United States Patent [19]

Hales

[11] **3,733,715**

[45] **May 22, 1973**

[54] **DRY CLEANING MACHINE**

[76] Inventor: **John H. Hales,** P.O. Box 1008, Aurora, Utah 84620

[22] Filed: **Mar. 11, 1971**

[21] Appl. No.: **123,170**

[52] **U.S. Cl.** **34/82,** 34/131, 34/132, 34/133, 55/304

[51] **Int. Cl.**.....**F26b 21/06**

[58] **Field of Search**.....34/54, 131, 132, 34/133, 139, 82; 55/304

[56] **References Cited**

UNITED STATES PATENTS

3,395,519	8/1968	Kleissler	55/304
3,543,483	7/1967	Sheehan	55/304
1,571,703	2/1926	Butzbach	34/132

FOREIGN PATENTS OR APPLICATIONS

215,407	7/1959	Austria	55/304

Primary Examiner—Carroll B. Dority, Jr.
Attorney—B. Deon Criddle

[57] **ABSTRACT**

A dry cleaning machine that gently tumbles fabrics, furs, and other such materials with a dry cleaning compound to remove dirt from the materials and that efficiently removes the compound and dirt from the machine tumbler. A forced, circulating, air flow system is provided to aerate the materials and to assist in moving the cleaning compound through folds of the materials so that a maximum amount of dirt is contacted by the compound. Control means are provided to regulate the air flow and to prevent premature loss of the cleaning compound used.

18 Claims, 10 Drawing Figures

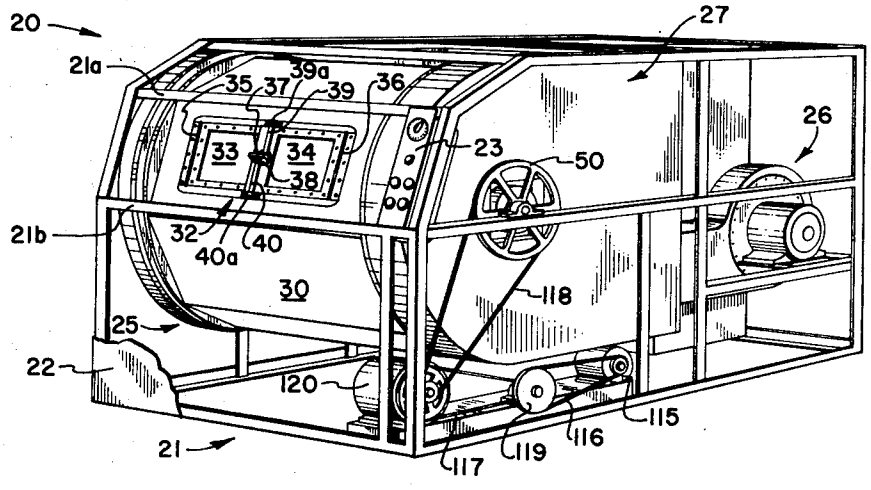


FIG 1

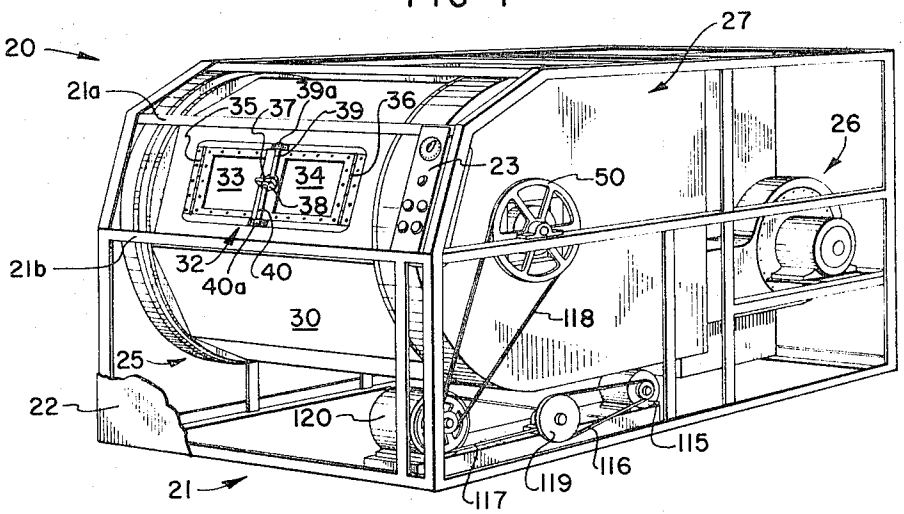


FIG 2

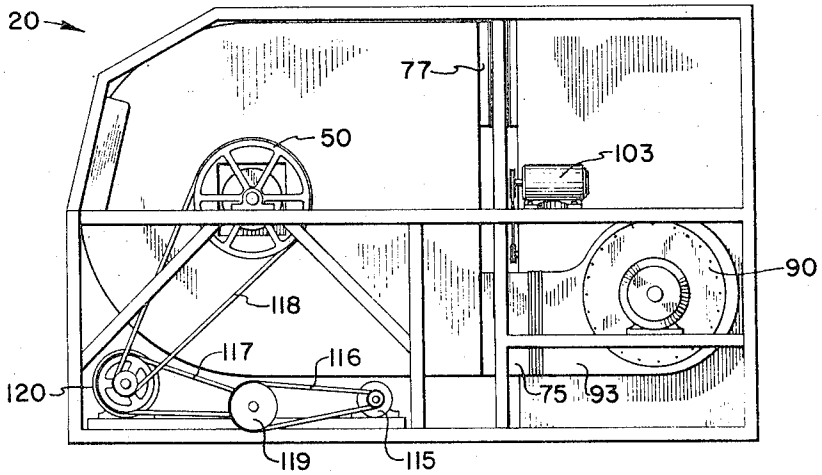
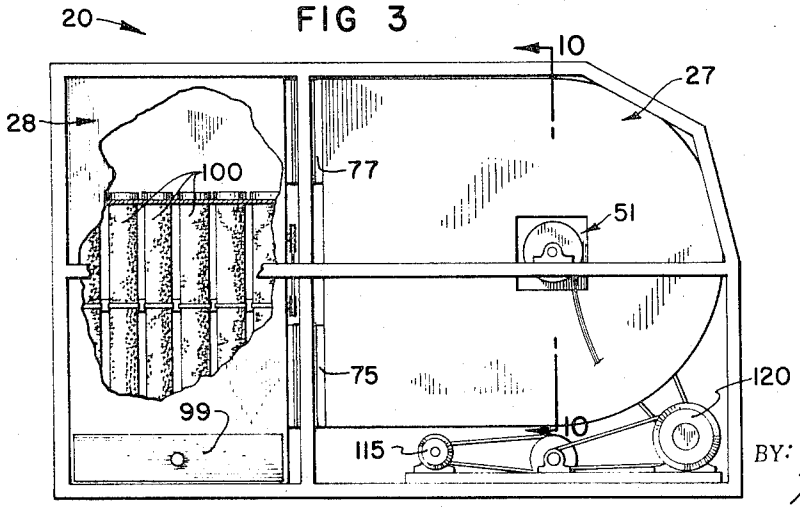


FIG 3



INVENTOR:
JOHN H. HALES

BY: P. Dean Tribble

ATTORNEY

FIG 4

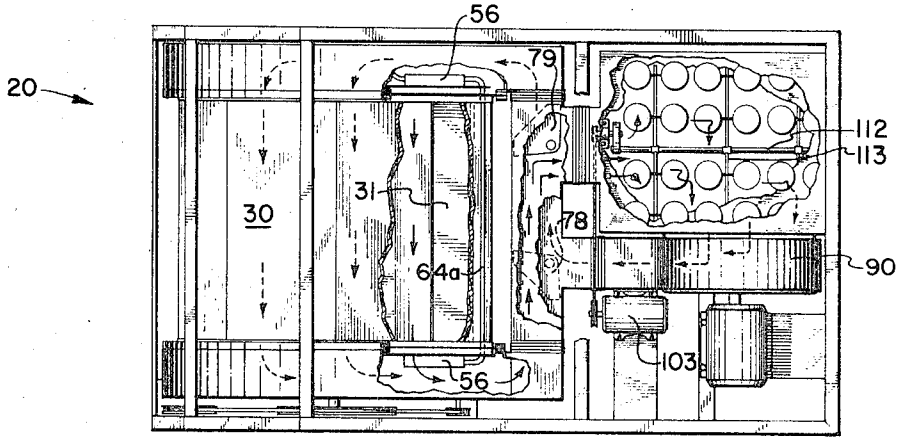


FIG 5

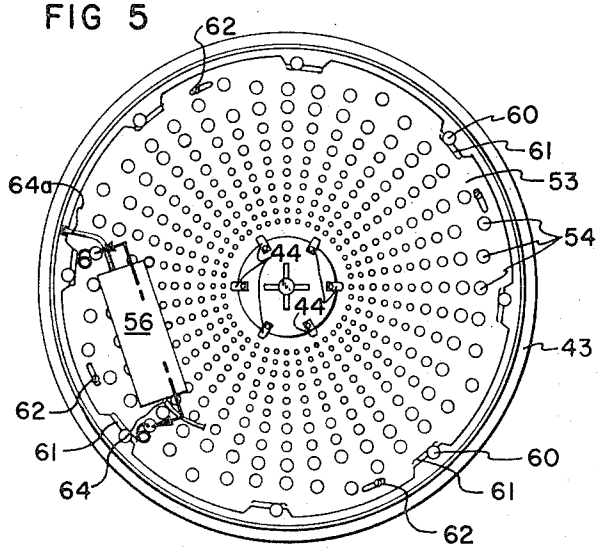


FIG 6

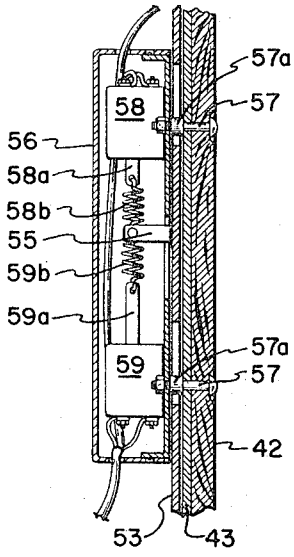
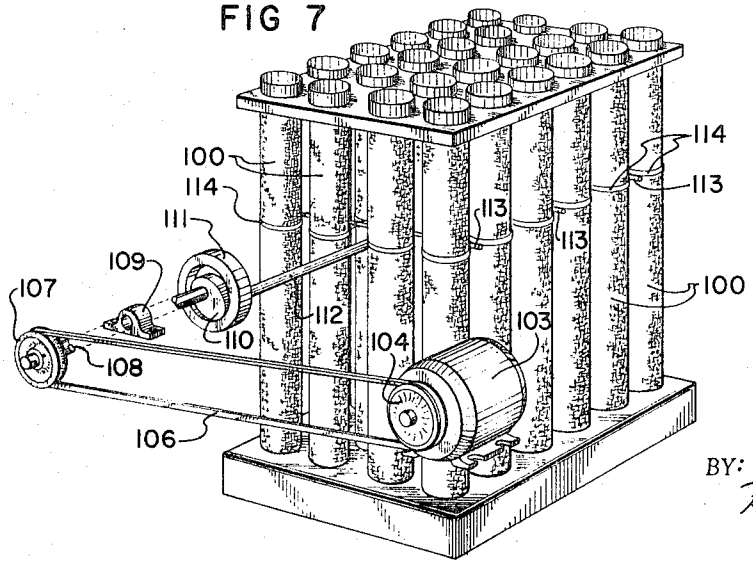


FIG 7



INVENTOR:
JOHN H. HALES

BY: B. Dean Criddle

ATTORNEY

FIG 8

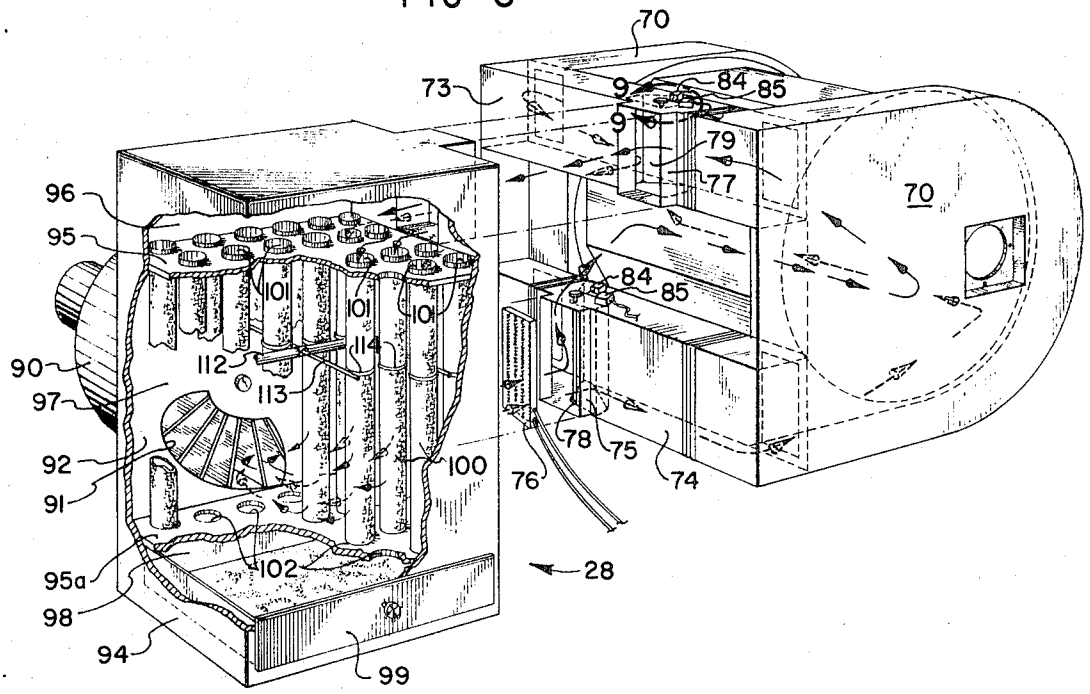


FIG 10

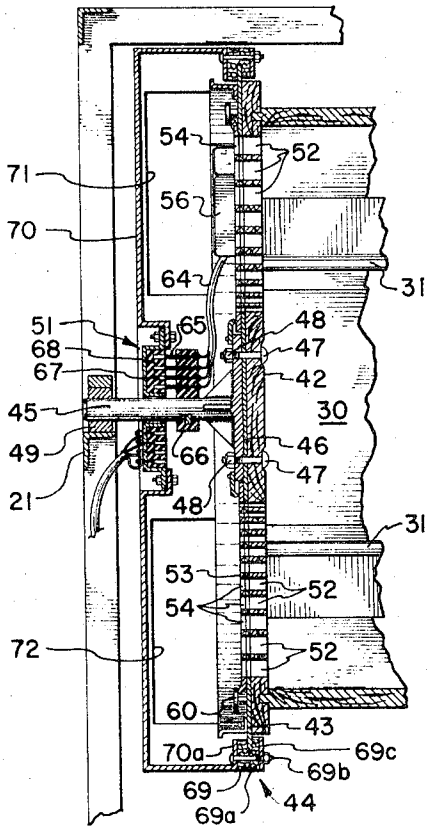
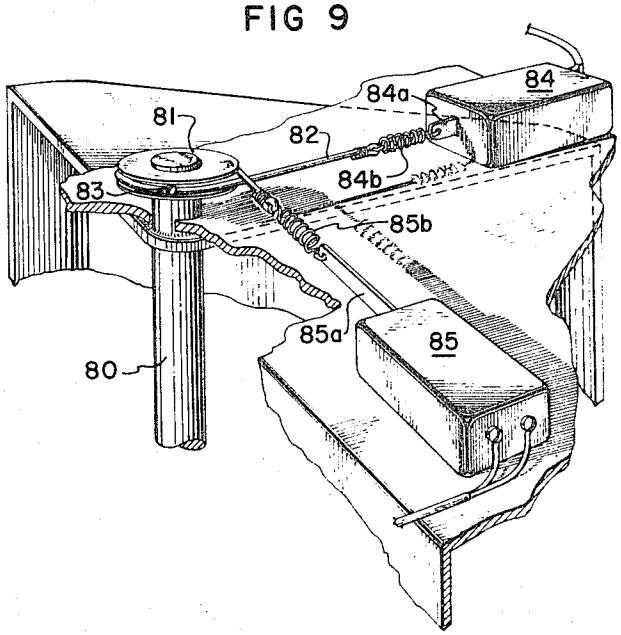


FIG 9



INVENTOR:
JOHN H. HALES

BY:

ATTORNEY

DRY CLEANING MACHINE

BRIEF DESCRIPTION OF THE INVENTION

1. Field of the Invention

This invention relates to dry cleaning machines and particularly to machines used to tumble fabrics, furs and other such materials with a dry compound that removes dirt from the materials and that removes both the dirt and the cleaning compound from the tumbler.

2. Prior Art

In the past there have been a number of machines proposed for cleaning fabrics, furs and other such materials. Many of these have used water which may damage the materials and have agitated the materials at rapid rates. Such rapid agitation may also damage the material being cleaned. Other devices have been developed to clean materials using a dry or semi-dry compound and a slower, more gentle agitation. U.S. Pat. No. 3,504,510 shows such a machine, wherein air is circulated through the material being cleaned to remove cleaning compound that has been previously agitated with the material.

So far as I am aware, however, there has not heretofore been developed a machine that will remove essentially all cleaning compound and accumulated dirt and that will gently aerate the material being cleaned in an efficient and gentle manner.

SUMMARY OF THE INVENTION

Principal objects of the present invention are to provide a cleaning machine for fabrics, furs and the like wherein material cleaned therein is gently tumbled during a cleaning cycle in the presence of a dry-type cleaning compound having an affinity for dirt and with the compound being held in the tumbler during the cleaning cycle, but thereafter being essentially totally removed.

Other objects are to provide such a machine wherein the cleaning compound and accumulated dirt are effectively collected from a carrying stream.

Principal features of the invention include an axially rotatable drum within a housing and with access doors through the housing and the side wall of the drum, said doors being aligned when rotation of the drum is stopped, and closable air ports at the opposite ends of the drum to control a carrying stream passed through the drum. The closable ports effectively allow flow through the entire ends of the drum.

Other features include a system for shaking fabric tube filters through which the compound and dirt is passed to separate the compound and dirt from the carrying stream and a flow control system for cyclically reversing flow of the carrying stream through the drum.

Further objects and features of the invention will become apparent from the following detailed description, taken together with the accompanying drawings.

THE DRAWINGS

In the drawings:

FIG. 1 is a perspective view of the invention, taken from a front corner and with the exterior housing panels removed and broken away to show the components inside;

FIG. 2, a side elevation view;

FIG. 3, an elevation view of the opposite side partially broken away to show the interior of the filter assembly;

FIG. 4, a top plan view, partially cut away for clarity;

FIG. 5, and end elevation view of the drum;

FIG. 6, an enlarged, fragmentary sectional view, taken on the line 6—6 of FIG. 5;

FIG. 7, an exploded and enlarged perspective view of the filter system;

FIG. 8, a perspective view of the invention, taken from a rear corner and with the exterior housing entirely removed and interior housing partially broken away to show the structure therein;

FIG. 9, an enlarged fragmentary section taken within the line 9—9 of FIG. 8; nd

FIG. 10, an enlarged, fragmentary vertical section taken on the line 10—10 of FIG. 3.

DETAILED DESCRIPTION

Referring now to the drawings:

In the illustrated preferred embodiment of the invention, the cleaning machine, shown generally at **20** has an exterior framework **21** to which panels, shown typically at **22** are mounted to form an exterior housing. A control panel **23** extends between framework members **21a** and **21*b*** and another panel, not shown, including an access door is used to close the rest of the opening between the member **21*a*** and **21*b***.

Inside the exterior framework there is mounted a drum assembly, shown generally at **25**, a blower, shown generally at **26**, that moves a carrying stream through a ductwork shown generally at **27**, and a filter assembly shown generally at **28**.

The Drum Assembly

The drum assembly **25** comprises an elongate, eight-sided wooden drum **30** having baffles **31** extending the length thereof at the junctions of the walls. The baffles extend partially into the center of the drum and serve to support the material being cleaned in the drum and to lift the material during a portion of drum rotation before the material drops off to the floor of the drum. A door **32** is provided in one side of the drum to allow access to the drum interior and the door is arranged to be aligned with a corresponding door, not shown, in the exterior housing. As shown, door **32** comprises a pair of swinging panels **33** and **34**, hinged respectively at **35** and **36** to the drum and with panel **34** overlapping an edge of panel **33** at their center junction. A knob **37** on a member **38** that is rotatably mounted on panel **34** allows the member to be rotated, thereby moving latch rods **39** and **40** that are pivotally connected to member **38** into and out of hasps **38*a*** and **40*a***, respectively on the drum. When the latch rods are withdrawn from the hasps the panels **33** and **34** can be pivoted open to allow access to the interior of the drum and, when the latch rods are in the hasps the panels **33** and **34** can be pivoted open to allow access to the interior of the drum and, when the latch rods are in the hasps the panels are securely locked.

The ends of the drum are each closed by a wooden end wall **42**, shown typically in FIG. **10**, and a plate **43**, of steel or the like, that is fixed thereto. The plate **43** extends beyond the end wall **42** and is clamped at its edge between seal means **44**.

A stub shaft **45** is fixed to and extends from a plate **46** to form an axis at each end of the drum, and bolts **47** and nuts **48** hold the stub shafts, in axial alignment, to the ends of the drum.

Each stub shaft **45** is journaled in a bearing **49** that is supported by a frame member of the framework **21**.

One stub shaft has a pulley 50 fixed thereto, FIGS. 1 and 2, and the other stub shaft 45 extends rotatably through an electrical ring assembly 51.

Circularly spaced holes 52 are extended through each end wall 42 and associated plate 43 and a movable end plate 53 overlies each plate 43 such that holes 54 therein can overlie the holes 52 or can be positioned between them, depending on the relative position of the plate 53 with respect to the plate 43. Each plate 53 surrounds a plate 46 and has a post 55, FIG. 6, fixed to and projecting therefrom.

Post 55 extends into a housing 56 that is held a spaced distance away from end wall 42 and plate 43 by spaced bolts 57. Rollers 57a surround the bolts 57 and turn when they are contacted by the plate 53. Plate 53 extends beneath housing 56 and grooves in the plate 53 surround the rollers 57*a*. A pair of solenoids 58 and 59 are positioned in the housing 56 at opposite sides of the post and their solenoid rolls 58*a* and 59*a* are respectively connected to opposite sides of the post through springs 58*b* and 59*b*. The springs 58*b* and 59*b* absorb shock and reduce noise as the post 55 and plate 53 are moved in response to alternate actuation of the solenoids.

Guide rollers 60, fixed to plate 43, are engaged by the periphery of plate 53 at peripheral notches 61, and bolts 62 threaded into plate 43 through slots in plate 53 assist clamps 44 that are secured to plate 56 and that overhang plate 53, in holding plate 53 against plate 43. Energization of solenoid 58 will retract its solenoid rod 58a to pull post 55 towards the solenoid. This rotates plate 43 around plate 46 and aligns the holes 54 with the holes 52. Energization of solenoid 59 along with the simultaneous deenergization of solenoid 58, since both solenoids are never simultaneously energized, will retract solenoid rod 59*a* and pull post 55 and rotate plate 53 around plate 46 such that the holes 54 are out of alignment with holes 52.

In operation, as will be further explained, the solenoids 58 and 59 within housing 56 at one end control flow through that end of the drum and the corresponding solenoids in the housing 56 at the other end simultaneously and correspondingly control flow through the other end of the drum. Bundled wires 64 provide the circuitry to energize the solenoids 58 and the solenoids 59 and the wires continues from one housing 56 to the other housing 56 along the outside of the drum, as seen best in FIG. 4 at 64*a*. Wires 64 are connected to electrical brushes 65, FIG. 10 that are carried by a housing 66 mounted on a stub shaft 45. The brushes are each arranged to be in electrical contact with a conductive ring 67 carried by a housing 68 of the electrical ring assembly 51 that is fixed to an associated end duct 70 to be hereinafter described.

The Ductwork

The seal means 44 provided at each end of the drum is shown typically in FIG. 10. As shown, the seal means comprises circular felt strips 69 and 69*a* at opposite sides of the periphery of plate 43 and bolts and nut combinations 69*b* clamping the felt strips between a backing ring 69*c* inside of the plate 43 and a flange 70*a* of an end duct 70 outside of plate 43. The drum and plates 43 are free to rotate but material moved through the ends of the drums is confined to the end ducts 70. An upper opening 71 and a lower opening 72 are provided to each end duct and the upper openings of the two end ducts are connected by an upper connecting duct 73, FIG. 8, while the lower openings are connected by a lower connecting duct 74, FIG. 8.

An inlet duct 75, having an electric heater 76 therein, connects into the lower connecting duct 74 intermediate the length of the duct 74 and an outlet duct 77 is connected into the upper connecting duct 73, intermediate the length of duct 73.

A diverter valve 78 is provided at the junction of the inlet duct 75 and the lower connecting duct 74 and is arranged such that when the valve is in one limit position flow is directed from the inlet duct to and through one side of the connecting duct and from there to one end of the drum and when the valve is in its other limit position the flow is directed from the inlet duct to and through the other side of the connecting and from there to the other end of the drum.

A similar diverter valve 79 is provided at the junction of the upper connecting duct. The valve 79 is arranged such that when the valve is in one limit position flow from one end of the drum and through the connected side of the upper connecting duct is directed through the outlet duct. When the valve is moved to its other limit position flow from the other end of the drum is directed through the other side of the upper connecting duct to the outlet duct.

Valves 78 and 79 are identically constructed and operated. As best shown in FIG. 9, each valve is mounted on an upright shaft 80 that is journaled top and bottom through its associated duct. A pulley 81 is fixed to the top of shaft 80 and a cable 82 is passed around the pulley and is fixed thereto by a screw 83.

A pair of solenoids 84 and 85 have their respective solenoid rods 84*a* and 85*a* connected through springs 84*b* and 85*b* to the opposite ends of cable 82. The solenoids 84 and 85 are oppositely actuated. That is, solenoid 84 is energized when solenoid 85 is deenergized and solenoid 84 is deenergized when solenoid 85 is energized. During operation of the cleaning machine the solenoids 84 and 85 of each of the valves 78 and 79 are cyclically operated to move the valves between their limit positions, thereby directing flow through the ductwork as will be hereinafter further explained. The springs 84*b* and 85*b* absorb shock and reduce noise during operation of the diverter valves.

The Blower

A centrifugal blower 90 has its inlet 91, FIG. 8, connected through a wall 92 of the filter assembly 28 and its outlet 93, FIG. 2, connected to the lower inlet duct 75. In operation, the blower takes in air from the interior of the filter assembly and blows it into the inlet duct and through the coils of heater 76 to diverter valve 78.

The Filter Assembly

Filter assembly 28 comprises a housing, shown generally at 94, that includes the wall 92, an upper horizontal divider plate 95 that divides the housing into an upper compartment 96 and a central compartment 97, and a lower horizontal divider plate 95*a* that divides the central compartment 97 from a lower compartment 98. A removable drawer 99 slides into the bottom of compartment 98 to receive cleaning compound and dirt, as will be further explained.

Spaced sleeves 100 extend from openings 101 through upper divider plate 95 to openings 102 in lower divider plate 95*a*. The sleeves are fabric and have a mesh such that air can circulate through the sleeve

walls but such that compound and dirt cannot pass through.

The inlet of blower **90** is connected through wall **92** of housing **93** to the central compartment **97** and the outlet duct **77** is connected at **103** through the housing to upper compartment **96.**

A motor **103** is fixed to and supported by framework **21** and has a pulley **104** thereof connected by a V-belt **106** to a pulley **107.** Pulley **107** is fixed to one end of a shaft **108** that is journaled through a bearing **109** carried by the framework **21** and that has an eccentric **110** mounted on the other end. A circular ring **111** surrounds the eccentric **110** and a shaft **112** is fixed to and projects from ring **111** between rows of the sleeves **100.** Arms **113** extend from the shaft **112** to be connected to weighted rings **114** that fit around the sleeves, intermediate the sleeve lengths.

Operation of motor **103** drives shaft **108** to turn eccentric **110** within ring **111.** This moves shaft **112** in a somewhat eliptical motion, transverse with respect to the axis of shaft **112.** The connnected arms **113** are moved with the shaft **112** and reciprocate the rings **114,** thereby setting up a vibratory shaking of the sleeves **100.** The shaking frees any cleaning compound and dirt accumulated on the inside walls of the sleeves and allows it to fall through the sleeves and to accumulate in the drawer **99.**

In normal operation of the dryer, a user will open the housing door, not shown, and the door **32** of the drum assembly. Draperies, furs, or other materials to be cleaned, and a quantity of suitable dry-type cleaning compound will be placed in the drum and the doors will be closed.

A motor **115,** FIG. **1,** will be actuated by conventional circuitry, not shown, and through V-belts **116, 117** and **118** and clutch **119,** gear box **120** and pulley **50** fixed on a stub shaft **45,** will rotate the drum to thoroughly contact all parts of the material being cleaned with cleaning compound. During this contact cycle the end plates **53** are positioned such that holes **54** are out of alignment with the holes **52** and the cleaning compound cannot escape from the drum.

After a predetermined cycle of drum rotation, with the end plates in a hole closing position, the end plates are moved to align holes **54** with holes **52** and to provide flow through the drum. At the same time diverter valve **78** is moved to one of its limit positions whereby flow from the continuously operating blower **90** is directed through one side of the lower connecting duct to one end of the drum. Simultaneously with movement of the diverter valve **78,** diverter valve **79** is moved to its limit position whereby flow from the other end of the drum is directed through the upper connecting duct and out the outlet duct **77** to the upper compartment **96** of filter housing **94.** Flow is then through the shaking sleeve filters, as has been previously described, with air moving through the sleeve walls to the inlet **91** of the blower and with the cleaning compound and accumulated dirt falling into drawer **99.** Periodically the drawer is removed and its contents emptied.

Cyclically, the positions of the diverter valves **78** and **79** are changed to reverse the direction of flow through the drum and such flow is continued until all cleaning compound and dirt has been removed. During the entire time that the carrying stream, which may be somewhat sub-atmospheric to give a vacuuming affect, since it is being continuously re-circulated, is moved through the drum, the drum continues to rotate, lifting and gently dropping the material being cleaned.

While the carrying stream may pick up some limited amounts of moisture that may be present in the material being cleaned or in the cleaning compound itself, the moisture is evaporated and the carrying stream is warmed slightly as it circulates through heater **76.** In addition, the ductwork fits together loosely enough to allow some moisture escape and to allow some small entrance of fresh outside air.

Once the carrying stream has been reversed as many times as is desired, the end plates are again moved to stop flow through the drum and drum rotation is stopped.

Conventional switch means (not shown) are provided to stop the drum such that door **32** will be properly positioned to be opened. If necessary circuit means, not shown, can be provided to "jog" the motor **115** as necessary to insure proper positioning of the door **32.**

With the present invention materials can be gently tumbled, fully contacted with cleaning compound, and thoroughly cleaned of all cleaning compound and dirt collected thereby, all without use of any water and without damage to the material being cleaned.

While a preferred embodiment of the invention has been herein disclosed and described, it should be understood that changes are anticipated and that the invention is to be limited only by the claims as hereinafter set forth.

I claim:

1. A cleaning machine comprising
a drum;
means journaling said drum at opposite ends thereof;
means for rotating said drum about an axis extending through said journaled ends;
door means for providing access to the interior of the drum through the wall thereof, between said ends;
means for cyclically circulating a carrying air stream through said drum from one end to the other end and vice versa; and
means to selectively open and close the ends of the drum to movement of the carrying stream therethrough.

2. A cleaning machine as in claim **1,** further including means for continuously recirculating the carrying air stream.

3. A cleaning machine as in claim **2,** wherein the means for cyclically circulating a carrying air stream includes
a blower having an inlet and an outlet;
first duct means leading from the outlet of the blower to opposite ends of the drum;
second duct means leading from the opposite ends of the drum to the inlet of the blower;
first diverter valve means in the first duct means having firs and second limit positions for alternately directing flow through the first duct means to the opposite ends of the drum;
control means for moving said first diverter valve between its first and second limit positions;
second diverter valve means in the second duct means having first and second limit positions for alternately directing flow from the opposite ends of the drum through the second duct means; and
control means for moving said second diverter valve between its first and second limit positions.

4. A cleaning machine as in claim 3, wherein the means to selectively open and close the ends of the drum to movement of the carrying stream therethrough comprises
fixed end plates on the ends of the drum;
spaced holes through the fixed end plates, said holes being circularly arranged;
movable plates overlying the fixed plates, said movable plates having spaced holes therethrough;
means for rotating said movable plates with respect to said fixed plates between a first position wherein the holes through the movable plates are aligned with the holes through the fixed end plates, and a second position whereby the holes through the movable plates are out of alignment with the holes through the fixed plates.

5. A cleaning machine as in claim 4, wherein the means for rotating the movable plates includes
solenoids carried by the fixed plates and having solenoid rods;
means connecting the solenoid rods to the movable plates; and
means for supplying electrical power to said solenoids.

6. A cleaning machine as in claim 5, wherein the means for supplying electrical power to the solenoids includes
ring means fixed exteriorly of said drum;
electrical cord means electrically connected to said ring means;
electrical brush means mounted to rotate with the drum and to engage said ring means; and
electrical connections between said brush means and said solenoids.

7. A cleaning machine as in claim 3, further including filter means between the second diverter valve and the blower, whereby said carrying air stream is passed through said filter means.

8. A cleaning machine as in claim 3, further including heater means between the blower and the first diverter valve whereby said carrying air stream is passed through said heater means to be dried and warmed.

9. A cleaning machine as in claim 8, further including filter means between the second diverter valve and the blower, whereby said carrying air stream is passed through said filter means.

10. A cleaning machine as in claim 9, wherein the means to selectively open and close the ends of the drum to movement of the carrying stream therethrough comprises
fixed end plates on the ends of the drum;
spaced holes through the fixed end plates, said holes being circularly arranged;
movable plates overlying the fixed plates, said movable plates having spaced holes therethrough;
means for rotating said movable plates with respect to said fixed plates between a first position wherein the holes through the movable plates are aligned with the holes through the fixed end plates, and a second position whereby the holes through the movable plates are out of alignment with the holes through the fixed plates.

11. A cleaning machine as in claim 10, wherein the means for rotating the movable plates includes
solenoids carried by the fixed plates and having solenoid rods;
means connecting the solenoid rods to the movable plates; and
means for supplying electrical power to said solenoids.

12. A cleaning machine as in claim 11, wherein the means for supplying electrical power to the solenoids includes
ring means fixed exteriorly of said drum;
electrical cord means electrically connected to said ring means;
electrical brush means mounted to rotate with the drum and to engage said ring means; and
electrical connections between said brush means and said solenoids.

13. A cleaning machine as in claim 7, wherein the filter means comprises
a housing having separated upper, central and lower compartments;
a drawer extending into the lower compartment;
spaced sleeve-type fabric filters through which air can be passed interconnecting the upper and lower compartments and extending through the central compartment; and
wherein the inlet to the blower is connected into the central compartment and the second duct means is connected into the upper compartment.

14. A cleaning machine as in claim 13, wherein the filter means further includes
means for shaking the filters.

15. A cleaning machine as in claim 14, wherein the means for shaking the filters includes
a motor;
an eccentric rotated by the output shaft of the motor;
a ring surrounding the eccentric;
rings surrounding each of the filters; and
means connecting the ring surrounding the eccentric and the rings surrounding the filters, whereby motion of the eccentric is transmitted to the filters.

16. A cleaning machine comprising
a drum;
means journaling said drum at opposite ends thereof;
means for rotating said drum about an axis extending through said journaled ends;
door means for providing access to the interior of the drum through the wall thereof, between said ends;
means for circulating a carrying air stream through said drum from one end to the other, said means including
a blower having an inlet and an outlet thereof connected to a duct means leading into said drum,
a means to selectively open and close the ends of the drum to movement of the carrying stream therethrough; and second duct means leading from the drum;
filter means receiving carrying air from said drum said filter means comprising
a housing having separated upper, central and lower compartments,
a drawer extending into the lower compartment,
spaced sleeve-type fabric filters through which air can be passed, said filters interconnecting the upper and lower compartments and extending through the central compartment, and
wherein the inlet to the blower is connected into the central compartment and the second duct means is connected into the upper compartment.

17. A cleaning machine as in claim 16, wherein the filter means further includes
means for shaking the filters.

18. A cleaning machine as in claim 17, wherein the means for shaking the filters includes
a motor;
an eccentric rotated by the output shaft of the motor;
a ring surrounding the eccentric;
rings surrounding each of the filters; and
means connecting the ring surrounding the eccentric and the rings surrounding the filters, whereby motion of the eccentric is transmitted to the filters.

* * * * *