

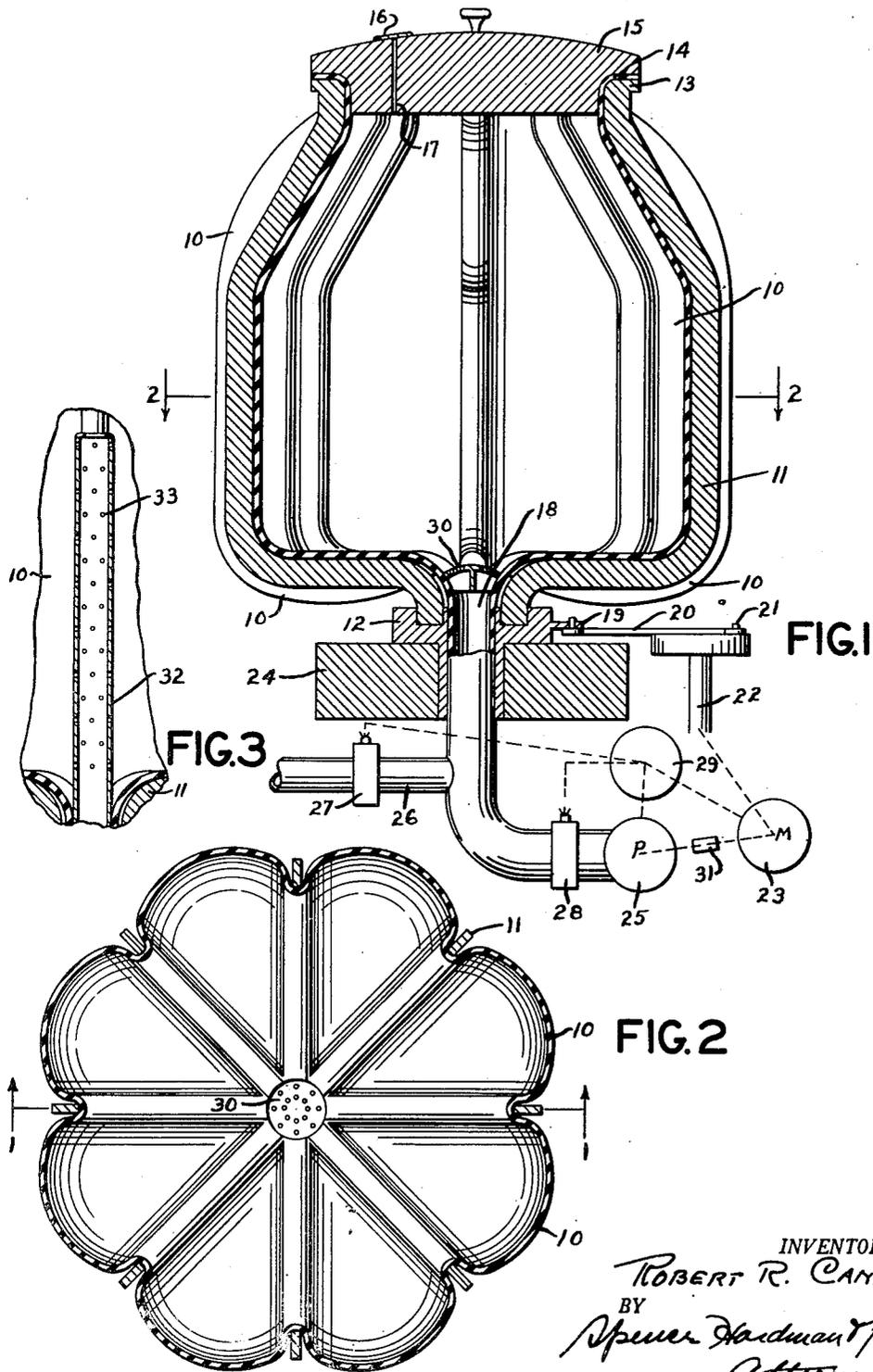
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R. R. CANDOR
COMBINED AGITATOR AND FLEXIBLE
DIAPHRAGM FOR WASHING MACHINES

2,692,494

Filed July 14, 1949

2 Sheets-Sheet 1



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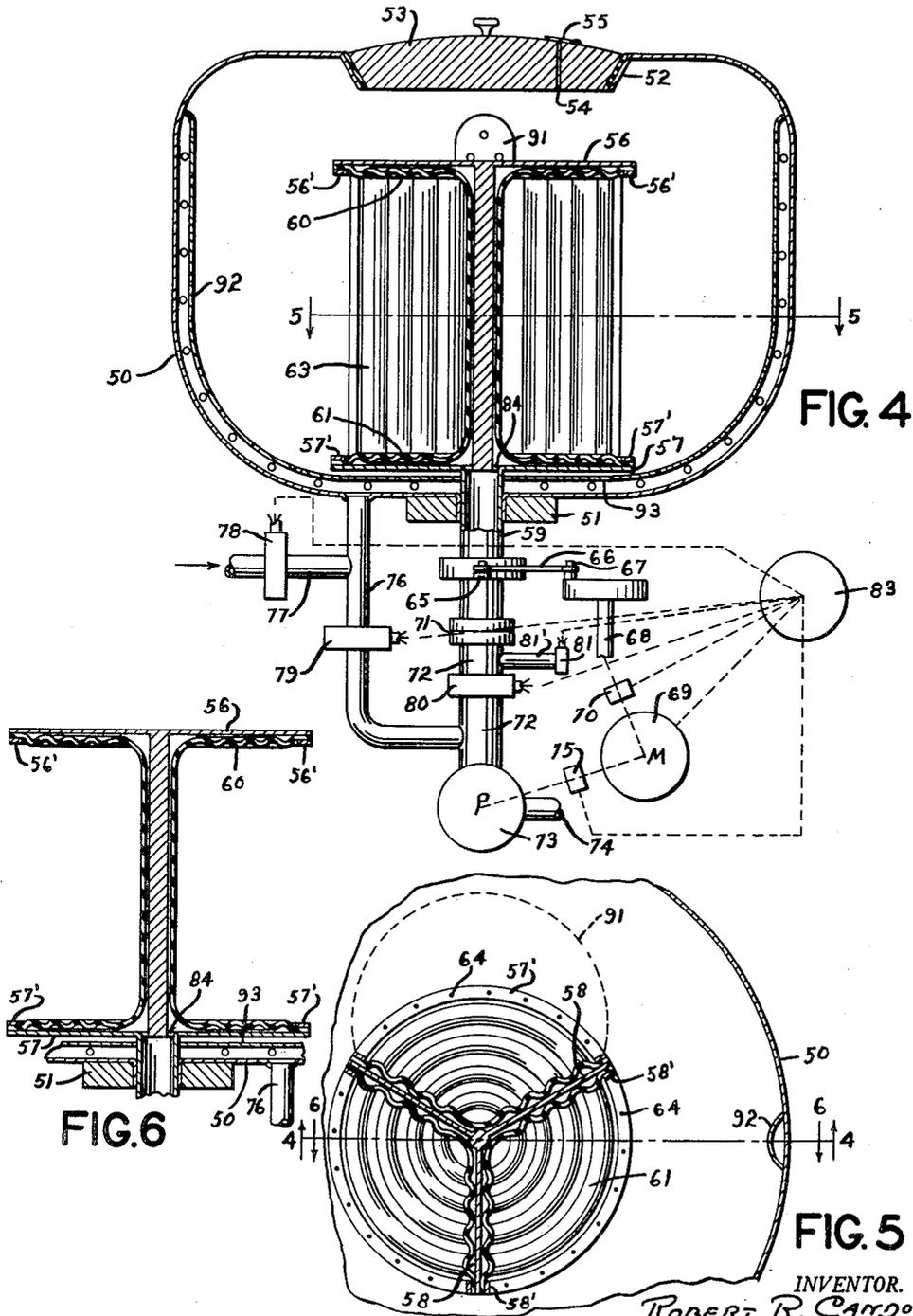


FIG. 4

FIG. 6

FIG. 5

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COMBINED AGITATOR AND FLEXIBLE DIAPHRAGM FOR WASHING MACHINES

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This invention relates to domestic appliances and more particularly to washing machines.

According to this invention a bag of flexible, impervious material is supported in a manner to create a fluted or irregular tub. The tub is filled with clothes and liquid and is oscillated to wash the clothes. Thereafter, the liquid and air are removed from the bag, which is collapsed by atmospheric pressure to wring the clothes. Or the bag-like structure may be surrounded by a tub, in which the liquid and clothes are placed, and the bag-like structure is outwardly expanded or collapsed preferably by atmospheric pressure.

An object of this invention is to provide a washing machine in which a bag is oscillated to produce washing action, and is collapsed by atmospheric pressure, to produce a wringing action.

Another object of this invention is to provide a flexible diaphragm or bag-like structure which may be oscillated to produce a washing action, and may be collapsed atmospherically, or by pressure, to produce a wringing action.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical cross-section of a washing machine embodying my invention, and taken along the line 1—1 of Fig. 2;

Fig. 2 is a horizontal cross-section taken along the line 2—2 of Fig. 1;

Fig. 3 is a vertical cross-section of a portion of a washing machine showing a slight modification of Fig. 1;

Fig. 4 is a vertical cross-section of another embodiment of the invention, and taken along the line 4—4 of Fig. 5;

Fig. 5 is a horizontal cross-section taken along the line 5—5 of Fig. 4; and

Fig. 6 is a vertical cross-section taken along the line 6—6 of Fig. 5.

In the modification of this invention shown in Figs. 1 and 2, a tub for washing clothes is formed by a flexible bag 10, made of material impervious to air and water. This bag is supported on a plurality of arms 11, which constitute an outwardly and upwardly directed spider or framework which is supported on an oscillatable frame 12, and which terminates in a ring 13 at its upper end. The bag 10 has its mouth 14 outwardly flared or otherwise supported on the ring 13, 55

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to constitute an opening for the insertion of clothes. This opening may be closed by a cover 15 provided with a valve 16 covering a relief aperture 17 in the cover 15. The bag 10 converges at its lower end into an opening 18, which conveniently may be formed by a flexible tube, which can be an extension of the bag 10, or may be a separate hose or pipe. When the bag is filled with liquid and clothes, it becomes a fluted or irregular tub, which violently washes the clothes when it is oscillated, and wrings the clothes when collapsed by vacuum.

The frame 12 may be oscillated by a crank 19, actuated by a connecting rod 20, driven from a rotating eccentric pin 21, actuated by shaft 22, which is driven by a motor 23.

The frame 12 may be supported on a stationary base 24, upon which the frame 12 may be oscillatably mounted in bearing surfaces diagrammatically indicated in Fig. 1.

The pipe 18 may be connected to a pump 25, which is capable of producing a vacuum within the bag 10. A water inlet pipe 26 is connected to the pipe 18, and pipe 26 may be connected to hot and cold water inlets which may be manually or thermostatically controlled. The pipe 26 may be provided with one or more solenoid valves 27 controlling hot and cold water inlets. The pipe 18 may be provided with a solenoid valve 28. All these pipes may be of flexible rubber tubing. The motor 23, pump 25 and the solenoid valves, such as 27 and 28 may be controlled by a timer 29 driven by its own motor. The timer energizes the various members in the desired sequences.

A strainer 30 may be placed in the bottom of the tub 10, to prevent downward movement of articles, and to permit inward or outward flow of liquids.

While the bag 10 is shown as loosely resting on the arms 11, it may be vulcanized or cemented thereto, or otherwise secured, if desired. Also it may be a sectional bag, formed as by separate sections between the arms 11.

In the operation of the machine, the cover 15 is lifted, and clothes and detergent are inserted in the bag 10. The cover 15 is replaced on the mouth 14, and the timer is started. The timer opens the valve or valves 27 and closes valve 28 and causes water to be introduced to the proper level, by a controlled flow, for example as described in patent to Kendall Clark 2,366,236, patented Jan. 2, 1945. The valve or valves 27 are then closed. Thereafter the frame 12 is oscillated, causing the arms 11 to oscillate about a vertical axis. Since the bag 10, when filled,

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takes on a fluted or irregular configuration, as indicated in Fig. 2, the clothes are violently agitated in the washing liquid. After a sufficient length of time, the pump 25 is operated, while valving 27 is closed and valve 28 is open, to withdraw liquid and/or air from the bag with or without stopping the oscillation of the arms 11. The pump continues to pump the liquid and/or air out of the bag 10, until a vacuum is created in the bag applying pressure differential to the walls of the bag. The vacuum is gradually increased until the bag collapses by atmospheric pressure against the clothes and wrings them to a substantial degree of dryness. Thereafter one or more rinsing operations, similar to the washing operation, but without detergent, take place, after which the timer stops operation of the mechanism. The cover 15 may be lifted by manually opening the valve 16.

Preferably the pump 25 is of the reversible type, and the motor 23, or the transmission 31, can reverse the pump 25 between the washing and rinsing cycles, and may introduce air to augment the liquid introduced through the pipe 26. Preferably, the amount of air may be only sufficient to completely fill the bag, but a slight extra amount may be added. Any excess air may leave through the opening 17 and the valve 16, which acts as a pop-up valve, or the excess air may escape by slightly lifting the cover 15.

In the modification shown in Fig. 3 the strainer 30 has been replaced by a tube 32 which is adapted to remove floating scum. It extends upwardly near the normal liquid level. This tube is perforated as indicated at 33. This tube enables the liquid to be more readily removed or inserted, and is adapted to remove some of the floating scum through its upper opening or openings during the wringing operation.

In the modification shown in Figs. 4, 5 and 6, a tub 50 is stationarily supported on any frame 51. It is provided with a mouth 52 having a cover 53 which has a bleed opening 54 which may be opened by a manually operable valve 55 to break a vacuum within the tub. An oscillatable, flexible diaphragm or tub-like structure may be placed in the tub. It may be supported on a framework in the form of horizontal platforms 56 and 57 which are connected by radial blades 58, this framework being supported on an oscillatable tube 59. The flexible diaphragm may be a unitary structure, or it may be made of three or more sections including horizontal "pie" sections 60 and 61, each joined by a vertical wall section 63, V-shape in cross section. It is obvious that each of these sections may be joined if desired to adjacent flexible sections by extending the vertical walls 63 around the outside edges of the walls 58. If desired the walls 63 may be corrugated as indicated. The flexible diaphragm is vulcanized, cemented or otherwise secured to the platforms 56, 57 and the blades 58 at their outer edges. As shown, they are secured by rim clamps 56', 57' and 58' respectively, using bolts, screws 64, or the like.

The pipe 59 may be oscillated by a crank 65, actuated by a connecting rod 66, driven by the eccentric pin 67, which is rotated by the shaft 68, connected to the motor 69 by means of an automatically controlled clutch transmission 70. The pipe 59 may be connected by any wellknown relatively movable seal 71 with a stationary pipe 72. The pipe 72 is connected to a pump 73 which discharges through the pipe 74. The pump 73 is driven from the motor 69 by any suitable transmission controlled by an automatic clutch 75.

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The tub 50 is connected by a pipe 76 with the pipe 72. Also, the pipe 76 is connected with a pipe 77 through which water may be introduced. The pipe 77 may be connected to one or two solenoid valves 78 for the introduction of hot and/or cold water. Solenoid valves 79 and 80 are placed in pipes 76 and 72 respectively. An atmospheric air inlet pipe 81' with solenoid valve 81 is also connected with pipe 72. A timer 83 controls the motor, pump, transmissions, clutches and valves as indicated by dotted lines. A plurality of perforated channels 92 are formed on the inside of tub 50. These are connected to the pipe 76 by means of the perforated false bottom 93. Liquid may flow through the perforations into the channels 92 and false bottom 93 into the pipe 76.

In the operation of the modification of Figs. 4, 5 and 6, clothes and detergent are inserted in the tub 50 by lifting and replacing the cover 53. Water at the desired temperature is introduced through the pipe 77, for example by water control as disclosed in said Clark patent. At the time water is introduced, solenoids 79 and 81 are closed while solenoids 78 are open. After the solenoids 78 close, the diaphragm may be oscillated by rotation of the shaft 68. Simultaneously the pump 73 may be actuated, while solenoids 77, 79 and 81 are closed and solenoid 80 is open, to produce a vacuum behind the diaphragm 60, 61, 63, the pipe 59 being connected through openings 84 with the space inside the diaphragm. The oscillation of the diaphragm and its supporting framework washes the clothes. Thereafter this oscillation is stopped. The pump 73 continues to operate to produce a vacuum in pipe 76 while the solenoids 78 and 80 are closed, and the solenoids 79 and 81 are open. This produces a vacuum in the tub 50, causing air to be introduced through the open valve 81, the air inlet pipe 81', and pipe 59 into the diaphragm to cause the diaphragm to expand or collapse outwardly as indicated in the dotted line 91 in Fig. 5. This wrings the clothes against the wall of the tub 50. The liquid flows through the perforated channels 92 on the inside of the tub which are connected with the pipe 76. The liquid is discharged through the pipe 74. Thereafter one or more rinsing operations are performed, which are similar to the washing operation, with detergent omitted, after which the timer 81 stops. The vacuum, if any, in the tub 50 may then be broken by manually opening the valve 55, thus allowing the cover 54 to be removed to enable the removal of the clothes.

In the modifications shown in Figs. 1, 2, and 3, the bag 10 may be placed with its axis in an inclined or horizontal position, and the framework 11 may be slowly rotated or oscillated, during the agitation period. If the framework is to be slowly rotated, then the pipe 18 may be provided with a sliding seal, of the type illustrated and described at 71 in Fig. 4. If necessary, the cover 15 may be provided with clamping means, for preventing the cover from falling off. When the bag is in either of these positions, the open end, to which the cover is attached, may be regarded as the "upper" end of the bag, and the opening to which the tube 18 is attached, may be considered the "lower" end.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

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What is claimed is as follows:

1. In combination, means forming a washing receptacle including a flexible elastic bag and a substantially rigid cage surrounding said bag and supporting said bag, said cage including spaced confining supporting portions arranged about an axis, said cage having spaces between said supporting portions so that the bag is supported by the supporting portions and extends into the spaces between the supporting portions, and means for oscillating said bag and cage about said axis.

2. In combination, means forming a washing receptacle including a flexible elastic bag and a substantially rigid cage surrounding said bag and supporting said bag, said cage including spaced confining supporting portions symmetrically arranged about an axis with each portion substantially in the plane of the axis, said cage having spaces between said supporting portions so that the bag is supported by the supporting portions and extends into the spaces between the supporting portions, and means for bodily oscillating as a unit said bag and said cage.

3. In combination, means forming a washing receptacle including a flexible bag with a top opening and a bottom opening, an oscillatable cage surrounding and supporting said bag and forming irregularities in the inner surface of said bag and permitting atmospheric pressure against the outside of said bag, a substantially rigid cover for said top opening, and a vacuum pump connected to said bottom opening.

4. In combination, means forming a washing receptacle including an impervious expansible and contractable diaphragm means having resilient portions, an open framework supporting said diaphragm means and having spaced supporting portions arranged about an axis to contact said diaphragm means in an extended position of said diaphragm means to impart a fluted form to the diaphragm means about said axis, means for oscillating said framework and said diaphragm means in unison upon said axis to wash clothes within said receptacle, said receptacle having a drain means, and means for applying a pressure differential to said diaphragm means to move said diaphragm means away from said framework and against said clothes to force

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a substantial portion of liquid from said clothes into said drain means.

5. In a washing machine, a stationary base assembly, means forming an expansible and contractable washing receptacle having a flexible elastic portion, means for oscillating said receptacle about a given axis, and a flexible drain connection for said receptacle substantially concentric with said axis of oscillation and having its one end attached to said receptacle and having its other end attached to said stationary base assembly.

6. In a washing machine, a stationary base assembly, means forming an expansible and contractable washing receptacle having a flexible elastic portion, a cage having spaced elements arranged about an axis and adapted to contact and hold said flexible elastic portion to form an irregularly shaped washing receptacle when expanded, means for oscillating said cage upon said axis, and means for imparting a vacuum to said receptacle to collapse said receptacle.

7. In combination, means forming a washing receptacle including a rigid cage and a flexible elastic bag within said cage and having irregularities formed by the cage, said bag being connected to the cage and having a first opening for the introduction of clothes and a second opening for the passage of fluid, means for oscillating said bag and said cage in unison with the irregularities transverse to the direction of oscillating movement, stationary means for imparting a vacuum to said receptacle including a flexible tube connecting said last named means to said second opening.

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