

Filed May 14, 1964

TRAVELING CLEANER FOR LOOMS

6 Sheets-Sheet 1

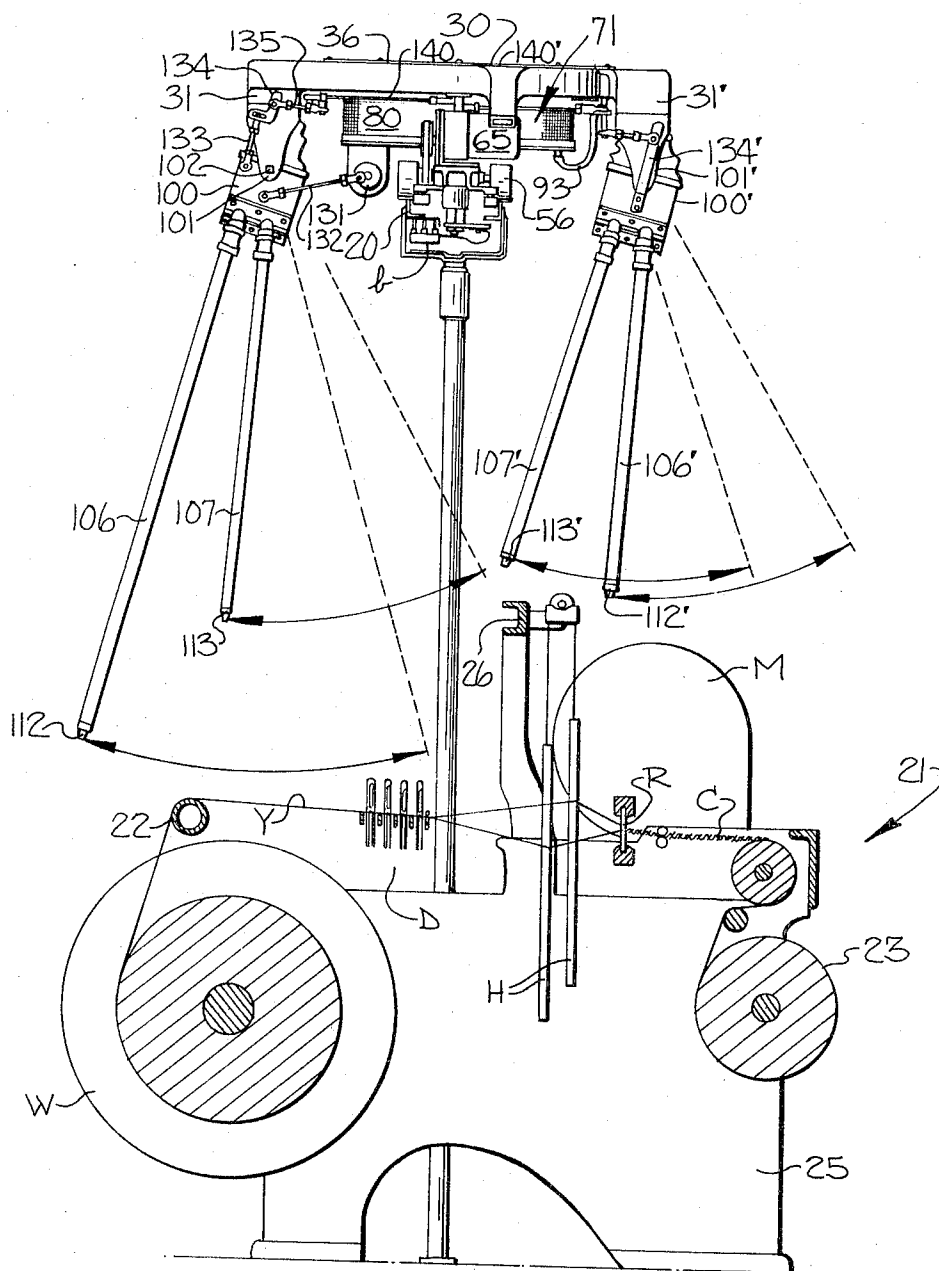


Fig-1

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ATTORNEYS

Feb. 21, 1967

G. SERESS ET AL

3,304,570

TRAVELING CLEANER FOR LOOMS

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6 Sheets-Sheet 2

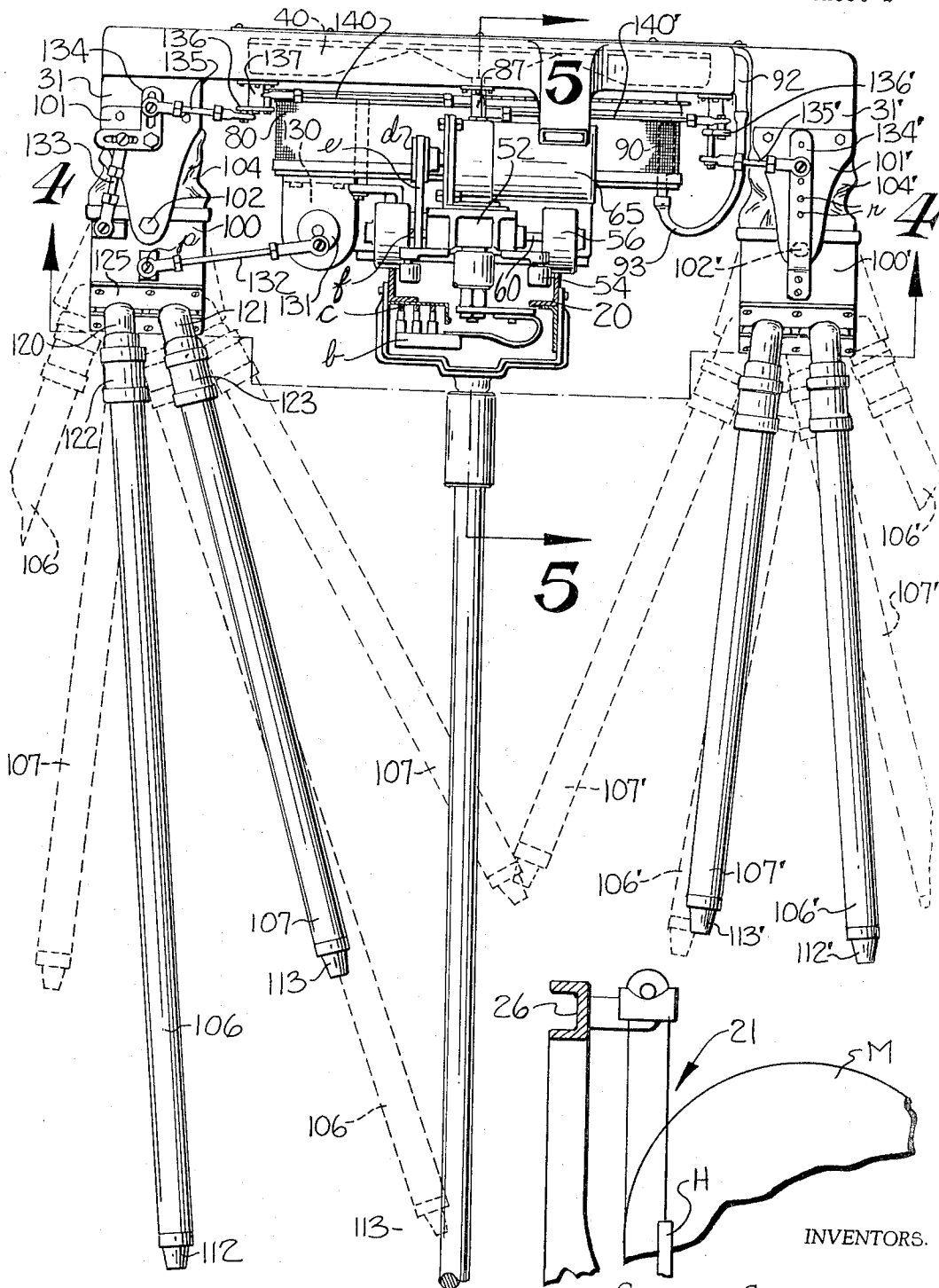


Fig-2

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TRAVELING CLEANER FOR LOOMS

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6 Sheets-Sheet 3

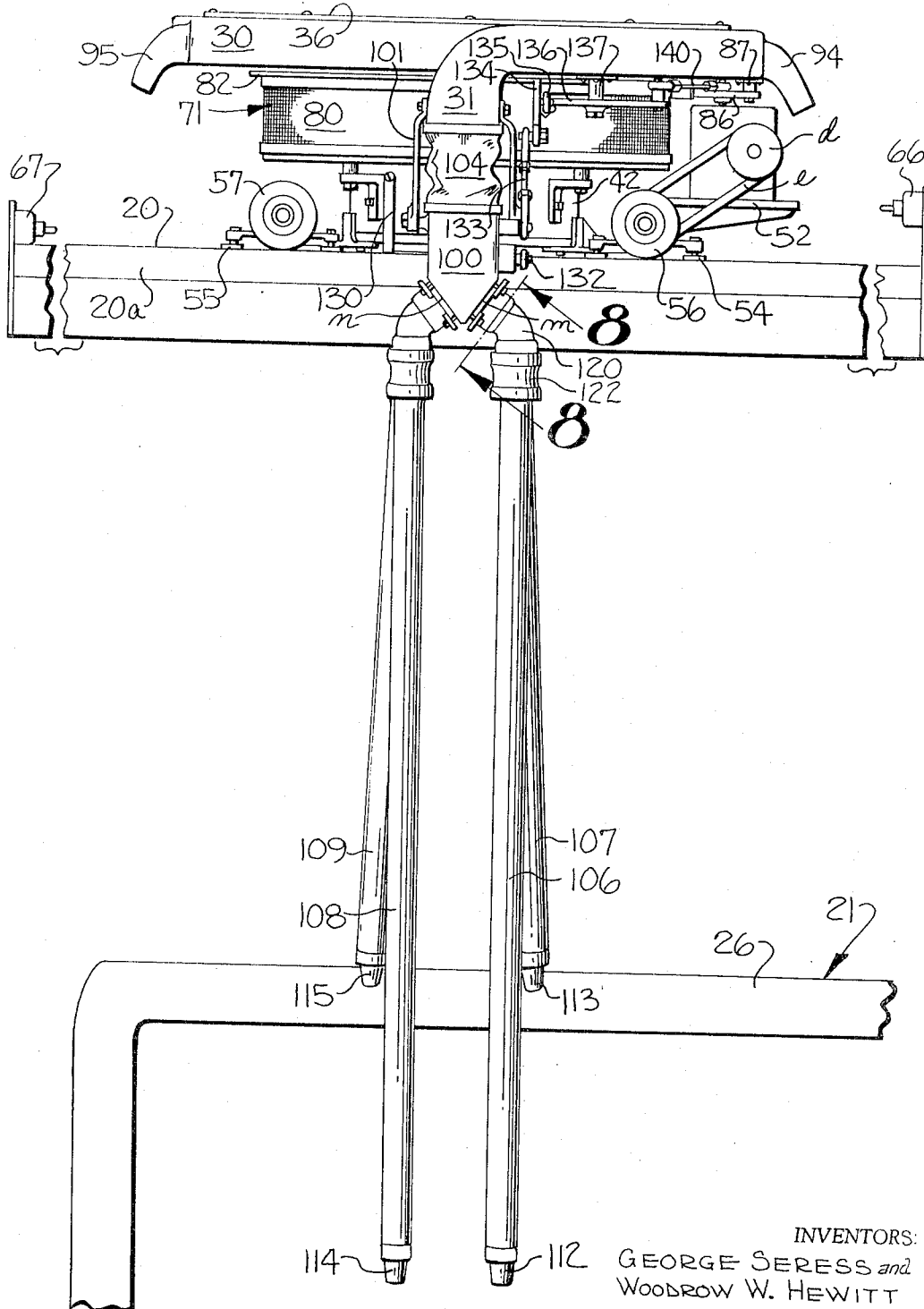


Fig. 3

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6 Sheets-Sheet 4

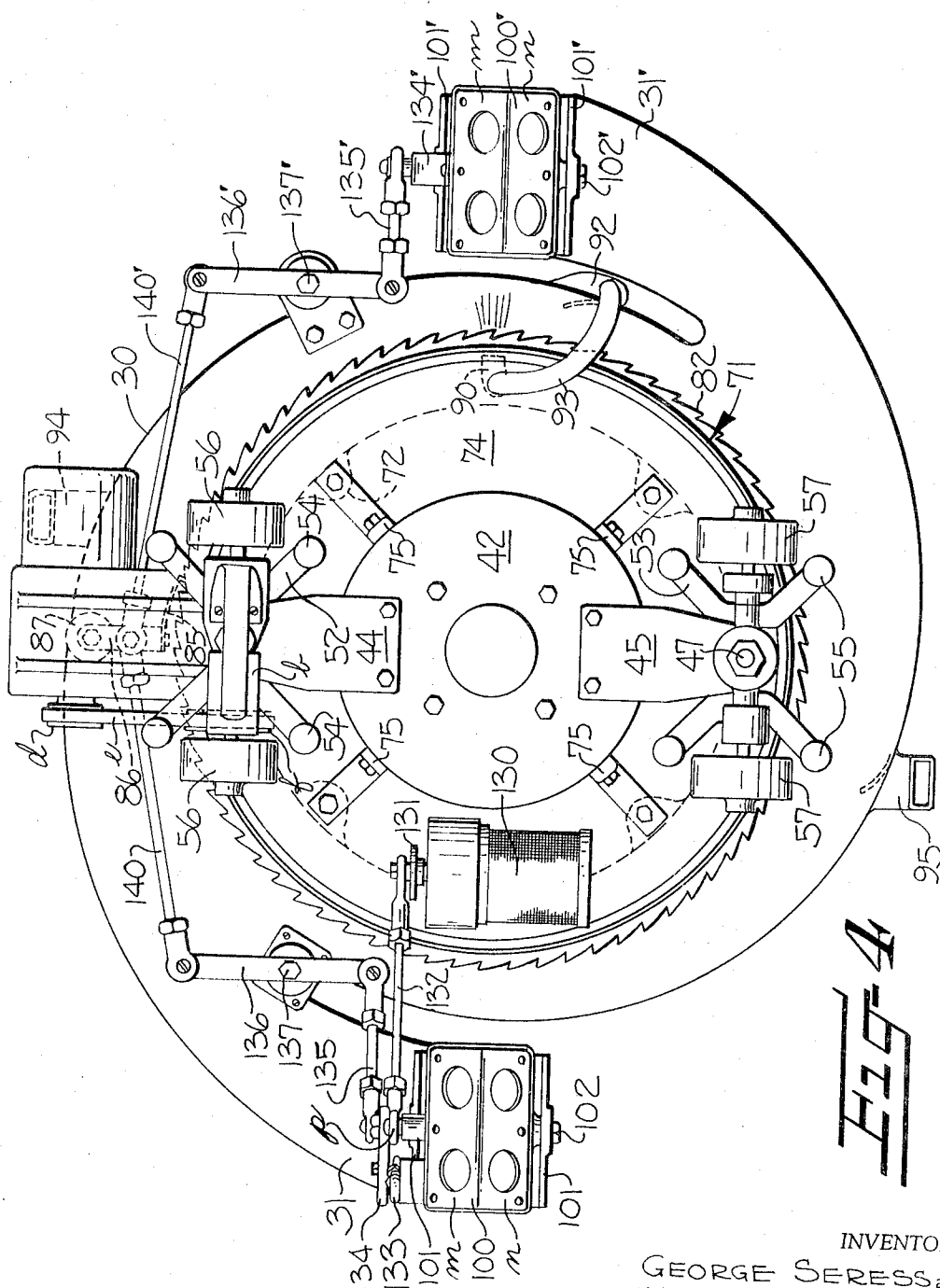


Fig. 4

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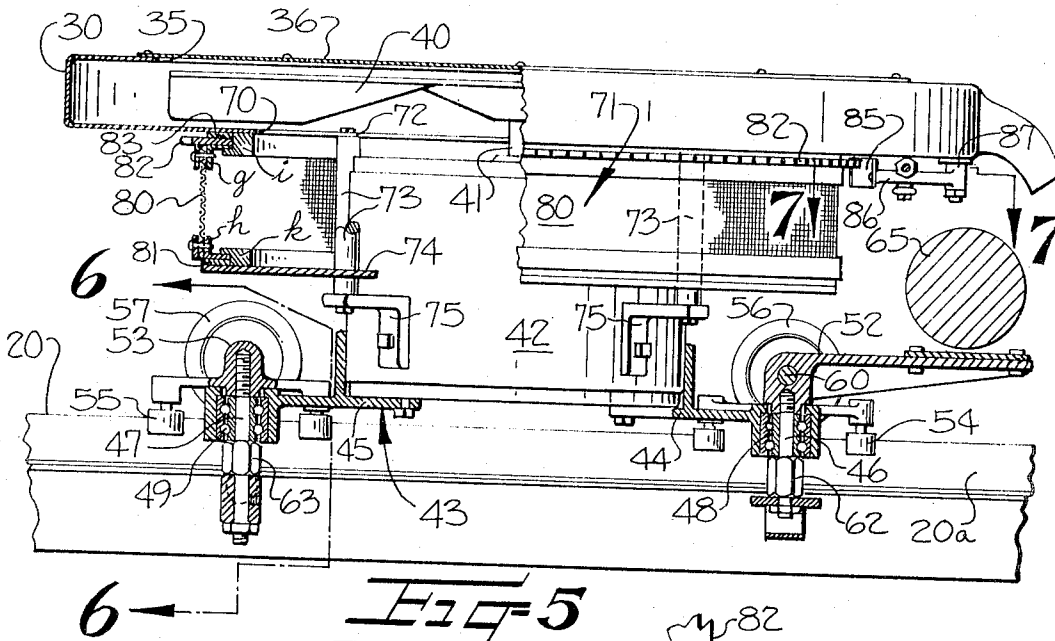
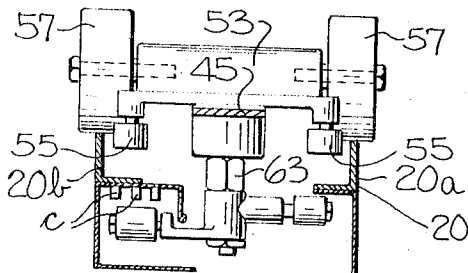
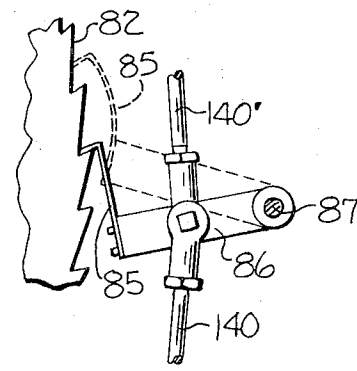
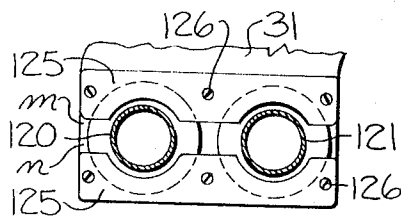
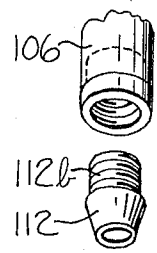
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TRAVELING CLEANER FOR LOOMS

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6 Sheets-Sheet 5



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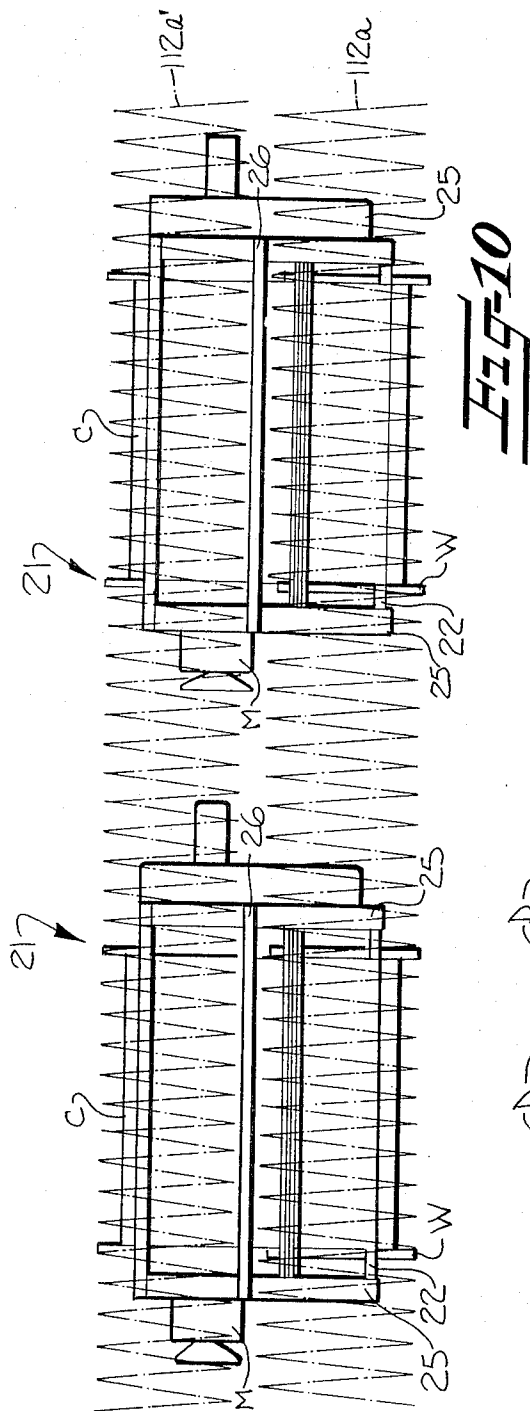
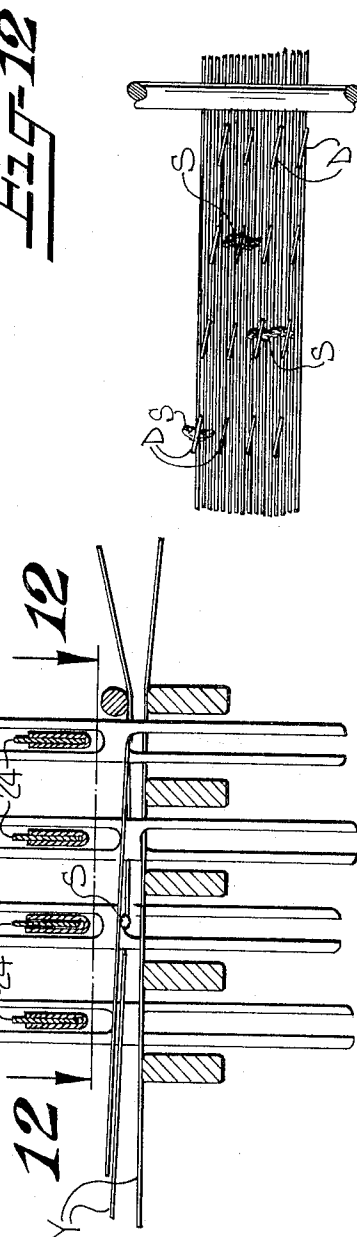
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TRAVELING CLEANER FOR LOOMS

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6 Sheets-Sheet 6



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TRAVELING CLEANER FOR LOOMS

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15 Claims. (Cl. 15—312)

This invention relates to an improved apparatus for removing fiber waste from textile looms during operation thereof and more particularly for cleaning critical upper portions of the loom, such as the drop wires, other stop motions, filling feed motions, heddles, reed cap and the like.

Cleaning looms, particularly cotton looms, of lint generated during the operation of the looms presents a long-standing and difficult problem, primarily because of the fact that the yarns being woven are usually coated with size or the like which becomes sticky, especially in the highly humid atmosphere in which most cotton looms are presently operated. As the yarns are moved through the looms and are manipulated, at increasingly high speeds, to form cloth, individual fibers or portions of fibers break loose from the yarns and form loose fly or lint. These ambient fibers tend to adhere to each other and to various parts of the looms and, because of the sticky characteristics of the size on the fibers, they are very difficult to remove, particularly during operation of the looms.

Up to the present time, the only known practical way to remove lint completely from the critical areas of looms has been by the use of a manually manipulated compressed air hose or "blow gun" directing a very high velocity air jet against various parts of the looms and material in process to dislodge and remove accumulations of lint. Periodically, the blowing is accompanied by wiping or additional cleaning with solvents or cleaning agents. To get the best results and for maximum convenience, this thorough manual cleaning takes place when the loom is stopped at warp outs. Certain areas can be cleaned during operation of the loom by manual manipulation of the air hose, including rapid oscillation, but this requires special care to prevent actuation of the stop motion, is expensive in labor cost, and at best, is sporadic and subject to human error, variation and oversight. Air pressure in the compressed air hose used heretofore for manual loom cleaning is between about 30 and about 90 pounds per square inch gauge. Diameter of the nozzle orifice is usually about 1/4 inch. Air velocity at the nozzle is above 20,000 feet per minute.

When compressed air is used for cleaning cotton looms manually, it is customary to so clean at intervals of from about 8 hours to about 24 hours. Between such normal periods of manual cleaning, there usually is sufficient lint accumulation so that use of compressed air causes quantities of lint and bunches of lint to fly about and settle elsewhere on the material in process and requires extra labor in removal to maintain quality of the finished product.

Many prior attempts have been made to develop mechanical apparatus to automatically clean looms, and some of these attempts have resulted in commercial devices. However, none of the prior devices have been capable of achieving the degree of cleanliness obtainable with manual air hoses.

Of the many prior attempts to solve the problem of automatic loom cleaning, several patented cleaners have been in commercial use. For example, traveling cleaners utilizing continuously oscillating streams of air from fans, as first disclosed in Holtzclaw Patent No. 2,695,039, have been in use for several years. Cleaners of the type disclosed in Miller et al. Patents Nos. 2,729,845 and

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2,798,825, utilizing wide streams of air traveling transversely of the warp threads and movable longitudinally thereof, also have been used, as well as rotating air stream traveling cleaners made under Fain Patent No. 2,981,644.

These cleaners, mounted either on overhead tracks or cranes, have served to blow some lint from the looms, but the area, velocity and direction of application of the air streams have been such that the critical areas of the looms were not cleaned as well as desired and areas below the level of the horizontal cloth level were cleaned little, if at all. These cleaners all have the same deficiency, that is, they are so designed that they cannot use air streams of sufficient velocity to keep the critical areas of the looms clean without interfering with the stop motions or other operations of the looms. For example, Patent No. 2,798,825 states that the volume and velocity of air which is delivered to the loom are critical and must be within the range of about 2,000 to 2,800 feet per minute velocity and between about 800 and 1,200 cubic feet per minute volume to clean without actuating the stop motions or creating undesired conditions.

We have now discovered a new traveling cleaner whereby we are able to utilize fine jet air streams having velocities much higher and areas much less than those of the prior art (with resulting much lower volumes), and apply these streams in such a way as to achieve results heretofore unobtainable.

It is therefore an object of this invention to provide a novel traveling loom cleaner for producing a plurality of fine jet, very high velocity air streams and causing these air streams to travel automatically and repeatedly along a row of looms and be directed toward critical areas of the looms in such a manner as to clean lint from these critical areas without interfering with the stop motions or other operations of the looms. Insofar as we know, that is an entirely new concept in this art.

It is another object of this invention to provide a cleaner for removing lint from upper portions of a plurality of textile looms, such as drop wires and filling fork, also heddles, reeds, harnesses and adjacent areas of looms during the operation of the looms by directing fine jet, very high velocity, air streams toward these areas and causing the fine jet, very high velocity, air streams to travel automatically transversely across the warp of looms arranged in rows while continuously oscillating these air streams substantially in directions parallel with the warp yarns, and automatically repeating the travel of the fine jet, very high velocity, air streams at such frequencies, rates of travel and rates of oscillation as to maintain the aforesaid areas in a substantially lint-free condition for extended periods of time.

In order to obtain the foregoing and other objects in a wide variety of loom cleaning situations, we have found that it is necessary to combine several important features.

Of particular importance is the fact that we use very high velocity air streams, that is, air streams having a velocity of from about 5,000 to 10,000 feet or more per minute at the surfaces to be cleaned. To secure a velocity of from 5,000 to 10,000 feet per minute at surfaces to be cleaned, we prefer a velocity at the nozzle on the order of 20,000 feet per minute. This nozzle velocity insures a very high velocity at the points of cleaning and reduces dispersion.

It is also important to utilize fine jet air streams that is, air streams from small nozzle openings (minimum internal diameter), preferably on the order of about one inch in diameter. By using a plurality of closely spaced or grouped nozzles and keeping the area of each nozzle opening small (as compared with nozzle openings of three or more inches in diameter in the prior art) and delivering the air at a very high velocity, the effective area of each air stream at the cleaning point is very

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small, permitting accurate placement of the air stream at the surfaces to be cleaned without interference with the loom operation. The very high velocity, fine jet air streams of the character described have been found effective in many instances in getting under the surface of adhered lint and peeling it off.

Even though we utilize very high velocity air streams, the greatly reduced area of the nozzle orifices results in much lower air volume (cubic feet per minute) than that utilized in the prior art. For example, when we use a nozzle one inch in diameter with air velocity at the nozzle of 20,000 feet per minute, its air volume is only about 109 cubic feet per minute. When we use a nozzle $\frac{3}{4}$ inch in diameter and air velocity at the nozzle of 20,000 feet per minute, the air volume is only about 61 cubic feet per minute.

For effective loom cleaning, it is important to oscillate the fine jet, very high velocity, air streams substantially in planes normal to the direction of travel of the cleaner when the cleaner travels transversely of the warp yarns. In other words, the air streams oscillate or move back and forth continuously, substantially in directions parallel to the longitudinal direction of the warp yarns. Rate of oscillation is sufficiently rapid relative to the rate of travel of the cleaner to properly minimize the distance traveled by each air jet transversely of the warp yarns during each period of oscillation of the air stream. The invention includes apparatus for fixing the aforesaid distance to suit requirements.

Another important factor of our invention is that the rate of travel of the air streams across the looms be rather slow, that is, less than the ordinary rate of travel of prior loom cleaners which usually travel at speeds of from about 60 to about 100 feet per minute or even faster. The preferred rate of travel of our new cleaner is from about 30 to about 50 feet per minute. The slower speed in combination with oscillation of each fine jet, very high velocity air stream insures an effective attack upon lint resting on or adhering to loom parts to dislodge or peel it off, and remove it, instead of merely packing the lint more firmly in place, as occurs frequently with conventional cleaners.

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

FIGURE 1 is a front elevation of one end of a preferred embodiment of the traveling blowing cleaner of the present invention for carrying out the present invention, showing the cleaner mounted on a track extending above a row of textile looms;

FIGURE 2 is an enlarged elevation corresponding to the upper portion of FIGURE 1;

FIGURE 3 is an elevation looking at the left-hand side of FIGURE 2;

FIGURE 4 is an enlarged inverted plan view looking substantially along line 4—4 in FIGURE 2, but omitting the track and the dependent oscillatable blowing tubes;

FIGURE 5 is an enlarged longitudinal vertical sectional view, partially in elevation, taken substantially along line 5—5 in FIGURE 2;

FIGURE 6 is a fragmentary transverse vertical sectional view taken substantially along line 6—6 in FIGURE 5;

FIGURE 7 is an enlarged fragmentary plan view taken substantially along line 7—7 in FIGURE 5 and showing a portion of the filter revolving means;

FIGURE 8 is a fragmentary elevation, partially in section, taken substantially along line 8—8 in FIGURE 3;

FIGURE 9 is a fragmentary, partially exploded, perspective view showing the free end of one of the blowing tubes and an associated blowing nozzle;

FIGURE 10 is a schematic plan view of a row of looms showing the approximate paths traced by two of

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the blowing nozzles, or the fine jet, very high velocity, blowing air streams, as they move longitudinally of the row of looms, i.e., transversely of the warp yarns of each successive loom;

FIGURE 11 is a transverse vertical sectional view showing four rows of drop wires and corresponding warp yarns passing therethrough; and

FIGURE 12 is a schematic plan view of a few of the drop wires taken substantially along line 12—12 in FIGURE 11 and showing how lint may collect between adjacent drop wires and render them inoperative.

Referring more specifically to the drawings, the novel traveling blowing cleaner of the present invention is shown mounted on an elongate track 20 extending above and longitudinally of a row of textile looms. Only one of the looms is shown broadly designated at 21 in FIGURES 1, 2 and 3, and two of the looms, representing a row of looms, are shown in FIGURE 10. As is usual, the looms are arranged crosswise in each row so the warp yarns Y thereof extend transversely of the rows. Thus, the track 20 extends transversely of each loom and parallel to the rows of drop wires D of each loom.

Each loom 21 may include the usual warp beam W (FIGURE 1) from which warp yarns Y are drawn upwardly over a roll 22, then forwardly through drop wires D, through heddles or harnesses H and through a reed R to the fell of the cloth C being woven. The cloth is taken up by a cloth take-up roll 23. Drop wires D are normally supported by warp yarns Y and are adapted to drop against stop motion bars or electrode bars 24 (FIGURE 11), upon corresponding warp yarns being parted, to stop the loom automatically. Bars 24 are carried by the loom frame 25, which frame also supports a filling magazine M and an arch 26 from which the harnesses H may be suspended in a well-known manner.

As heretofore stated, the warp yarns are usually coated with size or the like which becomes sticky in the highly humid atmosphere in which the looms are operated and, as the warp yarns move through the looms, individual fibers or portions thereof break loose from the yarns and form loose fly or lint. These ambient fibers tend to adhere to each other and to various parts of the looms and, because of the sticky characteristics of the size on the fibers, they are difficult to remove, particularly during operation of the loom. The problem of lint adhering to the loom parts is particularly critical at the harnesses H, reed R and yarn stop motions, such as the drop wires D, filling forks and the like. As is known, the drop wires are generally the most difficult parts of a loom to keep clean because they are very close together and, if the sticky lint is not removed from the drop wires, it builds up between adjacent drop wires, as shown at S in FIGURES 11 and 12, preventing free action of the drop wires, and causing adjacent warp yarns to adhere to each other.

Sometimes, wads of sticky lint S adhering to adjacent drop wires will be pulled off by the yarns and will be woven into the cloth, thus requiring subsequent removal from the cloth and sometimes resulting in seconds. Lint adhering to adjacent drop wires or corresponding yarns passing therethrough will frequently cause a drop wire to remain suspended so that the loom may continue to run for a considerable length of time after a warp yarn has parted, thus forming a length of seconds or requiring that the missing warp yarn be sewn into the cloth manually after it is removed from the loom.

Further, although the heddles H do not have a stop motion function, excessive accumulation of lint thereon frequently causes adjacent heddles to adhere to each other, thus preventing the formation of a proper shed by the heddles, or breaking of warp yarns at the heddles. Similar problems occur when lint is permitted to accumulate excessively on the reed R and adjacent parts, such as the filling fork, bobbins, temples, etc. It is thus seen that it is extremely important to the continued and efficient operation of looms that the critical

areas mentioned heretofore are maintained clean at all times.

The traveling cleaner of the present invention is particularly devised to keep such critical areas sufficiently clean to insure continued efficient operation of the looms over extended periods and to an extent which has been obtainable heretofore only by frequent manual cleaning.

Our traveling cleaner comprises a hollow blower housing 30 of volute form in plan (FIGURE 4) and having a pair of outwardly curved substantially laterally opposed ducts 31, 31' thereon whose ends are curved downwardly for pivotally supporting oscillatable blowing tubes in a manner to be later described. The top wall of housing 30 preferably is provided with an access opening 35 closed by a removable cover 36. Opening 35 is sufficiently large to permit installation of a high air velocity impeller or fan 40 in housing 30.

Fan 40 is fixed on the upper end of the substantially vertically disposed shaft 41 of an electric motor 42, the housing of which serves as a part of a carriage, broadly designated at 43, mounted for movement along track 20. Although the traveling cleaner may be propelled in either direction along track 20, for purposes of description it may be assumed that the right-hand end of the traveling cleaner in FIGURES 3 and 5 is the front thereof, and the left-hand end of the traveling cleaner in FIGURES 3 and 5 is the back or rear end thereof.

Carriage 43 includes a pair of front and rear end brackets 44, 45 suitably secured to electric motor 42 (FIGURES 4, 5 and 6) and in which respective substantially vertically disposed pivot shafts or posts 46, 47 are suitably journaled, preferably by means of anti-friction bearings 48, 49 (FIGURE 5). The upper ends of posts 46, 47 have respective trolley brackets 52, 53 fixed thereon whose lower portions are in the form of spiders (FIGURE 4) and have respective sets of four guide rollers 54, 55 journaled thereon for rotation about respective substantially vertical axes. Rollers 54, 55 are positioned between spaced substantially parallel rails 20a, 20b of track 20 and serve to maintain respective front and rear pairs of carriage wheels 56, 57 in engagement with rails 20a, 20b.

Rear carriage wheels 57 are suitably journaled on opposed sides of rear trolley bracket 53 (see FIGURE 6). Front carriage wheels 56 are fixed on opposed ends of a shaft or axle 60 journaled in front trolley bracket 52. Since carriage 43 is suspended from trolley brackets 52, 53 and wheels 56, 57, the lower medial portion of posts 46, 47 have respective enlarged portions or nuts 62, 63 thereon which engage the lower ends of the inner races of bearings 48, 49.

The lower end of front post 46 carries a suitable brush unit *b* which is biased against electrodes or conductors *c* (FIGURE 2) carried by and extending longitudinally of track 20. An electric carriage propelling motor 65, fixed on front trolley bracket 52, may be electrically connected to brush unit *b* by any suitable means, not shown, for driving carriage 43 in either direction along track 20. In this instance, electric motor 65 has a pulley *d* fixed on the shaft thereof which is engaged by an endless belt *e*. Belt *e* also engages a pulley *f* fixed on axle 60 (FIGURES 2 and 5).

The described manner of mounting carriage wheels 56, 57 is particularly desirable for use on tracks having bends therein, since guide rollers 54, 55 serve to swivel or turn wheels 56, 57 about the vertical axes of respective trolley brackets 52, 53 whenever the traveling cleaner traverses a bend in track 20.

Track 20 may be of the endless or double-ended type, provided that the traveling cleaner is moved across the looms at sufficiently frequent intervals to maintain the upper portions of the looms in a clean condition; i.e., substantially devoid of lint. For example, assuming track 20 is of the double-ended type, opposed ends thereof may be provided with suitable switches 66, 67 (FIGURE 3) engageable by the traveling cleaner for reversing elec-

tric motor 65 as it approaches each end of track 20, so as to repeat automatically the travel of the cleaner across the looms in the corresponding row or rows.

Although it is preferred that fan 40 is driven by a separate motor from that which propels carriage 43 along track 20, it is to be understood that carriage 43 may be constructed so the traveling cleaner is propelled by the same motor which drives the fan. For example, the traveling cleaner of the present invention may be supported and propelled along track 20 by mechanism such as that disclosed in the Hodge et al. Patent No. 2,011,763 or by any other suitable means, without departing from the spirit of the invention.

The bottom wall of blower housing 30 has a substantially circular air inlet opening 70 therethrough which is generally of substantially greater diameter than fan motor 42 and which communicates with a filter assembly or housing broadly designated at 71. The circular form of inlet opening 70 is interrupted by a plurality of inwardly projecting portions 72 (FIGURE 4) of the bottom wall of housing 30, which portions 72 are suitably secured to the upper ends of corresponding posts 73.

Posts 73 are arranged in substantially circularly spaced relationship around electric motor 42 and their lower ends are suitably secured against the upper surface of an annular bottom wall 74 of the filter housing 71. Bottom wall 74 of filter housing 71 encircles electric motor 42 in close proximity thereto and is suitably secured to a plurality of angle brackets 75 fixed to the casing of fan motor 42 (FIGURE 5).

Filter housing 71 includes an annular screen or filter 80 which may turn about a vertical axis substantially corresponding to the axis of motor shaft 41. To this end, upper and lower ends of filter 80 are suitably secured to annular frame members *g*, *h* (FIGURE 5) shaped in the manner of angle bars in cross-section, and whose inwardly projecting flanges engage the flanges of respective annular retaining rings *i*, *k*.

Retaining ring *i* is suitably secured to the lower surface of the bottom wall of blower housing 30 adjacent air inlet opening 70, and retaining ring *k* is suitably secured to the upper surface of bottom plate 74 of filter housing 71. The bottom annular frame member *h* of filter 80 may move in sliding engagement with the upper surface of bottom plate 74, but it is preferred that a suitable annular bearing strip 81, made from felt, plastic or any other suitable bearing material, is positioned between annular frame member *h* and plate 74.

The upper annular frame member *g* of filter 80 has an annular ratchet wheel 82 suitably secured thereto (FIGURES 4, 5 and 7) and a suitable annular spacer or bearing race 83 may be positioned between the proximal surfaces of ratchet wheel 82 and the bottom wall of blower housing 30. Ratchet wheel 82 is engaged by a pawl 85 in the form of a leaf spring member inherently biased inwardly toward ratchet wheel 82 and fixed to a pawl-carrying arm 86.

Arm 86 extends outwardly and is pivotally connected, as at 87, to the bottom wall of blower housing 30 adjacent its front portion. Pawl 85 and arm 86 may be oscillated continuously, by means to be later described, so as to impart stepwise rotation to filter 80 relative to housing 30 and bottom plate 74 of filter housing 71. Thus, filter 80 moves past a slotted filter-cleaning blowing nozzle 90 (FIGURE 2) positioned adjacent the inner surface of filter 80 and being suitably supported by plate 74. Nozzle 90 extends through plate 74 and is connected to a small air outlet portion 92 (FIGURE 4) on the side wall of blower housing 30 by means of a conduit 93. Since substantially all air drawn into blower housing 30 by fan 40 is filtered through filter 80, it is apparent that ambient lint tends to collect on the outer surface of filter 80. However, nozzle 90 blows lint outwardly and off the outer surface of filter 80 as successive portions thereof move past nozzle 90.

The side wall of blower housing 30 also has a pair of

outwardly and downwardly curved track cleaning blowing nozzles 94, 95 adjacent the front and rear portions thereof for directing blasts of air onto track rails 20a, 20b and thereby preventing excessive accumulation of lint thereon.

The downwardly extending distal ends of the curved ducts 31, 31' of blower housing 30 have respective dependent, laterally oscillatable and substantially cup-shaped cuff members or hollow couplings 100, 100' connected thereto by means of respective pairs of substantially triangularly-shaped suspension plates 101, 101'. The upper portions of plates 101, 101' are fixed to opposed sides of respective ducts 31, 31'. The lower ends of suspension plates 101, 101' have the upper portions of couplings 100, 100' pivotally connected thereto, as at 102, 102' (FIGURES 2 and 4), on axes substantially parallel with the path of travel of the traveling cleaner. Respective flexible tubes or boots 104, 104' are connected to and extend between the proximal ends of ducts 31, 31' and the respective couplings 100, 100'.

In its preferred embodiment, the traveling cleaner is equipped with three or four dependent very high velocity aid blowing tubes at each side thereof and which depend from the respective couplings 100, 100'. As shown in FIGURES 1, 2 and 3, the bottom portion of coupling 100 is substantially V-shaped and has opposed front and rear downwardly converging walls *m*, *n* forming the bottom thereof to which respective pairs of blowing tubes 106, 107 and 108, 109 are adjustably and removably connected, by means to be later described, for communication with the interior of coupling 100. Coupling 100' at the other side of the traveling cleaner also has four blowing tubes depending therefrom which may be arranged in the same manner as the blowing tubes 106-109. However, only the two front blowing tubes are shown in association with coupling 100' in FIGURES 1 and 2 and are designated at 106', 107'.

The blowing tubes 106-109, 106', 107' are preferably made from a relatively light rigid material, such as plastic, and have respective nozzles 112-115, 112', 113' suitably removably connected thereto as by being threaded into the lower ends of the corresponding blowing tubes. By way of example, a portion of blowing tube 106 and the corresponding nozzle 112 are shown in exploded relationship in FIGURE 9, wherein it will be observed that the lower end of tube 106 has an internally threaded ferrule adhesively or otherwise secured therein for receiving a reduced, externally threaded, upper portion 112b of nozzle 112 therein. It is thus seen that each of the nozzles 112-115, 112', 113' may be replaced by a nozzle having a nozzle opening of a different size therethrough, if desired.

Each pair of tubes 106, 107; 108, 109; and 106', 107' may be adjustably and detachably connected to the corresponding coupling 100 or 100' in the same manner. Accordingly, the manner in which the front pair of tubes 106, 107 only at one side of the traveling cleaner is connected to the angularly extending surface *m* of coupling 100 will be described and such description will suffice as a suitable means for detachably and adjustably connecting the rear pair of tubes 108, 109 at the corresponding side of the traveling cleaner and the tubes 106', 107' at the other side of the traveling cleaner to the corresponding coupling 100, 100'.

It will be observed in FIGURES 2 and 3 that the upper ends of blowing tubes 106, 107 are communicatively connected to respective pipe elbows 120, 121 by means of flexible tubes or boots 122, 123. Boots 122, 123 are preferably made from a semi-rigid material, such as rubber or the like, so they will normally hold the dependent tubes 106, 107 in predetermined positions relative to coupling 100, but which will permit the tubes 106, 107 to yield upon impact with any obstruction in the path of movement thereof, and then to return to their intended positions after they have moved out of engagement with the obstruction.

As best shown in FIGURES 3 and 8, the flanged upper

ends of pipe elbows 120, 121 are held in clamping engagement against the surface *m* of coupling 100 by a pair of clamping plates 125 which engage the outer surfaces of the flanges of both pipe elbows 120, 121 and are removably secured to the surface *m* by suitable screws 126. Thus, the relative positions of adjacent blowing tubes may be adjusted by turning corresponding pipe elbows, such as 120, 121, relative to couplings 100, 100'.

Tubes 106', 107, 107' 109 (FIGURES 2 and 3) are relatively short as compared to tubes 106, 108 so corresponding nozzles 112' 113, 113', 115 may pass above and in closely spaced relation to the loom arches 26 and magazines *M* while directing fine jet, very high velocity, air streams toward front and rear portions of harnesses or heddles *H* and reed *R*. Tubes 106, 108 are substantially longer than tubes 107, 109 so the nozzles 112, 114 thereof move in close proximity to drop wires *D* and warp yarns *Y* during oscillation thereof substantially normal to the path of travel of the traveling cleaner. It will be noted that, when tube 106, for example, occupies its innermost position adjacent arch 26, as shown in dotted lines in FIGURE 2, nozzle 112 also directs a fine jet, very high velocity, air stream toward the lower portions of harnesses *H* and toward the warp yarns passing there-through.

Nozzle 113' is oscillated substantially in planes normal to the path of travel of the traveling cleaner so that it moves across and above the arches 26 of successive looms and also directs a fine jet, very high velocity, air stream toward the front portions of heddles *H*, reeds *R*, the reed caps, lays, filling forks and shuttle boxes of successive looms.

Although nozzle 112' does not oscillate above arches 26 of successive looms, its path of oscillation may overlap that of nozzle 113' to further assist in dislodging lint from reed *R* and associated elements of each loom 21, including the cloth *C* and the magazine *M*. Nozzle 112' is positioned to move in an oscillating path above reed *R* and associated elements. If the looms are equipped with a magazine *M*, nozzle 112' is preferably positioned so as to swing above the level of the magazines of successive looms in the corresponding row. The proximity of the various nozzles to certain elements of successive looms, and the minimum and preferred velocities at which air is to be directed toward said components as well as the preferred diameters of the air streams as they flow from the openings of the nozzles will be later described.

For good results, the various heretofore described nozzles on the ends of the dependent tubes and, especially the nozzles 112, 114 (FIGURES 2 and 3), should make at least about one complete lateral oscillation for each twelve inches of movement of the traveling cleaner along track 20. In situations where cleaning is especially difficult, two or more oscillations per foot of travel may be desirable, or additional nozzles may be employed with or without more rapid oscillation.

It is to be noted that we are able to utilize much higher air velocities than possible in prior art traveling cleaners because we use much smaller or finer air streams. By using a plurality of small diameter nozzles, we obtain complete coverage. Preferably, three or more closely grouped nozzles are used adjacent each side of the loom arches so as to obtain better coverage of the areas being cleaned than that of the single larger nozzles of the prior art and which permits much higher air velocities and much greater cleaning effectiveness than the single larger nozzles.

The means for oscillating blowing tubes 106-109, 106', 107' and corresponding nozzles 112-115, 112', 113' may comprise a relatively small electric motor 130 suitably secured to the lower surface of bottom plate 74 of filter housing 71 (FIGURES 1, 2 and 4). Electric motor 130 may receive its electrical energy from conductors *c* shown in the upper central portion of FIGURE 2 by suitable electrical connections therewith, not shown. Motor 130

may include a variable speed device or the speed thereof may be varied electrically, as by means of a rheostat, so as to vary the number of oscillations of the blowing tubes per minute.

The shaft of motor 130 extends substantially parallel with the direction of travel of the traveling cleaner along track 20 and has a disk or crank 131 fixed thereon to which one end of a link 132 is pivotally connected in eccentric relation to the shaft of motor 130. Link 132 extends outwardly and is pivotally connected to a medial portion of coupling 100 below pivot point 102, as at p (FIGURE 2). The lower end of a link 133 is pivotally connected to the upper portion of coupling 100 and the upper end of link 133 is pivotally and adjustably connected, by a slot and pin connection, to one arm of a bell crank 134 oscillatably mounted on suspension plate or bracket 101.

The other arm of bell crank 134 has the outer end of a link 135 pivotally and adjustably connected thereto, by a slot and pin connection. The inner end of link 135 (FIGURES 2 and 4), adjacent filter 80, is pivotally connected to one end of a lever 136 suitably journaled, as at 137, on the lower wall of blower housing 30. Lever 136 extends forwardly and has the outer end of a link 140 pivotally connected thereto.

Referring to the right-hand upper portion of FIGURE 2 and the right-hand central portion of FIGURE 4, it will be observed that the front side of coupling 100' has the lower end of a crank arm 134' fixed thereto, whose upper portion has the outer end of a link 135' pivotally connected thereto. Crank arm 134' is provided with several holes r permitting adjustment of link 135' relative to arm 134'. Link 135' extends inwardly and is pivotally connected to the rear end of a lever 136' (FIGURE 4) journaled on housing 30, as at 137', and to which the outer end of a link 140' is pivotally connected. The proximal ends of links 140, 140' are pivotally connected to a medial portion of pawl-carrying arm 86. Links 132, 133, 135, 140, 135', 140' preferably are of the extensibly adjustable type, as shown, in order to vary the range of oscillation of hollow couplings 100, 100' and corresponding blowing tubes.

It is apparent that rotation of the shaft of motor 130 imparts lateral oscillation to the blowing tubes and nozzles at all times during operation of the traveling cleaner, through the intervening connections heretofore described. Since the proximal ends of links 140, 140' are pivotally connected to pawl-carrying arm 86, it is apparent that stepwise rotation also is imparted to filter 80 at all times during operation of the traveling cleaner.

The air pressure and volume capacity of fan 40 in blower housing 30 must be high enough to cause the air to be exhausted from each of the plurality of relatively small nozzles 112-115, 112', 113' at such velocity that the air velocity at the surfaces to be cleaned, especially at drop wires D, is at least about 5,000 feet per minute and is preferably on the order of 10,000 or more feet per minute. Not only are the nozzle openings relatively small as compared to the nozzle openings of prior art traveling loom cleaners, but they can be advantageously located to move as closely adjacent the surfaces to be cleaned as loom obstructions will permit. They oscillate continuously in substantially parallel relation to the warp yarns Y of successive looms during their relatively slow travel across the looms (longitudinally of the loom row or rows).

In tests with a suitable fan, it has been found that excellent cleaning results are obtained by utilizing nozzles 112-115, 112', 113' each having nozzle openings of approximately one inch diameter. Favorable results have been obtained in some installations when nozzles were of various other sizes of from about one-half inch to about one and one-half inches in diameter.

In some experimental tests, the traveling cleaner described herein was equipped with eight nozzles grouped

in sets of four depending from opposite sides of the traveling cleaner substantially as shown in accompanying drawings. In one series of tests, a 20-inch diameter 3,500 r.p.m. fan was employed and in another series of tests, a 21-inch diameter 3,500 r.p.m. fan was employed. The tests were conducted to determine the nozzle air velocity when utilizing each of three different sizes of nozzles as well as to determine the velocity of the air at various distances from each nozzles, at a room temperature of approximately 70° Fahrenheit.

The following Charts A, B, C show the approximate air velocity at each nozzle in the group of eight. Separate tests were made on groups of nozzles of different sizes and at various distances downstream from the nozzle, when utilizing a 20-inch diameter fan. The velocities in column V of Chart A are those produced when air was exhausted through nozzle openings three-fourths inch in diameter; the velocities in column V of Chart B were produced by exhausting the air through nozzle openings one inch in diameter; and the velocities in column V of Chart C were produced by exhausting the air through nozzles one and one-fourth inches in diameter. Column D, in each instance, indicates the distance that the testing instrument was spaced from a corresponding nozzle. The instrument used for determining the velocities is known as a Merriam Manometer and was provided with a pitot tube having a one-eighth inch diameter orifice substantially alined with the center of the air stream. All velocities appearing in the charts are given in feet per minute and all distances from the nozzle are given in inches.

Chart A		Chart B		Chart C	
Nozzle Opening ¾" Diameter		Nozzle Opening 1" Diameter		Nozzle Opening 1¼" Diameter	
D	V	D	V	D	V
0----	19,400	0----	18,400	0----	16,500
2----	19,200	2----	18,400	2----	16,500
4----	18,000	4----	18,400	4----	16,500
6----	14,500	6----	17,700	6----	16,000
8----	11,300	8----	16,000	8----	15,000
12----	6,930	12----	10,600	12----	11,200
18----	5,050	18----	6,900	18----	7,600

Tests conducted utilizing a 21-inch fan, and under the same conditions as set forth above, resulted in the approximate velocities set forth in Charts D, E, F.

Chart D		Chart E		Chart F	
Nozzle Opening ¾" Diameter		Nozzle Opening 1" Diameter		Nozzle Opening 1¼" Diameter	
D	V	D	V	D	V
0----	20,300	0----	19,300	0----	16,900
2----	20,200	2----	19,300	2----	16,900
4----	19,700	4----	19,000	4----	16,900
6----	16,800	6----	17,900	6----	16,400
8----	12,900	8----	15,100	8----	15,000
12----	8,700	12----	10,900	12----	11,300
18----	5,900	18----	7,100	18----	7,500

The fan diameters are given by way of description only, since the speed of the fan, the width of its blades and other factors determining the air delivery characteristics thereof may be varied as desired.

The Charts A-F, while being exemplary only, show that the fans used can produce velocities above the aforementioned desired minimum velocity of 5,000 feet per minute at surfaces to be cleaned, even when nozzles are positioned as much as 18 inches away from the surfaces.

Although nozzles having openings, that is, minimum internal diameter, of as little as one-half inch diameter may be used in some cases, it has been found that one-

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half inch nozzles when used with either the 20-inch fan or 21-inch fan of the type used in the tests have to be positioned within 12 to 13 inches of surfaces to be cleaned in order that such surfaces can be subjected to air velocities of at least 5,000 feet per minute. Since the magazine of a loom requires that corresponding nozzles be spaced from 14 to 18 inches above the cloth C, it may be desirable to use nozzles having openings of at least three-fourths inch diameter when the blowing tubes are positioned to travel over the front portions of the looms, such as the nozzles 112', 113'.

At the back of the loom, the openings in the nozzles may in some cases be as small as or even less than one-half inch in diameter, since best results are obtained by positioning the nozzles 112, 114 so they will pass within a distance of from four to ten inches of the upper surfaces of the drop wires.

Since the drop wires have their sides extending substantially parallel to the warp yarns, the fine jet, very high velocity, air streams emanating from applicants' nozzles, as above described, would cause the drop wires to lay over or tilt excessively if the nozzles delivering air at such high velocity were moved in a straight linear path across successive looms. As stated earlier, it is important to oscillate the fine jet, very high velocity, air streams substantially in planes normal to the direction of travel of the traveling cleaner and at sufficiently high speed relative to the rate of travel of the cleaner to minimize the distance traveled by each air jet transversely of the warp threads during each period of oscillation of the air stream. Further, in some, if not all cases, the traveling cleaner preferably should move along the track 20 at a relatively slow speed of from about 30 to about 50 feet per minute so as to restrict the necessary rate of oscillation and insure an effective attack by the fine jet, very high velocity, air streams upon lint resting or adhering to loom parts to dislodge or peel it off and remove it.

The optimum air jet velocity, rate of travel of the air jets longitudinally of the rows of looms and the simultaneous rate of oscillation of the jets are dependent upon the material and type of yarns being woven, the ambient humidity and other conditions in the weave room.

It will be observed in FIGURE 10 that the fine jet, very high velocity, air streams emanating from the nozzles 112, 112', for example, trace respective zig-zag paths, identified at 112a and 112a' in the course of travel of the traveling cleaner over the row of looms shown in FIGURE 10. Similar paths are traced by the air streams from nozzles 113, 114, 115, 113'. In these paths 112a, 112a', it will be noted that the extent of lateral movement of the jet streams is substantially equal to the distance from the arches 26 to the respective rearmost and foremost portions of the looms. It will be noted however that the extent of lateral movement of the streams may be varied by adjustment of the linkage heretofore described with reference to FIGURES 4 and 8. Also, it will be noted that for purposes of illustration, the zig-zag paths are shown as if they were straight lines traced on a horizontal plane such as the surface of the warp. Actually, such lines would bend slightly toward the direction of travel of the cleaner.

As herein outlined, we have found in typical cases that excellent cleaning results from using fine jet air streams flowing from one inch diameter nozzles, each having a velocity at surfaces to be cleaned of over 5,000 feet per minute and oscillating rapidly enough to limit travel of the cleaner along its track crosswise of the warp yarns to from about 3 to about 12 inches during each complete oscillation.

If the several factors set forth herein are taken into consideration with regard to the range of sizes of the nozzles, the very high velocity of the fine jet air streams emanating from the nozzles, the distances of the nozzles from the surfaces to be cleaned, the continuous relatively rapid oscillation of the nozzles longitudinally of the

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warp yarns, and the relatively slow travel of the traveling cleaner along the track 20, the looms, and especially the critical areas thereof, are maintained clean to such extent that the looms may be operated without manual cleaning for periods far exceeding those at which looms could be so operated heretofore.

From the foregoing, it is seen that the present invention utilizes a plurality of fine jet, very high velocity, continuously oscillating air streams which impinge upon the surfaces to be cleaned in relatively small areas so that they will not cause accidental operation of the stop motions of the loom while effectively stripping and otherwise removing lint and other fiber waste from the aforementioned critical areas of looms as well as other adjacent areas, including the warp yarns Y and the cloth C. In many instances, the entire loom including top, sides and areas below the warp yarns and cloth are kept well cleaned by cleaners of this type; the lint being blown into adjacent alleys where it may be picked up by an associated traveling vacuum cleaner of a type disclosed in Patent No. 3,011,202, for example.

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

We claim:

1. Apparatus for cleaning upper portions of a plurality of textile looms arranged in a row including drop wires and yarns being processed thereon which comprises a high air velocity blower fan, means for continuously traveling said fan across the looms in said row, said fan having at least one depending air discharge nozzle movable adjacent each side of the arch of each successive loom having a minimum internal diameter of not over 1/4 inches and from which nozzles air from the fan is discharged as a very high velocity fine jet air stream, said nozzles being spaced sufficiently close to the warp level of the looms so that the velocity of the fine jet air streams therefrom is at least 5,000 feet per minute at such level, said means for traveling said fan being operable to cause said nozzles to travel across each successive loom, means for continuously oscillating said nozzles substantially in planes normal to the direction of, and during, travel of the blower fan, and said means for moving said fan being operable to repeat automatically the travel of the blower fan across the looms at sufficiently frequent intervals to maintain the material in process and upper portions of the looms at a high level of cleanliness.

2. Apparatus according to claim 1 wherein the means for oscillating said nozzles and the means for causing said fan to travel across the looms are such that the very high velocity fine jet air streams trace zigzag paths on the warp yarns and cloth of the loom with each zigzag having a substantially greater distance component normal to the line of travel of said fan than the component thereof parallel to the line of travel of said fan.

3. A traveling loom cleaner according to claim 1 wherein a plurality of said nozzles are arranged in closely spaced groups adjacent each side of the arches of the looms.

4. A traveling loom cleaner according to claim 1 including means for varying the number of oscillations per unit of distance of travel of the apparatus longitudinally of the row of looms.

5. Apparatus according to claim 1 wherein the air discharge nozzles are oscillated at the rate of at least about one complete oscillation per foot of travel of said fan along the row of looms.

6. A traveling loom cleaner according to claim 1 including means for adjustably varying the extent of oscillation of at least one of said nozzles relative to the length of travel of said fan during each oscillation.

7. Apparatus according to claim 1 wherein the rate of

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travel of the blower fan over the row of looms is between about 30 and 50 feet per minute.

8. Apparatus for cleaning upper portions of a plurality of textile looms arranged in a row including drop wires and yarns being processed thereon which comprises a high air velocity blower fan, means for continuously traveling said fan across the looms in said row, said fan having at least one depending air discharge nozzle movable adjacent each side of the arch of each successive loom, each nozzle having an internal diameter of not over 1¼ inches and from which nozzles air from the fan is discharged as a very high velocity fine jet air stream, said nozzles being spaced sufficiently close to the areas to be cleaned so that the velocity of the fine jet air streams therefrom is from about 5,000 feet per minute to about 20,000 feet per minute at the warp level of the looms, said means for traveling said fan being operable to cause said nozzles to travel across each successive loom, means for continuously oscillating said nozzles substantially in planes normal to the direction of, and during, travel of the blower fan, and said means for moving said fan being operable to repeat automatically the travel of the blower fan across the looms at sufficiently frequent intervals to maintain the material in process and upper portions of the looms in a substantially clean condition.

9. Apparatus according to claim 8 wherein the rate of travel of the blower fan over the row of looms is between about 30 and 50 feet per minute.

10. Apparatus for cleaning textile looms having stop motions and being arranged in rows with their arches in alignment; said apparatus comprising a blower housing movable repeatedly over a row of said looms and having an air impeller therein, substantially vertical air discharge ducts each having at least one nozzle having a minimum internal diameter of not over 1¼ inches, said nozzles being directed downwardly and spaced within eighteen inches of the horizontal planes of those surfaces on the loom to be cleaned, said ducts being movable adjacent opposite sides of the arches of the looms, said impeller serving to discharge air through said nozzles and down onto said surfaces in fine jet air streams of at least about 5,000 feet per minute velocity at said surfaces, means operatively associated with said ducts for continuously oscillating said air streams substantially in planes normal to the path of travel of said blower housing, and the size of the nozzles, rate of travel and rate of oscillation of said nozzles being such as to render the air streams incapable of actuating the stop motions of the looms while effectively removing lint from material in process and from surfaces of the looms.

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11. A structure according to claim 10, wherein said looms have banks of drop wires thereon, and at least one of said nozzles being oscillated within ten inches of said drop wires.

12. In a traveling cleaner for textile looms including a blower fan having a housing movable above and longitudinally of a row of looms, and at least one air outlet duct extending outwardly from one side of said housing; the combination therewith of a hollow coupling communicating with and suspended from said duct for pivotal movement on a substantially horizontal axis substantially parallel to the path of travel of said housing, at least one blowing tube communicatively connected to said coupling and extending downwardly from said coupling to points closely adjacent upper surfaces of the looms over which the tube moves with said housing, said tube having a downwardly directed nozzles outlet at its lower portion of a maximum of one and one-quarter inches diameter, said blower fan discharging air through said nozzle opening at such velocity and the nozzle opening being so spaced relative to the looms that the resulting air stream impinges upon surfaces of the looms to be cleaned at a velocity of at least about 5,000 feet per minute, and means for continuously oscillating said coupling at such a rate that said nozzle opening completes at least one complete to and fro oscillation for every foot of travel of said housing.

13. A structure according to claim 12, in which said means for oscillating said coupling comprises a motor on said housing, a member driven by said motor, and linkage eccentrically and pivotally connected to said member and also being connected to said coupling.

14. A structure according to claim 13, including means for adjustably varying the effective length of said linkage and to thereby vary the path of oscillation of the corresponding nozzle opening.

15. A structure according to claim 13, including means for varying the rate of oscillation imparted to said coupling by said motor.

References Cited by the Examiner

UNITED STATES PATENTS

2,695,039	11/1954	Holtzclaw	15—312 X
2,729,845	1/1956	Miller et al.	15—312
2,981,644	4/1961	Fain	15—312 X
3,153,803	10/1964	Bahnson	15—312

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