from textile machines and floors, and wherein volumes, velocities and pressures of the respective blowing and suction air currents are produced independently of each other, even though the impeller means for all the sections are driven by a common motor. Thus, the impeller means may be designed for the requirements of each individual cleaning section independently of the others. Where two suction cleaning sections are employed, however, as in FIGURES 16–18, economy of construction dictates the use of a common impeller therefor. A separate impeller still would be used for the blowing cleaning section.

It is seen further that means are provided in the first, second and third embodiments of the invention whereby the ducts of the cleaning sections are relatively angularly adjustable about the substantially vertical axis of the traveling cleaner and that means are provided for mechanically angularly moving or adjusting these ducts between relatively open and closed positions so that adjacent ducts adjacent either side of the cleaner may be spaced a substantial distance apart while they are traversing a row of textile machines and they may be positioned in proximal relationship during transition of the travel-
ing cleaner from one machine row to another, thereby avoiding engagement of the tubes with the adjacent end-most machines in the rows during such transition. 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, the scope of the invention being defined in the claims.

I claim:

1. A self-propelled traveling cleaner adapted to travel over at least one row of textile machines and combining in a single compact unitary structure independent systems for blowing cleaning and suction cleaning, comprising:

(a) a single horizontally positioned blowing housing having at least one air inlet spaced substantially above the floor for receiving relatively clean air and also having at least two air outlets,

(1) a flexible blowing air tube communicatively connected to each of said air outlets with at least one of said tubes depending into the aisle space on each side of the row of textile machines and having openings therein for directing blowing air toward the machines for cleaning;

(2) a rotary blowing air impeller mounted in the blowing housing on a vertical axis and said impeller being constructed to produce blowing air streams flowing from the openings in the blowing air tubes at sufficient velocities and volumes to blow lint and the like from the textile machines;

(b) a single horizontally positioned suction housing having at least two air inlets and at least one air outlet,

(1) a flexible suction tube communicatively connected to each of said inlets of said suction housing, at least one suction tube depending in the aisle space on each side of the row of textile machines, and said suction tubes having inlet nozzles adjacent the floor for picking up lint and the like on the floor for conveyance upwardly through the suction tubes,

(2) a rotary suction air impeller mounted on a vertical axis within the suction housing creating a flow of suction air through the suction tubes sufficient to suck up lint and the like and being constructed to permit passage of lint and the like therethrough without clogging,

(3) a collection chamber connected to said suction housing outlet and including a filter for separating lint sucked up through the suction tubes from the air and collecting it in said chamber,

(c) means for driving said blowing air impeller and said suction air impeller,

(d) said blowing and suction housings being in non-air-communicating relationship, and

(e) said blowing housing, said suction housing, and said driving means all being arranged in closely related superposed relation over the center of the row of machines for travel longitudinally of the row.

2. A traveling cleaner according to claim 1, including filter means for filtering lint and the like from air entering said air inlet of the blowing housing.

3. A traveling cleaner according to claim 2, including means traveling with the cleaner for cleaning the filter means for the air inlet of the blowing house.

4. A traveling cleaner according to claim 1, wherein the means for cleaning the filter means for the air inlet of the blowing housing comprises a suction nozzle traveling with the cleaner and located closely adjacent the outer surface of said filter means and means connecting the suction nozzle to the suction housing.

5. A traveling cleaner according to claim 3, wherein means are provided for effecting relative movement between said filter means for the inlet of the blowing housing and said suction nozzle.

6. A traveling cleaner according to claim 5, in which said filter means for the inlet of the blowing housing comprises an annular filter, and said means effecting relative movement between said filter means and said suction nozzle comprises means for automatically imparting movement to said annular filter during travel of the cleaner to cause substantially all areas of the filter to be cleaned.

7. A traveling cleaner according to claim 2, including a filter cleaning blowing nozzle traveling with the cleaner and located closely adjacent the inner surface of said blowing housing for blowing air outwardly through said filter means to remove fiber waste from the outer surface of said filter means.

8. A traveling cleaner according to claim 4, wherein means for cleaning the filter means for the inlet of the blowing housing also includes a blowing nozzle traveling with the cleaner and positioned adjacent the inner surface of the filter means in opposed relation to the suction nozzle, and means connecting said blowing nozzle to the blowing housing for producing a blowing air stream directed outwardly through said filter means and into the suction nozzle.

9. A traveling cleaner according to claim 1, wherein the means for driving said blowing and suction air impellers is a single motor.

10. A pneumatic traveling cleaner adapted to travel over at least one row of textile machines and combining in a single compact unit independent means for blowing cleaning and suction cleaning comprising at least one flexible suction tube on each side of the row of machines for sucking fiber waste off the floor supporting the machines, and at least one flexible blowing tube on each side of the row of machines for directing blowing air streams toward the machines, superposed suction and blowing housings positioned above the machines in non-air-communicating relationship and to which the respective suction and blowing tubes are communicatively connected, separate blowing and suction rotary air impellers means each rotatable on a vertical axis in the respective blowing and suction housings, means for driving said impeller means, said blowing impeller means being arranged to blow air into the blowing tubes independently of said suction impeller means, said suction impeller means being arranged to suck air and fiber waste into the suction tubes independently of said blowing impeller means, and said suction and blowing housings being movable relative to each other on a vertical axis to vary the spaced relationship of the depending suction and blowing tubes on each side of the row of machines.

11. A traveling cleaner according to claim 10, including means automatically operable as the traveling cleaner approaches a predetermined point for decreasing the distance between the blowing and suction tubes at each side of a machine row, and means automatically operable to increase the distance between the blowing and suction tubes at each side of a machine row after the cleaner has passed said predetermined point.

12. A pneumatic traveling cleaner adapted to travel over at least one row of textile machines and combining in a single compact unit independent means for blowing cleaning and suction cleaning comprising at least one flexible suction tube on each side of the row of machines for sucking fiber waste off the floor supporting the machines, and at least one flexible blowing tube on each side of the row of machines for directing blowing air streams toward the machines, superposed suction and blowing housings positioned above the machines in non-air-communicating relationship and to which the respective suction and blowing tubes are communicatively connected, separate blowing and suction rotary air impellers means each rotatable on a vertical axis in the respective blowing and suction housings, means for driving said impeller
means, said blowing impeller means being arranged to blow air into the blowing tubes independently of said suction impeller means, said suction impeller means being arranged to suck air and fiber waste into the suction tubes independently of said blowing impeller means, and said suction housing comprising two superposed sections movable relative to each other about a vertical axis.

13. A self-propelled traveling cleaner adapted to travel over at least one row of textile machines and combining in a single compact unitary structure independent pneumatic systems for blowing cleaning and suction cleaning, comprising

(a) a single blowing housing positioned with its largest dimension extending horizontally and having at least one air inlet which is disposed substantially above the textile machine floor so as to receive relatively clean air, said blowing housing also having at least two air outlets,

(1) a filter for filtering lint and the like from air entering the inlet to the blowing housing;

(2) means traveling with the cleaner for cleaning the filter including a suction nozzle adjacent the outer surface of the filter;

(3) a flexible blowing air tube communicatively connected to each of said air outlets with at least one of said tubes arranged so as to depend into the aisle space on each side of the row of textile machines and having openings therein for directing blowing air toward the machines for cleaning;

(4) a rotary blowing air impeller mounted in the blowing housing on a vertical axis, said impeller being constructed to produce blowing air streams flowing from the openings in the blowing air tubes at sufficient velocities and volumes to blow lint and the like from the textile machines;

(b) a suction housing fixed with respect to said blowing housing and positioned with its largest dimension positioned horizontally and having at least two air inlets and at least one air outlet;

(1) a flexible suction tube communicatively connected to each of said inlets of said suction housing, at least one of said suction tubes being arranged to depend in the aisle space on each side of the row of textile machines, said suction tubes having inlet nozzles disposed adjacent the floor for picking up lint and the like from the floor for conveyance into the suction tubes;

(2) a rotary suction air impeller mounted on a vertical axis for creating a flow of suction air through the suction tubes sufficient to pick up lint and the like;

(3) at least one collection chamber connected to said suction housing discharge outlet and having a filter therein for separating lint sucked up through the suction tubes from the air and collecting it in said chamber;

(c) means communicatively connecting the suction nozzle for cleaning the filter on the inlet of the blowing housing and the inlet side of the suction housing to cause lint picked up from said filter to be emptied into said collection chamber;

(d) means for driving said blowing air impeller and said suction impeller;

(c) said blowing and suction housings being in non-air-communicating relationship;

(f) said blowing housing, said suction housing, and said driving means all being arranged in closely related superposed relation and adapted for travel above the center line of the row of machines.

14. A traveling cleaner according to claim 13 wherein said collection chamber comprises an enclosed internally unobstructed substantially cylindrical vertically disposed housing with means for directing lint laden air from the outlet of the suction housing in a path tangent to the inner surface of said cylindrical chamber to cause the air to move around the inner surface of said chamber while creating a low pressure collection area in the central portion of the collection chamber, and a portion of the cylindrical chamber being perforated and serving as an exhaust filter for the air flowing therethrough.

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ROBERT W. MICHELL, Primary Examiner.