Jan. 23, 1940. J. W. CHAMBERLIN ET AL. 2,187,770

CLEANING APPARATUS

Filed March 6, 1937 2 Sheets-Sheet 1

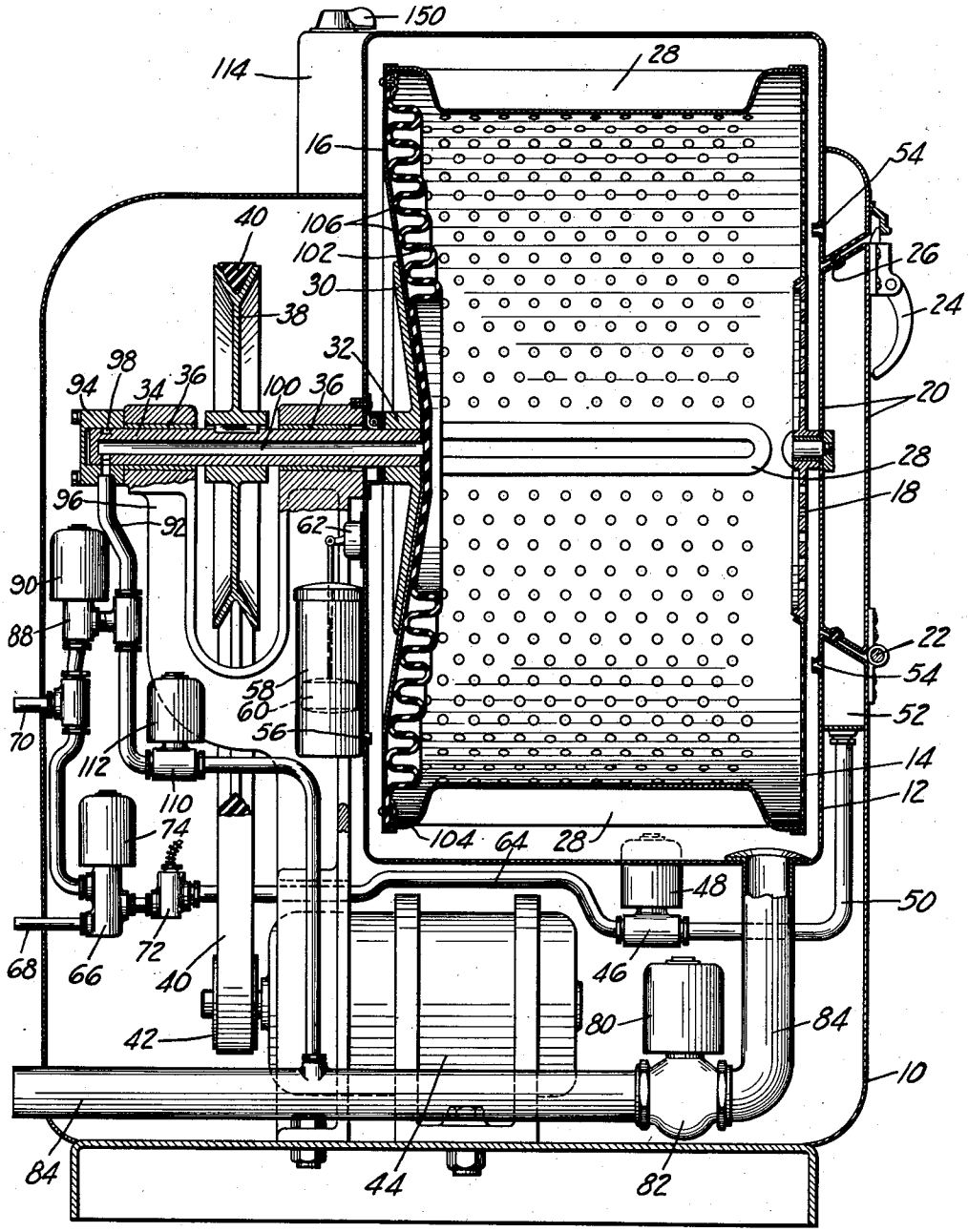


FIG. 1

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CLEANING APPARATUS

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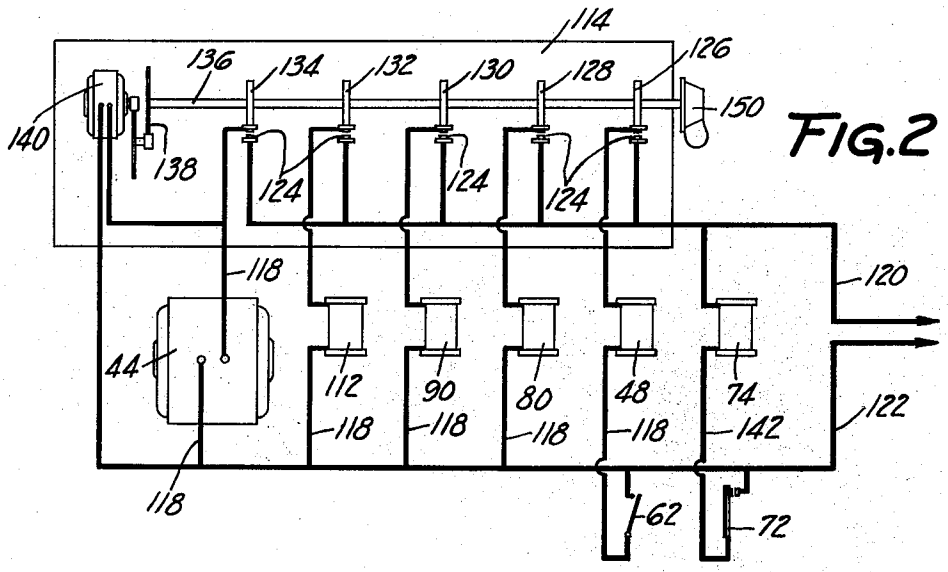


FIG. 2

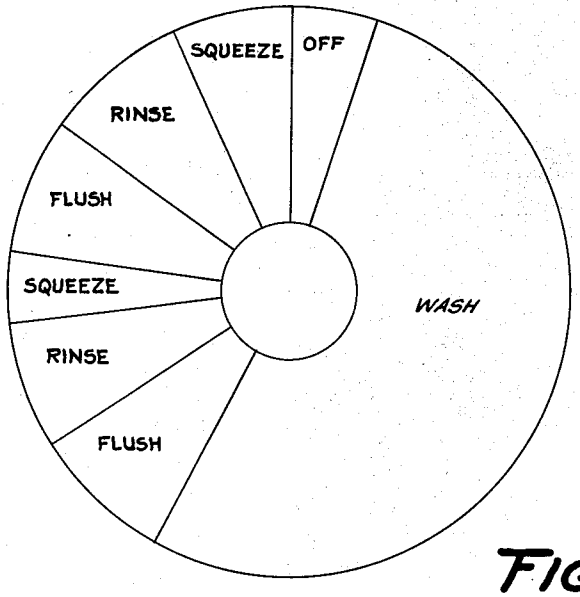


FIG. 3

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UNITED STATES PATENT OFFICE

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CLEANING APPARATUS

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Application March 6, 1937, Serial No. 129,426

7 Claims. (Cl. 68—21)

This invention relates to apparatus for cleaning materials such as clothes, and is illustrated as embodied in an automatically-controlled cyclically-operated washing machine.

One object of the invention is to simplify the cycle of machines of this character, by providing the apparatus with means which can be actuated effectively at the proper point in the cycle to dry the clothes, without changing the speed with which the clothes-containing drum or its equivalent is driven, thereby doing away with the necessity for an expensive multiple-speed transmission and its control mechanism. Preferably this is accomplished by squeezing the clothes dry by pressing them against the drum.

In one desirable arrangement, the drying pressure is applied by fluid pressure, preferably acting on the clothes through the medium of a flexible diaphragm which can adjust itself to the irregular contour of the clothes on which it acts.

Various important features of novelty relate to (1) arranging for the diaphragm or its equivalent to act after all sediment and the like has been drained from the machine, so that no dirt can possibly be squeezed into the clothes, (2) to the construction and arrangement which permits drying the clothes without changing the speed or direction in which the machine is driven, and (3) to arrange the diaphragm to act on the clothes in a driven perforated drum or otherwise so that the control of the cleaning agent used is independent of the operation of the diaphragm.

Other features of novelty relate to the structure and mounting of the diaphragm and its relation to the other parts of the apparatus, and to the automatic control of its operation, and to various other novel combinations and desirable arrangements which will be apparent from the following description of the illustrative embodiment shown in the accompanying drawings, in which:

Figure 1 is a vertical section through the apparatus;

Figure 2 is a wiring diagram; and

Figure 3 is a diagram of the operating cycle.

The illustrated machine includes a suitable casing or frame **10**, supporting a stationary fluid-tight housing or tub **12** adapted to contain wash water and rinse water or other cleaning material, and within which is a rotatable drum or the like perforated container **14** in which the clothes are placed.

The illustrated drum is cylindrical in form, with a solid back end **16** having its front end formed with a large central opening closed during operation by a perforated disk **18** rotatably mounted on a door **20** mounted on the casing **10** by a hinge **22** and secured in closed position by a suitable lock **24**. The door **20** is made fluid-tight by means such as a suitable gasket **26**.

The drum is provided on its inner periphery with ribs **28** extending parallel to the axis of rotation, and which, as the drum rotates continuously at a uniform speed in the same direction, keeps lifting the clothes until they approach the top of the drum, whereupon they fall back into the water in the lower part of the drum, thus giving the desired washing action.

The drum is mounted for rotation about a horizontal axis, and to that end the head **16** is secured to a flange **30** extending radially from a sleeve **32** secured to a hollow horizontal shaft **34** journaled in bearings **36**. The shaft **34** is driven continuously at a substantially constant and uniform speed, being shown provided with a large pulley **38** for a V-belt **40** driven by a small pulley **42** connected by suitable reduction gearing to the drive shaft of an electric motor **44**.

When the clothes or other material to be cleaned have been placed in the drum **14**, an inlet valve **46** is opened by its solenoid **48** to supply water through a pipe **50** to an annular space or manifold **52** surrounding the door **20** and serving also as a door jamb, whence it is injected through an annular series of nozzles **54** into the drum **14**. When the water reaches the proper level for washing, in the tub **12**, water rises through a connection **56** in a float chamber **58** to raise a float **60** to operate a float switch **62** which breaks the circuit for the solenoid **48** and closes the valve **46**. Thereafter sufficient soap preferably in the form of powder is supplied.

The valve **46** receives its water through a pipe **64** a mixing valve **66** which mixes hot water from a pipe **68** and cold water from a pipe **70** to give water of a temperature determined by a suitable thermostat **72** which operates a switch in the circuit of solenoid **74** which controls the mixing valve **66**. Other means may be provided, if desired, for supplying water at the proper temperature.

At the conclusion of the washing operation, a solenoid **80** is energized in the manner described below, to open a valve **82** in a drain pipe **84**. After the dirty wash water has run out, valve **46** is again opened, to inject clean rinse water with the drain valve open, to flush out as much as possible of the wash water remaining in the clothes. The drain valve **82** is then closed, the

inlet valve 46 remaining open, to fill the machine with clean rinse water; after operating the machine for a suitable period this rinse water is then drained off by opening the drain valve. The inlet valve having previously been closed by the float switch, it now is opened by the draining action, and a short flushing action takes place before the main control switch closes it again shortly after the initiation of the squeezing action described below, thereby obviating the possibility of "squeezing" any sediment into the clothes.

Following this, a pressure fluid such as water under pressure from the cold water pipe 70 is admitted by a valve 88 controlled by a solenoid 90 through a pipe 92 to an end fitting 94 bolted to the bracket 96 carrying the end bearing 36, through a passage registering with a groove 98 in the shaft 34. The groove 98 communicates with the internal passage 100 of the hollow shaft 34.

It will be seen that opening the valve 88 admits fluid under pressure through the shaft 34 into the drum 14 into a space between the solid end 16 and a novel flexible imperforate diaphragm 102 of resilient rubber material. The diaphragm 102 is peripherally secured to the outer margin of the end 16 by means such as a clamp ring 104 bolted thereto, and is preferably molded to form a series of concentric corrugations 106 of considerable depth.

This construction enables the diaphragm to offer a yielding resistance to stretching under the fluid pressure introduced behind it as described, so that it serves as its own return spring.

The pressure of the water behind the diaphragm 102 expands the diaphragm to the right, squeezing the clothes against the perforated drum to dry them. By "dry" is not meant completely dry, but sufficiently dry for removal from the machine for ironing—i. e. at a water pressure of forty pounds, the clothes will be approximately as dry as if they had been run through an ordinary wringer.

The next step in the cycle is the closing of the inlet pressure-fluid valve 88, and the opening of a drain valve 110 having a control solenoid 112, and which connects the pipe 92 and the passage 100 with the main drain 84. After a sufficient interval for the resilient diaphragm 102 to force out substantially all of the water behind it, the valve 110 closes again, and the motor 44 stops, the cycle completed ready for the removal of the clothes.

These steps of flushing, rinsing and squeezing dry, may be repeated as often as desired, the diagram of Figure 3 showing one such repetition.

The controls for the motor 44, and the solenoids 48, 80, 90, and 112, are arranged in a control box 114 mounted at some accessible point on the casing 10.

Figure 2 shows the wiring, and Figure 3 is a diagram of the cycle described above. The various solenoids 48, 80, 90, and 112, as well as the motor 44, have connections 118 arranged in parallel between line wires 120 and 122. Each connection includes a switch 124, illustrated as a pair of spring contacts opened and closed by a series of control cams 126, 128, 130, 132, and 134 all rigidly mounted on a shaft 136 connected by reduction gearing 138 with a driving motor 140, preferably a small self-starting synchronous motor of the type used in electric clocks or by a suitable reduction drive directly connected with the main drive motor 44.

The motor 140 is connected across from the connection 118 of the main motor 44, at one side of its contacts 124, to the opposite line wire 122. The float switch 62 is in the connection 118 of the solenoid 48, and the mixing valve solenoid 74 and its control thermostat switch 72 are connected in series in a connection 142 between the line wires 120 and 122.

Figure 3 gives a diagram outlining in a sequence reading clockwise the cycle in detail. It will be noted that the "wash" part of the cycle, when the contacts 124 of solenoid 48 are closed and the contacts 124 of solenoids 80, 90, and 112 are all open, is arranged for the maximum length of time desirable for washing.

The length of this part of the cycle can be shortened when desired, without changing the timing of the other steps in the cycle, by turning the shaft 136 part way around manually, for example by a control knob 150 on the end of the shaft and arranged on top of the control box 114. A suitable scale, something like Figure 3, may be provided for a pointer on the knob 150.

The above-described control mechanism 114—150 may if desired be of the construction more fully described, and claimed, in application No. 78,635, filed July 24, 1936, by Rex Earl Bassett. The general construction of the machine, except as our improved drying means is included, is claimed in application No. 6,425 filed February 14, 1935, by Rex Earl Bassett.

While one illustrative embodiment has been described in detail, it is not my intention to limit the scope of the invention to that particular embodiment, or otherwise than by the terms of the appended claims. Where the term "clothes" is used herein, it is intended to cover any material adapted to be cleaned in a machine of this type.

We claim:

1. Cleaning apparatus comprising a drum having a horizontal axis and mounted on a horizontal driven hollow shaft and having a diaphragm mounted across one end over the outlet of said shaft, means for supplying and withdrawing cleaning agents to the part of the drum on the side of the diaphragm opposite the outlet of the shaft, and means for supplying and withdrawing fluid under pressure through said shaft to actuate said diaphragm to press the material in the drum against the opposite end of the drum.

2. A drum for use in cleaning apparatus having a rotatable mounting including a hollow shaft opening into one end of the drum, and having a diaphragm peripherally secured to said end symmetrically around the opening from said shaft, said diaphragm being formed in its face with a series of concentric deep corrugations permitting it to be extended under pressure of a fluid introduced through said shaft to press the contents of the drum against the drum.

3. A horizontal cylindrical drum for use in cleaning apparatus having secured centrally to one end a rotatable hollow horizontal shaft opening into one end of the drum, and having an imperforate flexible vertical diaphragm peripherally secured to said end symmetrically around and across the opening from said shaft and operated by fluid introduced through said shaft under pressure to press material in the drum against the end of the drum opposite said shaft.

4. Cleaning apparatus comprising a perforated cylindrical drum mounted at one end for rotation about a horizontal axis and having an opening in its other end and having a flexible diaphragm secured across said one end, a cover for said opening, a housing in which said drum is mounted and

which is formed and arranged to contain cleaning agents to act on the contents of the drum, said drum and housing being formed to permit the introduction of material into the drum through the end opposite the diaphragm, and means for introducing fluid under pressure between the diaphragm and said one end of the drum to press said material against said other end of the drum and against said cover to squeeze it dry.

5. Cleaning apparatus comprising a perforated cylindrical drum mounted for rotation about a horizontal axis and having a flexible diaphragm secured across one end, a housing in which said drum is mounted and which is formed and arranged to contain cleaning agents to act on the contents of the drum, said drum and housing being formed to permit the introduction of material to be cleaned into the drum through the end opposite the diaphragm, means for introducing fluid under pressure between the diaphragm and said one end of the drum to press the material in the drum to squeeze it dry, means for operating the apparatus in a cycle by introducing and withdrawing said cleaning agents and introducing and withdrawing said fluid under pressure, and means for driving said drum continuously at a uniform speed throughout said cycle.

6. Cleaning apparatus comprising a container for material to be cleaned having a hollow shaft on which it is rotatably mounted and provided with a diaphragm peripherally secured to the container across the inner end of said shaft, means for rotating said container upon said shaft about a generally horizontal axis, means operable automatically for supplying and withdrawing cleaning agents while the container is so driven, and means operating thereafter to introduce pressure fluid through said shaft to act on said diaphragm to press said material against one side of the container to remove the cleaning agents therefrom.

7. An automatically-controlled cyclically-operated cleaning machine comprising means for containing cleaning agents, a perforated container therein for material to be cleaned, said container being rotatably mounted at one end and having in its other end an opening provided with a removable cover, means for supporting said cover to rotate with the container, means to supply and withdraw cleaning agents, a flexible diaphragm positioned across said one end of the perforated container, and means for introducing fluid under pressure behind said diaphragm for pressing it against cleaned material in the container to squeeze it against said other end of the container and against said cover to dry it.

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