Feb. 28, 1967 F. C. LORNITZO 3,306,083

AUTOMATIC DRY-CLEANING MACHINE

Filed April 16, 1965 6 Sheets-Sheet 1

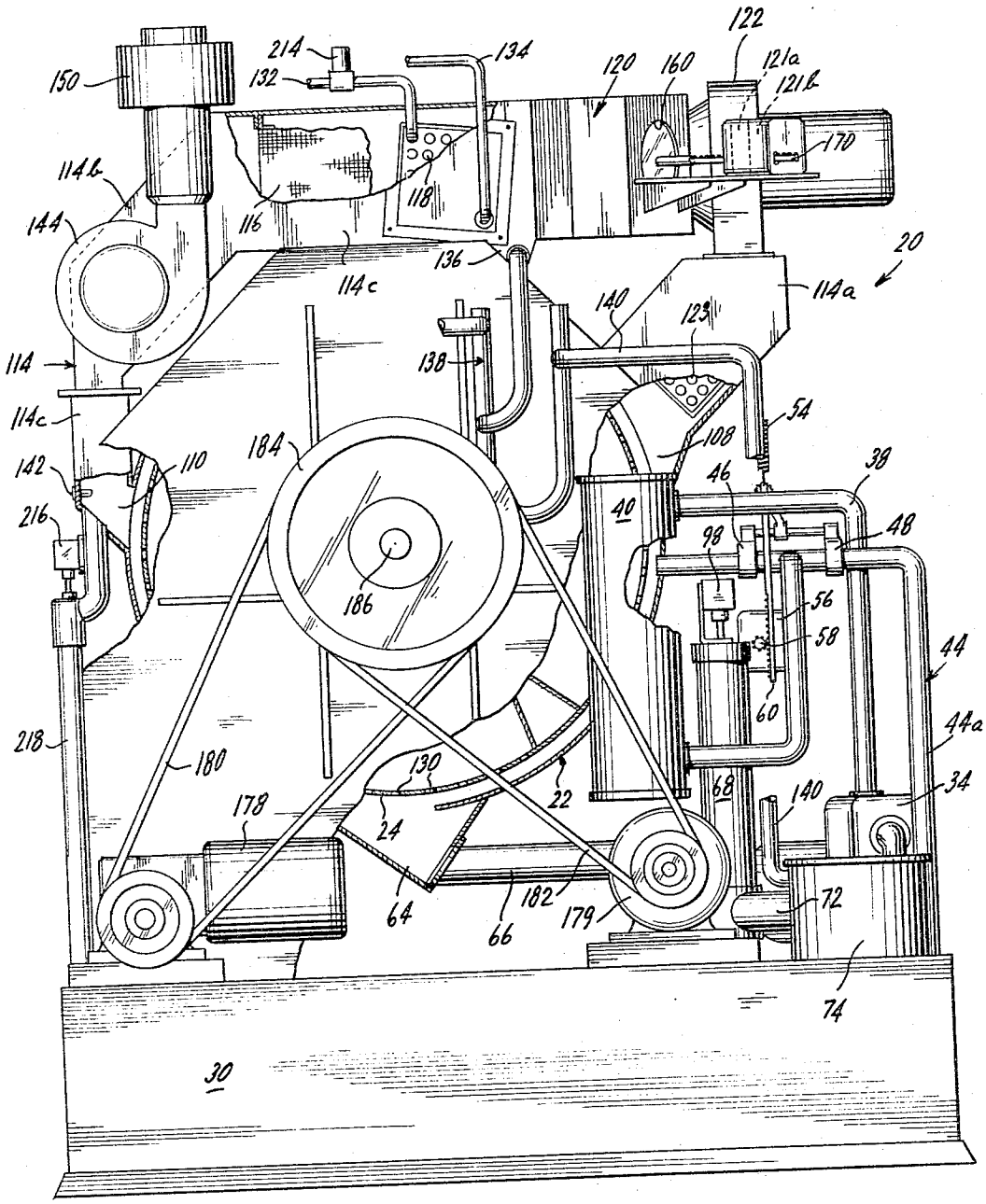


FIG. 1.

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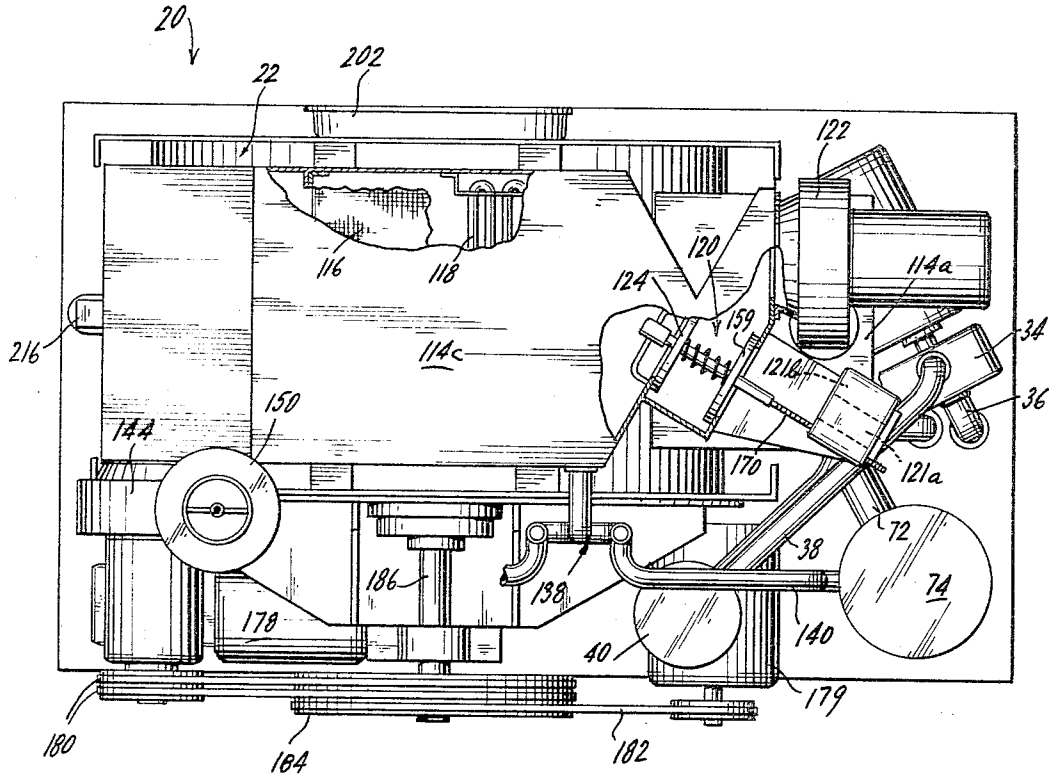


FIG. 2.

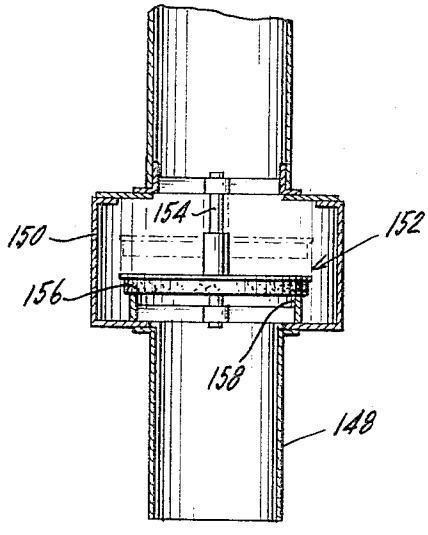


FIG. 3.

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FIG. 4.

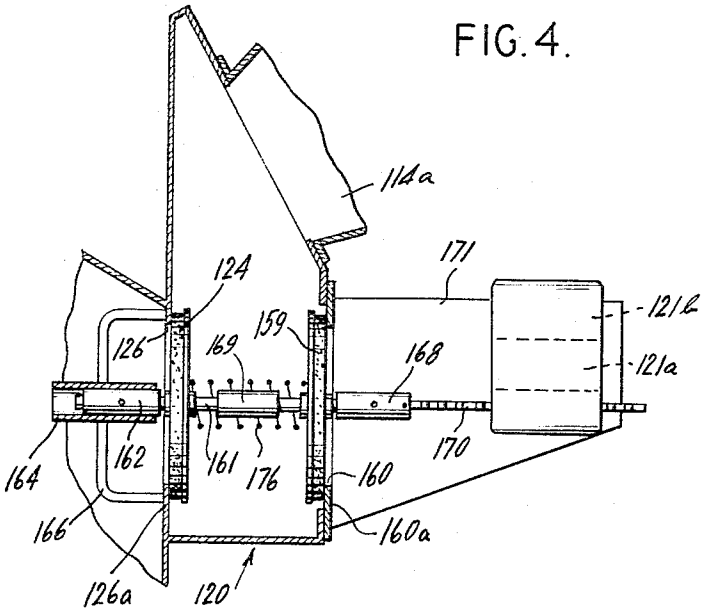
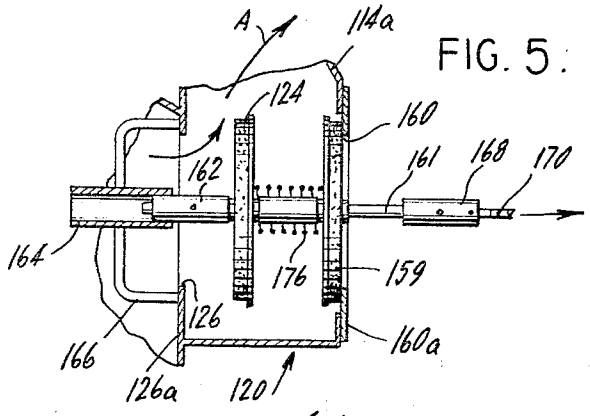


FIG. 5.



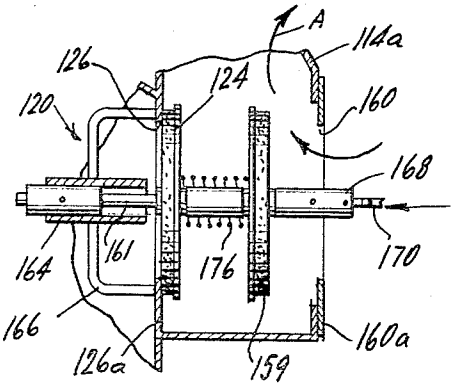
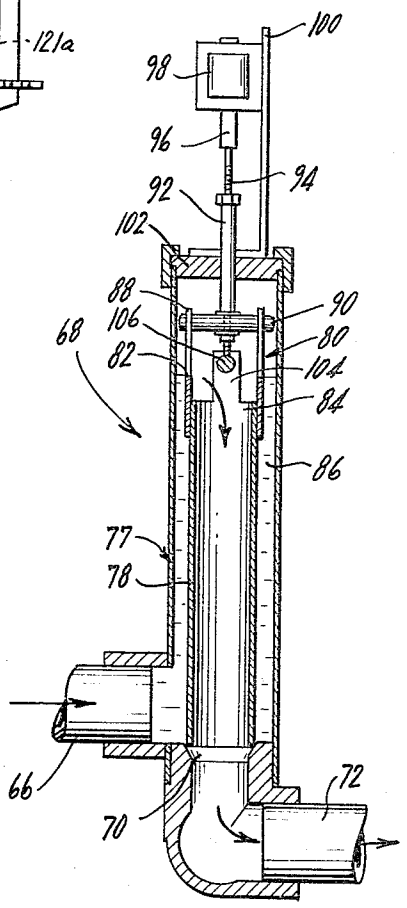


FIG. 6.

FIG. 7.



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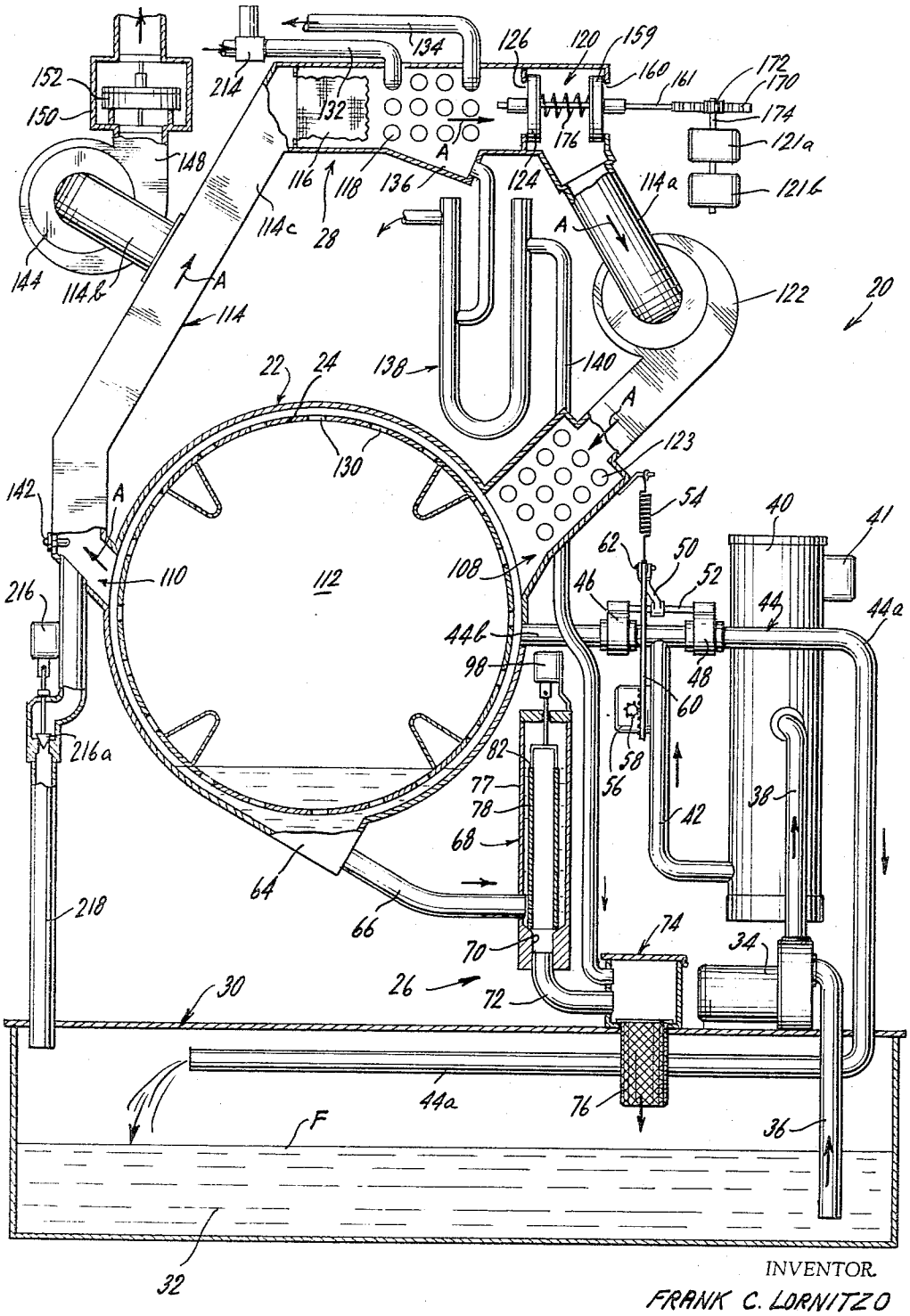


FIG. 8.

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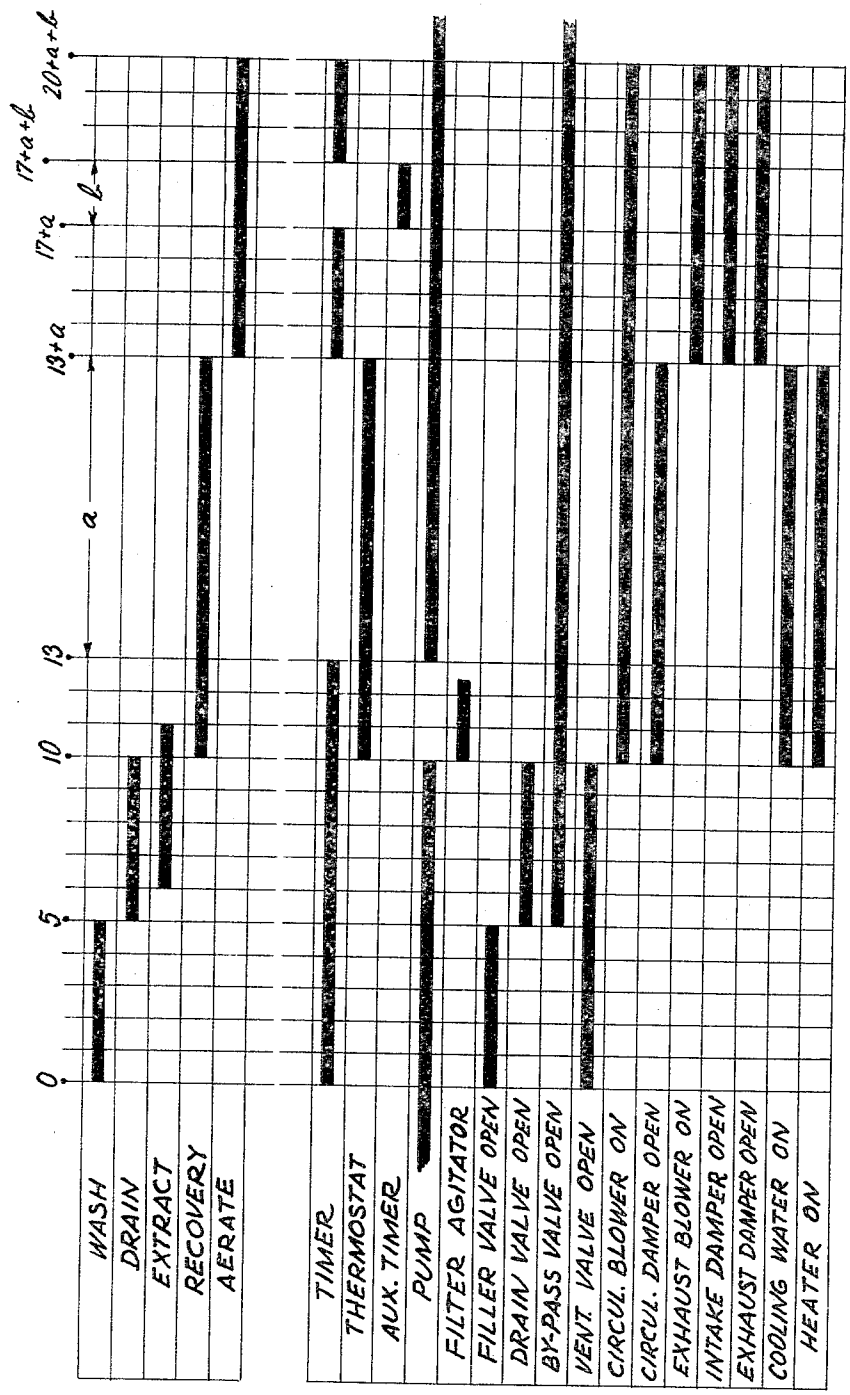


FIG. 9.

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AUTOMATIC DRY-CLEANING MACHINE

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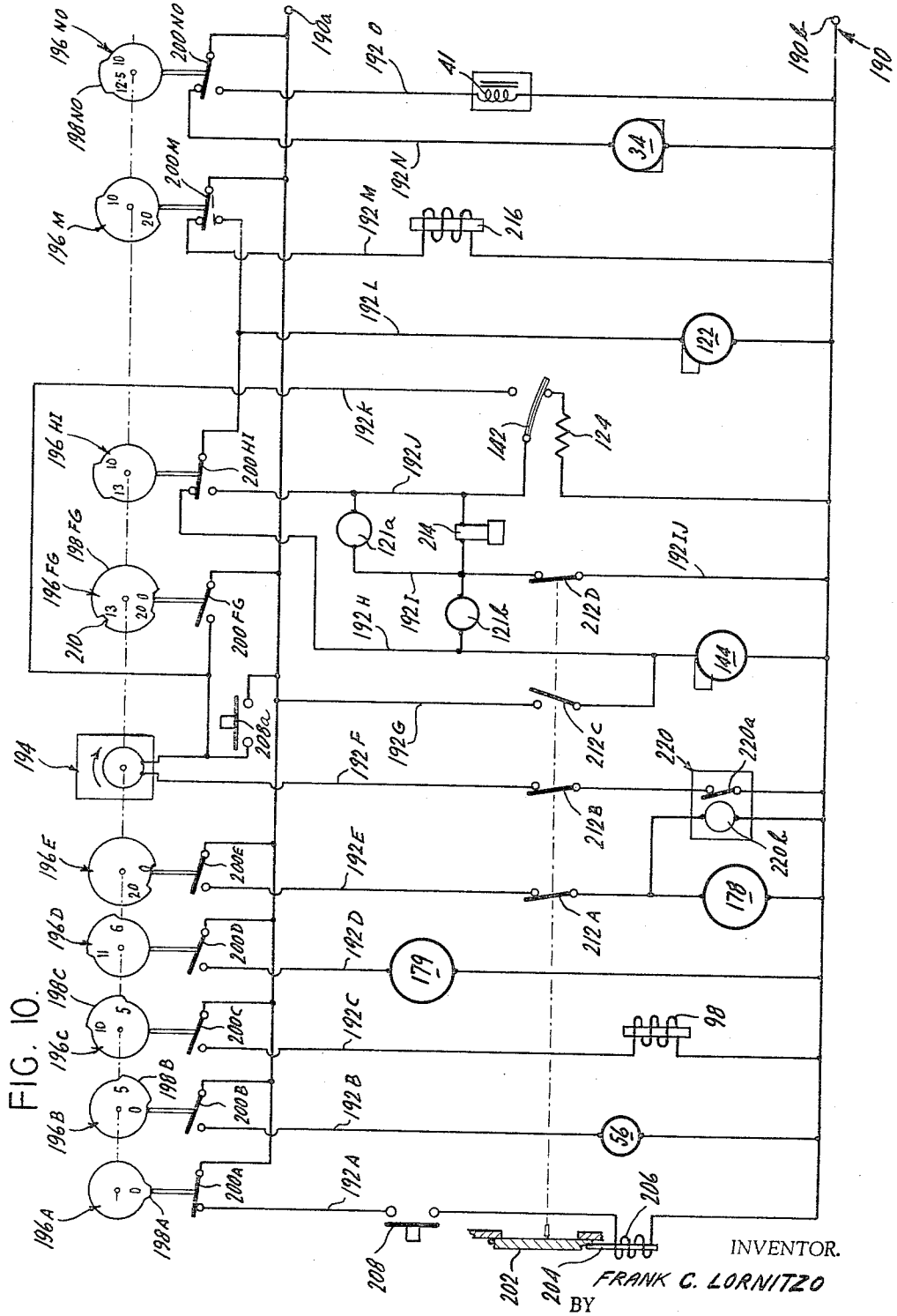


FIG. 10.

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3,306,083

AUTOMATIC DRY-CLEANING MACHINE

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Filed Apr. 16, 1965, Ser. No. 448,738
3 Claims. (Cl. 68—12)

The present invention relates generally to a dry-cleaning machine which is programmed for automatic operation in accordance with a machine cycle having a predetermined sequence of operations, and more particularly to improvement in the construction and mode of operation of said machine which contemplates the efficient recovery of cleaning fluid during said machine cycle.

A dry-cleaning machine of the present invention is of the class having an automatic programmed operating cycle and employing a volatile cleaning fluid to achieve its cleaning function. The efficient operation of this class of machine necessitates the recovery of reusable cleaning fluid from the clothes cleaned by the machine. Although such cleaning fluid recovery techniques or procedures are now provided in such machines, they are not entirely satisfactory since in some cases they adversely effect the automatic operation of the machine, and in other instances they are not specifically related to the specific need for cleaning fluid recovery which is dictated by the particular clothes that are cleaned. In other words, depending on the character and the nature of the clothes cleaned, the cleaning fluid recovery period should be conducted on an extensive basis, or in other circumstances is best discontinued at an early stage because continued efforts at cleaning fluid recovery are not economical. It is also desirable that the cleaning fluid recovery procedure or technique be consistent with automatic programmed operation of the dry-cleaning machine, and thus must be capable of being readily incorporated into an automated machine cycle.

Broadly, it is an object of the present invention to provide a dry-cleaning machine overcoming these and other shortcomings of the prior art. Specifically, it is an object to provide and incorporate an efficiently operating cleaning fluid recovery technique and procedure into the normal operation of a dry-cleaning machine, and one which further is capable of being regulated in duration for only as long as it is economical to conduct said cleaning fluid recovery.

It is another object of the present invention to provide a dry-cleaning machine which has a programmed automatic operating cycle, and in which the cleaning fluid recovery period is an integral part of said cycle and is automatically initiated and conducted for only as long as it is economical to attempt to recover reusable cleaning fluid.

Still another object of the present invention is to provide a dry-cleaning machine in which the cleaning fluid recovery procedure is also advantageously employed to purge the machine and the dry-cleaning drum of any residual cleaning fluid vapors which ordinarily presents a health hazard in the operation of such machines.

It is a still further object of the present invention to provide a damper control system having novel features of construction and a mode of operation permitting selective use of an air circulation system during the operation of said dry-cleaning machine for cleaning fluid recovery purposes and also to purge said machine of hazardous cleaning fluid vapors.

A dry-cleaning machine demonstrating features of the present invention is one employing a cleaning fluid to achieve its primary cleaning function, and further includes an appropriate control means for causing automatic operation of said machine in accordance with a

typical automated machine cycle including periods for washing the clothes with said cleaning fluid, draining and extracting said cleaning fluid from said clothes, a residual cleaning fluid recovery period, and finally an aerate period during which said machine is purged of hazardous cleaning fumes. More particularly, to the end of recovering reusable cleaning fluid there is included suitable means defining a closed path having communication with the cleaning drum of said machine, and also means located in said path for driving a stream of heated air through said drum to cause flashing of cleaning fluid into vapor within said drum, said air stream being also effective to carry said flashed vapor from said drum to a remote point where the vapor is converted back to a liquid state and returned to an appropriate storage compartment for reuse in subsequent cleaning operations. Further included as part of the cleaning fluid recovery means is a thermostat which is advantageously located in a position to sense the temperature level of the air stream exiting from the drum and which, at an appropriate elevated temperature level thereof which is indicative of minimal cleaning fluid flashing, is effective to cause the discontinuation of the operation of said dry cleaning recovery means and to simultaneously change over the mode of operation of this means to the function of exhausting or purging hazardous dry-cleaning fumes from the dry-cleaning drum and said closed path. The foregoing functioning of the cleaning fluid recovery means and its subsequent conversion to aerate the cleaning drum of the dry-cleaning machine is automatically initiated and conducted as part of the programmed sequence of operations of the dry-cleaning machine, being readily achieved by conventional electrical circuitry and controls for the machine.

The above brief description, as well as further objects, features and advantages of the present invention, will be more fully appreciated by reference to the following detailed description of a presently preferred, but nonetheless illustrative embodiment in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a front elevational view of a dry-cleaning machine demonstrating features of the present invention and having portions thereof broken away and in section to better illustrate the internal construction thereof;

FIG. 2 is a top view projected from FIG. 1, in which portions thereof are again broken away and in section for clarity of illustration;

FIG. 3 is an isolated elevational view, on an enlarged scale, and in section, of an exhaust valve for the air circulation system of said dry-cleaning machine;

FIGS. 4, 5 and 6 are sectional elevational views of a damper control for said air circulation system, in which more particularly the various operating positions of said control are depicted, namely, to wit:

FIG. 4 illustrates the damper control in its neutral operative position;

FIG. 5 illustrates said damper control after movement of an actuating rod thereof to the right which uncovers an internal valve opening and permits air circulation within an air circulation duct system of the dry-cleaning machine; and

FIG. 6 illustrates still another operative position of said damper control wherein in response to movement of said actuating rod to the left another valve member of said damper control uncovers an external opening of the air circulation duct system for purging said duct system of cleaning fluid fumes;

FIG. 7 is an isolated elevational view, in section and on an enlarged scale, of a cleaning fluid level control for said machine;

FIG. 8 is a rear elevational view substantially similar to FIG. 1, but with more of the external structure broken away and with more of the remaining structure in section to better illustrate the internal construction of said machine;

FIG. 9 is a chart which graphically illustrates the various periods and the duration in minutes of said periods in a typical machine cycle; and

FIG. 10 is a diagrammatic representation of the electrical circuitry for programming said dry-cleaning machine through a typical machine cycle.

Reference is made first to FIGS. 1 and 8 and the showing therein of a dry-cleaning machine demonstrating features of the present invention and therein generally designated **20**. The machine **20** includes a main housing **22** enclosing a rotatable dry-cleaning drum **24**, and also associated or auxiliary equipment, generally designated **26**, for circulating cleaning fluid F through said drum **24**. The equipment **26** as is best illustrated in FIG. 8 is generally situated on a level with and to the right of the drum **24**. The machine **20** also includes auxiliary equipment, generally designated **28**, for circulating air through said drum **24** in a manner and for the purposes described in more detail subsequently herein, said auxiliary equipment **28** (still referring to FIG. 8) being generally situated above said drum **24**.

The machine **20** may advantageously be compactly constructed on a hollow base **30** which additionally functions as a storage compartment **32** for the cleaning fluid F. Included in the equipment **26** for circulating said cleaning fluid F is a pump **34** which has its suction end connected to a conventional pipe or liquid conduit **36** extended into the compartment **32** and normally below the level of the stored cleaning fluid F therein, and its high pressure end or outlet connected to a conduit **38** connected to a filter **40**. The outlet of the filter **40** is connected via an L-shaped conduit **42** to a main flow conduit **44**, the connection into said main flow conduit **44** being more particularly between two operatively associated valves **46**, **48**. At all times when valve **46** is open permitting flow past said valve the other valve **48** is closed, and vice-versa. At start up of the machine **20**, it will be understood that valve **46** is closed and that valve **48** is open so that cleaning fluid F is withdrawn from the sump or compartment **32** only to be returned again through the valve **48** and through the return portion **44***a* of the main flow conduit **44**.

The operating conditions of the valves **46**, **48** are, however, easily reversed in a well understood manner by actuation of a lever **50** mounted on a shaft **52** common to both valves and which shaft on rotation is effective to move the internal valve members thereof into an open or closed position within the conduit **44**. From the up-position of the valve **50** as depicted in FIG. 8 and normally produced by the urgency of a spring **54**, the lever **50** is adapted to be placed into a down-position by operation of a motor **56** having a driving gear **58** in meshing engagement with a rack **60** pivotally connected, as at **62**, to said lever **50**. In the down-position of the lever **50** the valve **46** is opened and the valve **48** is closed to thereby channel the cleaning fluid F through the valve **46** and through the drum inlet portion **44***b* of the main flow conduit **44** into the drum **24**.

As is best shown in FIG. 8, the external drum housing **22** at the base of the drum **24** is provided with an appropriate configuration **64** for channeling said cleaning said cleaning fluid F to a drum outlet conduit **66** which empties into a cleaning fluid level control device, generally designated **68**, the details of operation of which are next described herein. It will suffice now only to note that the cleaning fluid F is permitted in the operation of said level control device **68** to flow out of said device through an outlet **70**, through conduit **72** into a filter trap **74**, and from thence through a filter **76** back into the cleaning fluid storage compartment **32**.

Referring now specifically to the detailed view of FIG. 7 as well as to FIG. 8, it will be better understood how the cleaning fluid level control device **68** functions to control the operating level of the cleaning fluid F within the drum **24**. Changes in said operating level as are contemplated herein are more of a seasonal adjustment, wherein, for example, during the winter when heavy clothes are usually cleaned, it is desirable that the operating level of said fluid be raised to provide a greater quantity of said fluid within said drum, and conversely during the summer a lower operating level is desirable. To accomplish this objective, the device **68** includes a casing **77** in which there is disposed a hollow overflow pipe **78** provided with a slidable end section **80**. Only the bottom portion of said section **80** is solid and thus up to the edge **82** thereof such section serves as an extension of the outlet opening **84** of the overflow pipe **78** and requires a level of cleaning fluid F in the annular clearance **86** between the pipe **78** and the casing **77** exceeding the height of the edge **82** before there can be an outflow of cleaning fluid F from the device **68** through the overflow pipe **78**. In a well understood manner, the cleaning fluid F will naturally seek and attain the same level in the drum **24** as it does in the device **68**, said device **68** and drum **24** being in direct communication with each other through the conduit **66** and in side-by-side relationship to each other. To adjust the section **80** relative to the outlet opening **84**, section **80** has extensions **88** going beyond the edge **82** and which extensions are connected by a cross-piece **90** to a member **92** threadably disposed on a threaded end **94** of a plunger **96** of a conventional solenoid device **98**. An L-shaped frame member **100** mounts the solenoid **98** on the casing head **102** through which said member and threaded end **92**, **94** extend into the level control device **68**. By threaded adjustment of the member **92** on the threaded end **94** of the plunger **96**, it is thus a simple matter to either raise or lower section **80** on the overflow pipe **78** and thereby raise or lower the operating level of the cleaning fluid F within the drum **24**. During this adjustment, the overflow pipe **78** remains seated in said outlet opening **70**. However, at the pipe outlet opening **84** there are machined extensions **104** fitted with a cross-piece **106** and connected to said plunger threaded end **94**, so that upon operation of the solenoid **98** and the withdrawal of said plunger **96** within the body of said solenoid the overflow pipe **78** is lifted off of the opening **70** permitting direct flow of cleaning fluid F from the conduit **66** into the sump return conduit **72**.

Continuing with the description of the machine **20** with particular reference to FIGS. 1, 2 and 8, and turning now specifically to the air circulation auxiliary equipment **28** thereof, it will be seen that said equipment **28** includes an air inlet duct **108** and an air outlet duct **110** suitably connected into opposite sides of the drum housing **22** and in communication with the interior **112** of the drum **24**. These inlet and outlet ducts **108**, **110** are further connected end-to-end to each other as is best illustrated in FIG. 8 to form a closed air duct system, herein more specifically designated **114**. In the operation of the machine **20** in accordance with the present invention, it is contemplated that the closed duct system **114** will be used during a portion of the machine operating cycle for the continuous circulation of air for the purpose of flashing cleaning fluid as fumes from the cleaning fluid saturated clothes within the drum **24**, thereby permitting the subsequent condensation of said fumes and the recovery of said cleaning fluid for re-use.

To achieve this objective of recovering re-usable cleaning fluid, there is provided in the closed duct system **114**, proceeding in the direction of the air flow depicted by the arrows designated A in FIG. 8, a filter bag **116**, a conventional condenser **118**, a motor-operated flow control damper **120**, an air-circulating blower **122**, and finally a heater **123**. More particularly, the suction end of said air-circulating blower **122** is connected via a length of

duct 114*a* immediately downstream of the damper 120, and upon operation of the blower 122 and a first damper motor 121*a* moving the damper disc 124 from a position normally closing the duct opening 126 to a position opening the same (see FIG. 5), there is produced a continuous circulation or flow of air through the closed duct system 114 as depicted by the air flow arrows A.

The foregoing cleaning fluid recovery process is started at a prescribed point during the normal operating cycle of the machine 20, at which point all cleaning fluid F is also drained from the drum 24 by operation of the solenoid 93 and the circulation of said fluid through the drum 24 is discontinued and diverted instead through the bypass or return conduit 44*a*. Air circulated by said blower 122 is forced through the inlet duct 108 past the heater 123 and thus enters into the interior 112 of the drum 24, through the drum openings 130, in a heated condition. In a well understood manner, the heated air causes evaporation or flashing of the cleaning fluid from the clothes being cleaned within the drum 24 and thus there is, at least initially, a heavy concentration of cleaning fluid fumes in the air flowing out of the drum 24 through the outlet duct 110. This current or body of air is cleaned in an obvious manner by passage through the filter bag 116, and then is cooled by heat exchange in its pass through the condenser coils 118 continuously fed with a coolant through inlet and outlet pipes 132, 134. Beneath the condenser coils 118 the section of duct 114*c* of the closed duct system 114 is advantageously provided with a configuration 136 which channels the cleaning fluid F which is condensed from said circulating air flow into a separator 138. Operating in a well understood manner, the separator 138 is effective to separate the cleaning fluid and water from each other, and said cleaning fluid is then channeled through the conduit 140 into the filter trap 74, and from there flows through the filter 76 back into the sump or compartment 32 for re-use.

During the foregoing recovery process by air circulation, however, a point is eventually reached when the air exiting from the drum 24 contains so little cleaning fluid vapor as to no longer economically warrant continuing with said air circulation. In accordance with the present invention, this point in the operation of the machine 20 is automatically detected by a thermostat 142 mounted in the outlet duct 110 and operating to discontinue said air circulation, all as is subsequently explained in greater detail, when the temperature of said exiting air attains a predetermined elevated level approximating the temperature of said air being fed into the drum 24. This it will be appreciated is indicative that the circulating air is losing little heat in heat exchange with the clothes within said drum 24, or in other words that said circulating air is causing very little flashing of cleaning fluid from said clothes which can be recovered. At this time, an exhaust blower 144 mounted on and in communication with the outlet duct 110 is operated in tandem with the air circulating blower 122 which is continued in operation. Exhaust blower 144 has its suction end connected via a duct 114*b* to said closed duct system 114 and its high pressure end exhausting to atmosphere via a duct 148 which will be understood to channel said cleaning fluid contaminated air to a safe point for discharge. Mounted in a duct section 150 of the duct 148 is a conventional one-way air valve 152 including a disc centering piece 154, and a disc-156 mounted thereon which on operation of the exhaust blower 144 is lifted off of the duct opening 158 for opening the exhaust duct 148 to air flow (see FIG. 3).

When operation of the exhaust blower 144 is started in aid of operation of the air circulating blower 122, the second damper motor 121*b* is operated to replace the damper disc 124 in its closed position in the internal duct opening 126 and to simultaneously open the closed system 114 to atmosphere by causing movement of the damper disc 159 uncovering the external duct opening 160 as depicted in FIG. 6. Thus, continuously flowing fresh air is forced through the duct 114*a*, the air inlet duct 108, and through the drum interior 112 and air outlet duct 110 to the exhaust blower 144 for discharge through the exhaust duct 148. In this way the drum 24 and the closed duct system 114 of the machine 20 are purged of cleaning fluid fumes preparatory to the next cleaning cycle, such purging being conducted efficiently by tandem operation of the blowers 144, 122.

By reference to FIG. 8 and a comparison of FIGS. 4–6, it will be seen that the flow control damper 120 includes a disc mounting rod 161 which on one end has a sleeve 162 disposed in a guide bushing 164 mounted by a bracket 166 in a centered position just beyond the internal duct opening 126. On the opposite end of the rod 161 is a sleeve 168 connecting said rod to a rack 170 which is common to the damper motors 121*a*, 121*b* carried on a platform 171 of the duct system 114. Rack 170 is selectively driven in opposite directions by a common driving gear 172 in meshing engagement with said rack and journalled on the single shaft 174 of the motors 121*a*, 121*b*. The damper discs 124 and 159 are slidably disposed on the rod 161 entirely within the sectional length of duct 114*a* to the air circulating blower 122, being more particularly normally seated under the outward urgency of an interposed spring 176 against the radial flange 126*a* of the opening 126 and the radial flange 160*a* of the opening 160, respectively, as is best illustrated in FIG. 4. However, upon operation of the motor 121*a* which occurs during operation of the air circulating blower 122, the rod 161 is thrust to the right as depicted in FIG. 5, and the damper disc 124 is carried by the sleeve 162 during said rod movement off of the internal damper opening flange 126*a* thereby unblocking the opening 126 for the passage of air therethrough as depicted by the air-flow arrows A. Another operative position of the damper 120 is achieved by operation of the damper motor 121*b* and rod movement in a reverse direction as depicted in FIG. 6 which occurs during operation of the exhaust blower 144. This results in movement of the disc 124 to its position closing the opening 126 and the carrying of the other disc 159, by the sleeve 168, off of the damper opening flange 160*a* thereby unblocking the opening 160 for the passage of air therethrough. Sleeve 169 maintains the spacing between the discs 124, 159.

Having particular reference again to FIG. 1, the machine 20 as best shown therein includes both a slow and a fast driving motor 178 and 179, each having a belt 180, 182 trained about a common pulley 184 mounted on the shaft 186 of the drum 24 which will be understood to be appropriately journalled for rotation within the main housing 22. The slow rotational speed is employed during the cleaning portion of the main cycle since this produces more thorough saturation of the clothes with the cleaning fluid F by tumbling of the clothes, while the faster rotational speed is employed during other periods of said cycle, as for example during the cleaning fluid recovery process when said fast speed is effective to remove or extract said cleaning fluid F from the clothes by centrifugal force. By employing a conventional overriding clutch the changeover from the slow motor 178 to the fast motor 179 is made without interrupting the operation of the machine 20.

Directing attention now to FIG. 9, in which figure the time periods of various operations in a typical operating cycle are graphically illustrated, it will be seen that a variable time period, designated *a* is included as an integral part of said cycle and is the time period during which cleaning fluid F is recovered for reuse. Said cleaning fluid recovery time period *a* differs from other cycle time periods in that it is for a duration which may differ from cycle to cycle and is dependent on the characteristics of the clothes being cleaned which in turn determines the point in time when the thermostat 142 is operated to signal the end of said time period *a*. As previously stated,

it is at this point of time when it is no longer economical to continue the air circulation through the duct system **114** to purge the drum interior **112** of cleaning fluid F and cleaning fluid vapors. Thus, while the wash period is set for a known duration which typically is five minutes, and the drain, extract and aerate periods are also for known periods of time, the cleaning fluid recovery period *a* is known only to start at approximately thirteen minutes after machine start-up, but otherwise the duration of this period is not known beforehand and continues until terminated by the operation of the thermostat **142**. After termination of the recovery period *a* the machine **20** has a typical conluding aerate period.

Reference is now made to FIG. 10 in which there is shown a diagrammatic representation of appropriate electrical circuitry for programming the machine **20** through a typical machine cycle, said circuitry being generally designated **190** and including appropriate contacts, **190***a*, **190***b* for being connected across an appropriate electrical source. Circuitry **190** essentially includes fifteen subcircuits all connected in parallel to each other and herein designated **192A–192O**, and a timer **194** which powers nine cams in rotation, each cam being designated with the numeral **196** followed by the suffix of the subcircuit with which it is associated. It will be understood that the timer **194** is designed to operate for a duration of twenty minutes and thus on the cams **196A**, **196B**, etc., the start and termination of the cam rise is keyed to this twenty minute duration by appropriate references to the point in time during this twenty minute duration when said start and termination points are encountered. Thus, on cam **196C**, the cam rise **198C** thereof is first encountered five minutes after the start-up of the timer **194** and is operational until ten minutes after the timer start-up. Additionally, there is associated with each of the subcircuits **192A–192O** a normally open switch which disconnects the subcircuit from the energy source except when said normally open switch is actuated closed by a cam, each of these switches being herein designated by the reference numeral **200** followed by the letter subscript of its associated cam.

Proceeding now with a description of the operation of the dry-cleaning machine **20** in connection with the circuit diagram of FIG. 10, let it be assumed that the door **202** of the drum **24** is closed as is shown in cross section at the left of FIG. 10, and that said door **202** is maintained in its closed position by a plunger **204** of a solenoid **206** of the subcircuit **192A**. To open the door **202** it is necessary to depress the switch **208** of the subcircuit **192A** which completes said subcircuit when the cam **196A** is in its illustrated FIG. 10 position closing the switch **200A**. Thus, at this time, the solenoid **206** is energized through the completed subcircuit **192A** thereby withdrawing the solenoid plunger **204** from its position preventing the opening of the door **202**. It will be readily appreciated, however, that after machine start-up, and at a time when the cam **196A** has rotated into a posiiton which results in the switch **200A** assuming its normally open position, that at this time depressing the switch **208** will not have the desired effect of actuating the solenoid **206**, which is as it should be since it is not desirable that the door **202** be opened during the machine cycle. Assuming that the door **202** of the drum **24** is closed, the machine cycle is initiated by depressing the timer start button **208***a* which starts rotation of the timer **194** including the cam **196FG**, which by closing the switch **200FG**, completes the subcircuit **192F** for the timer **194** through a bypass circuit which is provided to maintain said timer **194** in operation even though the switch **208***a* is subsequently released. Thus, the timer **194** remains in operation until a notch **210** is encountered in the cam rise **198FG**, of the cam **196FG**, and which notch **210** is indexed to be encountered at thirteen minutes after the start-up of the machine to signal and cause the start of the "recovery" period of the machine cycle. It should be noted at this time that the opening and closing of the drum door **202** controls the actuation of four switches, one of which is the exhaust blower switch **212** which is closed by the opening of the drum door **202** and places in operation the exhaust **144** as a safety measure every time that the door **202** is opened. However, before the expiration of thirteen minutes of the machine cycle, the machine **20** is programmed through the wash, drain and extract periods.

More particularly, and having particular reference to the second subcircuit **192B**, it will be seen during the first five minutes of the operation of the timer **194** that the cam rise **198B** on the cam **196B** is effective to close the switch **200B** of said subscircuit **192B** which will be understood to operate the valve motor **56** placing the lever **50** in its down-position which opens valve **46** and simultaneously closes valve **48** and thereby channels cleaning fluid F into the drum **24**. It will be noted that at this time the windings for the pump **34** which is part of the subcircuit **192N** is appropriately energized by virtue of the switch **200NO** being in a position at this time which completes the subcircuit **192N**. In fact, the pump **34** continues in operation until the cam rise **198NO** of the cam **196NO** actuates the switch **200NO** into a position which completes the subcircuit **192O** and places in operation the filter agitator **41** (see FIG. 8) while simultaneously opening the pump subcircuit **192N** and temporarily discontinuing the operation of the pump **34**. The filter agitator **41** continues in operation from ten minutes to twelve and one-half minutes of the machine cycle.

As is shown in subcircuit **192C**, after completion of the wash cycle which occurs after the first five minutes of the operation of the machine **20**, subcircuit **192C** is completed by the closing of the switch **200C** by the cam **196C** from between five minutes and ten minutes of the machine cycle which places in operation at this time the solenoid device **98** which is effective to open up the outlet **70** of the level control device **68** which drains cleaning fluid F from the drum **24** into the storage compartment **32**. Turning now to the subcircuits **192D** and **192E**, it will be seen by a comparison of said subcircuits that normally the slow motor **178** operates the drum **24** except when through the operation of a conventional overriding clutch a changeover is made to the fast motor **179** during the interval of the machine cycle from six minutes to eleven minutes after machine start-up. This time period corresponds to the "extract" period of the machine cycle.

Assuming that thirteen minutes of the machine cycle has transpired, and that the cam notch **210** on the cam **196FG** has been encountered, as previously indicated this will open the switch **200FG** breaking the energizing subcircuit **192F** for the timer **194** and thereby causing the discontinuation of the timer **194** at this point of time. More particularly, at this point of time the cam **196M** is stationary in a position which has actuated the switch **200M** into a position completing the subcircuit **192L** for the circulation blower **122**, thereby starting the operation of said circulation blower **122**. Also at this time the cam **196HI** is in a stationary position which has actuated the switch **200HI** into a position which completes the subcircuit **192IJ** and its individual branch subcircuits **192I** and **192J**, the switch **212D** of course being closed at this time. Considering first the branch subcircuit **192J**, it will be seen that this causes operation of the condenser solenoid **214** (FIG. 8) which permits the circulation of cold water through the coils of the condenser **118**. Simultaneously, the completion of the branch subcircuit **192I** places the damper motor **121***a* in operation which is effective to move the damper **120** into its FIG. 5 position, which in turn results in air circulation through the closed duct system **114**. The circulation blower **122** operates by itself (i.e. without the blower **144**) for a period of time corresponding to the length of time of the recovery period *a*, which period is in turn determined by the thermostat **142** which has two operative positions, one of which

is its "cold" position as illustrated in FIG. 10, and the other of which is its "hot" position which brings into operation the subcircuit 192K for energizing the timer 194 and again starting the operation of this device. More particularly, in the "cold" position of the thermostat 142, the heater 124 is effective to raise the temperature of the circulating air entering into the drum 24 which as previously described is in turn effective to cause flashing of residual cleaning fluid F within the drum 24. As long as this flashing occurs to a reasonably substantial degree, it is deemed advisable to continue with the cleaning fluid recovery period. However, when substantial flashing does not occur, the temperature of the air exiting from the drum 24 is at an elevated temperature level which is effective to actuate the thermostat 142 into its "hot" position. In this position of the thermostat 142, an energizing circuit for the timer 194 is completed to again start the operaiton of this device. This energizing circuit may be traced from line contact 190*a* through the closed switches 200M and 200HI, and through the "hot" position of the thermostat 142, and finally through the subcircuits 192K and 192F to the other line contact 190*b*. The immediate effect of the operation of the timer 194 is to rotate the notch 210 of the cam 196FG from an operative position effecting the switch 200FG and thereby again resulting in the closing of this switch, and also simultaneously causing rotation of the cam 196HI which breaks the just described energizing circuit for the timer 194 by permitting the switch 200HI to return to its position depicted in FIG. 10. In this position of the switch 200HI and the FIG. 10 phantom perspective position of the switch 200M, the exhaust blower 144 is placed in operation as is also the damper motor 121*b* which places the damper 120 in its FIG. 6 position for exhausting the closed duct system 114 and drum 24 to atmosphere.

There is additionally provided in the circuit 190 a subcircuit 192M including a solenoid device 216 (see FIG. 8) which during the first ten minutes of the machine cycle holds a plunger 216*a* in a raised position in a conduit 218 connected between the cleaning fluid storage compartment 32 and the interior 112 of the drum 24 for the purpose of equalizing the pressure of said cleaning fluid F in said compartment 32 and drum 24. During the last ten minutes of the machine cycle, however, the cam 196M actuates the switch 200M to prevent operation of this solenoid 216 and thus the plunger 216*a* at this time as again effective to close off the storage compartment 32.

Completing the electrical circuitry 190 for the dry-cleaning machine 20, is an auxiliary timer 220 which is integrated in the subcircuit 192F of the timer 194. The auxiliary timer 220 includes a normally closed switch 220*a* and a timing mechanism 220*b*. As is generally understood, the mode of operation of the auxiliary timer 220 contemplates opening the normally closed switch 220*a* for a length of time which can be set by the timing mechanism 220*b*, after which said switch 220*a* closes to complete whatever circuit said auxiliary timer 220 is incorporated in, which in FIG. 10 is the subcircuit 192F for the timer 194. Thus, whenever the auxiliary timer 220 is operated, it has the effect of discontinuing the operation of the timer 194 for whatever length of time is set in the timing mechanism 220*b* of said auxiliary timer 220. Thus, for example, if it is desired to extend the wash period for an additional length of time, this is done by merely operating the auxiliary timer for this additional length of time during this period of the machine cycle.

A lattitude of modification, change and substitution is intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A dry-cleaning machine including a dry-cleaning drum for dry-cleaning clothes therein in association with cleaning fluid, a control means for said dry-cleaning machine effective to operate said machine in accordance with a machine cycle having a predetermined sequence of operations, a cleaning fluid supply means operatively connected to a source of cleaning fluid and to said dry-cleaning drum for conducting cleaning fluid into and out of said dry-cleaning drum during a cleaning period of said machine cycle, and a cleaning fluid recovery means operatively connected to and operated by said control means after said cleaning period to remove any residual cleaning fluid from said dry-cleaning drum, said cleaning fluid recovery means comprising means defining a closed path having communication with said drum, a first blower means located in said closed path and operatively connected to and operated by said control means to drive heated air through said dry-cleaning drum to cause flashing of cleaning fluid into vapor therein and to carry said vapor from said dry-cleaning drum, a second blower means located in said closed path and operatively connected to and operated by said control means to exhaust said drum and said closed path to atmosphere, and temperature sensing means located in said closed path and operatively connected to and operated by said control means and effective in response to an elevated temperature in said heated air exiting from said drum and indicative of minimal cleaning fluid flashing in said drum to cause the operation of said second blower means simultaneously with operation of said first blower means.

2. A dry-cleaning machine including a dry-cleaning drum for dry-cleaning clothes therein in association with cleaning fluid, a control means for said dry-cleaning machine effective to operate said machine in acordance with a machine cycle having a predetermined sequence of operations, a cleaning fluid supply means operatively connected to a source of cleaning fluid and to said dry-cleaning drum for conducting cleaning fluid into and out of said dry-cleaning drum during a cleaning period of said machine cycle, and a cleaning fluid recovery means operatively connected to and operated by said control means after said cleaning period to remove any residual cleaning fluid from said dry-cleaning drum, said cleaning fluid recovery means comprising a normally closed duct system having communication with said drum and means including at least two blowers located in said duct system and operatively connected to and operated by said control means to first drive heated air through said dry-cleaning drum to cause flashing of cleaning fluid into vapor therein and to carry said vapor from said dry-cleaning drum and thereafter to exhaust said drum and said duct system to atmosphere, temperature sensing means located in said duct system and operatively connected to said control means and effective in response to an elevated temperature in said heated air exiting from said drum and indicative of minimal cleaning fluid flashing in said dry-cleaning drum to cause the simultaneous operation of said blows, in tandem, to purge said drum and duct system of cleaning fluid, a valve means located in said duct system and operatively connected to and operated by said control means to open said duct system to atmosphere when said temperature sensing means senses minimal cleaning fluid flashing.

3. A dry-cleaning machine including a dry-cleaning drum for dry-cleaning clothes therein in association with cleaning fluid, a control means for said dry-cleaning machine effective to operate said machine in accordance with a machine cycle having a predetermined sequence of operations, a cleaning fluid supply means operatively connected to a source of cleaning fluid and to said dry-cleaning drum for conducting cleaning fluid into and out of said dry-cleaning drum during a cleaning period of said machine cycle, and a cleaning fluid recovery means operatively connected to and operated by said control means

after said cleaning period to remove any residual cleaning fluid from said dry-cleaning drum, said cleaning fluid recovery means comprising a normally closed duct system having communication with said drum and means including at least two blowers located in said duct system and operatively connected to and operated by said control means to first drive heated air through said dry-cleaning drum to cause flashing of cleaning fluid into vapor therein and to carry said vapor from said dry-cleaning drum and thereafter to exhaust said drum and said duct system to atmosphere, temperature sensing means located in said duct system and operatively connected to said control means and effective in response to an elevated temperature in said heated air exiting from said drum and indicative of minimal cleaning fluid flashing in said dry-cleaning drum to cause the operation of the one of said blowers simultaneously with the operation of the other of said blowers to purge said duct system of cleaning fluid, a valve means located in said duct system and operable to selectively permit continuous circulation of said heated air through said duct system when the temperature of said heated air as sensed by said temperature sensing means is below a predetermined level and to exhaust said heated air to atmosphere when said temperature is above said predetermined level, said valve means including a first valve member controlling flow through said duct system and a second valve member opening said duct system to atmosphere, and means selectively operating said valve members operatively connected to and operated by said control means.

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