

Filed Oct. 2, 1947

WASHING MACHINE

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FIG. 2.

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Aug. 25, 1953

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2,649,706

Filed Oct. 2, 1947

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FIG. 3.

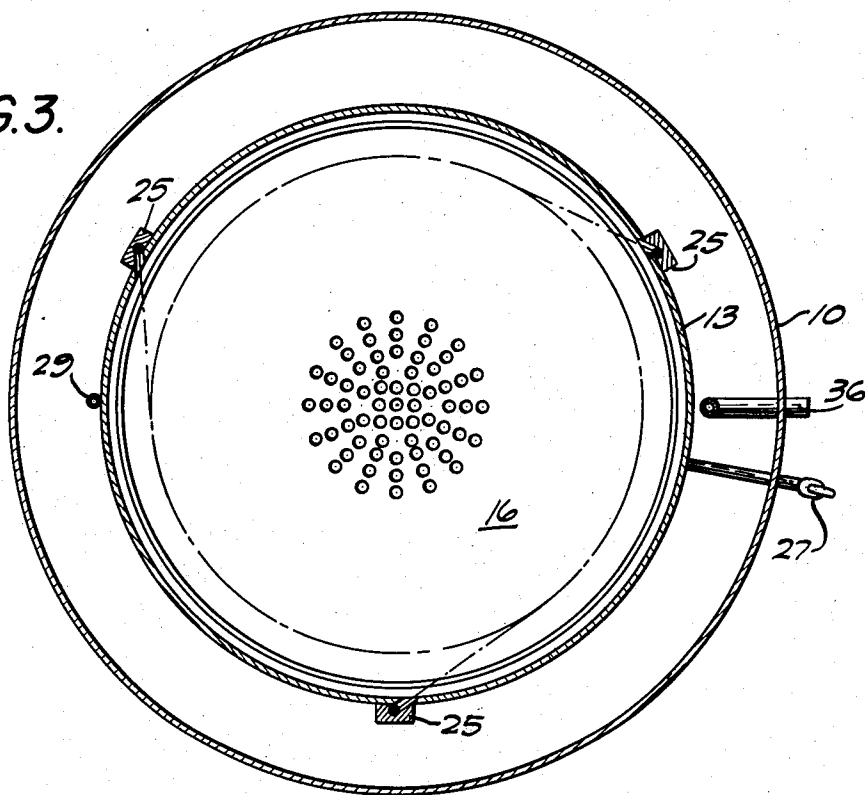
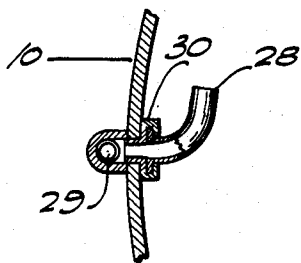


FIG. 4.



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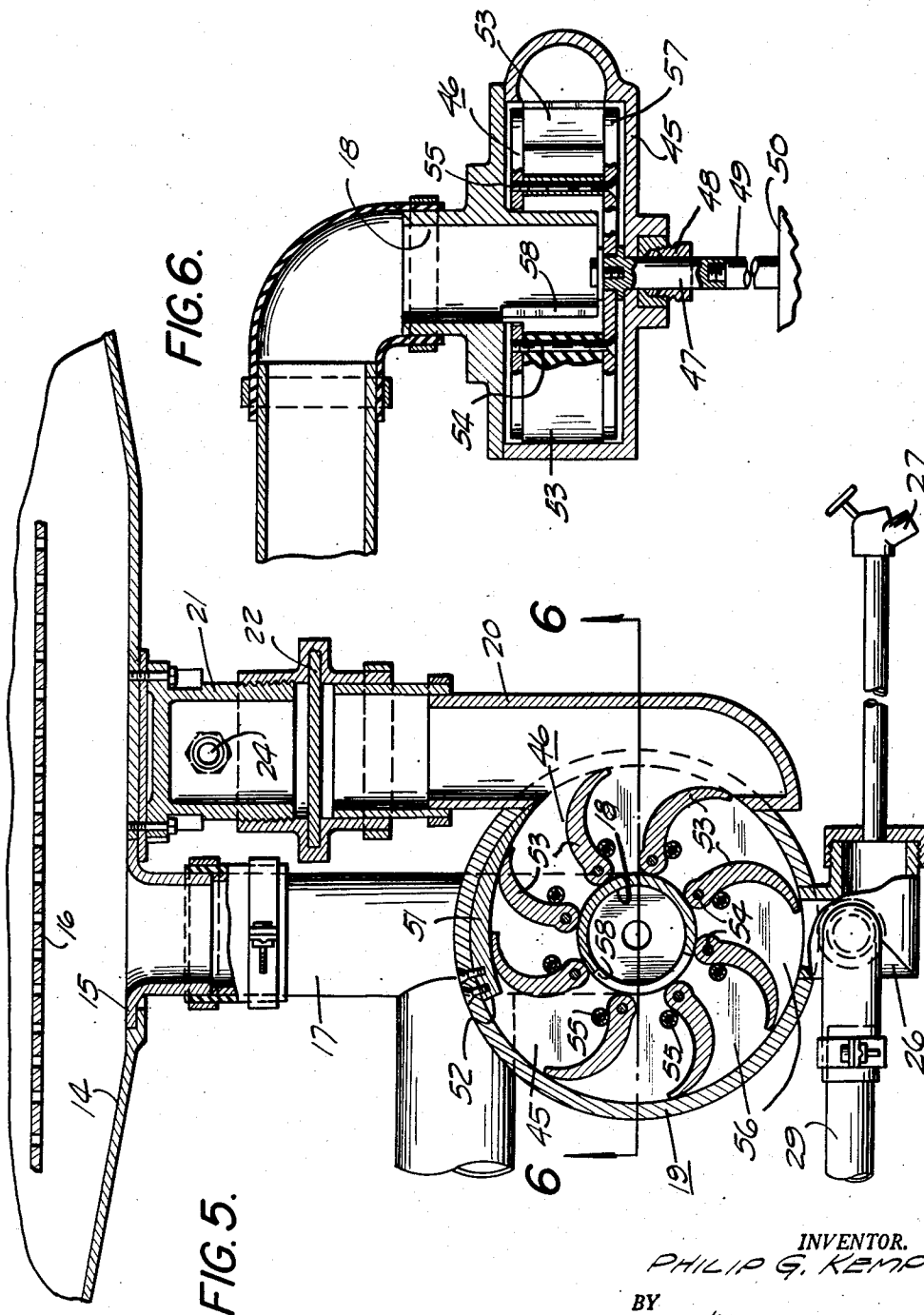
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,649,706

WASHING MACHINE

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Application October 2, 1947, Serial No. 777,443

3 Claims. (Cl. 68—184)

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This invention relates to a washing machine and more particularly to a machine of the type commonly used for laundering clothes and the like.

It is an object of this invention to provide an economical and efficient washing machine having a minimum of moving parts so that mechanical failures and the necessity for replacing worn parts are materially reduced.

It is also an object of the invention to provide a washing machine in which the clothes are agitated and washed by means of jets of water directed at them rather than by mechanically actuated paddles or by rotation of the clothes retainer itself.

Another object of the invention resides in the provision of a fluid pump which is small in size and nevertheless pumps a large volume of water at a relatively high pressure and which may be driven by a motor connected with the usual household electrical outlet.

A further object resides in the provision of a fluid pump which serves as a pressure pump during the washing operation and as a vacuum pump during the draining operation to remove excess moisture from the clothes.

Still another object of the invention is to provide a washing machine having a built-in vacuum drier which enables drying the clothes to a degree desired before removal from the machine.

Other objects and improvements will become evident from the following description and drawings in which:

Figure 1 is a side elevation, partly in section, of my washing machine illustrating the general arrangement of parts.

Figure 2 is a bottom view of the machine.

Figure 3 is a sectional view taken along line 3—3 in Figure 1 showing jets spaced around the periphery of the inner tub.

Figure 4 is a sectional view taken along line 4—4 in Figure 1 showing the movable nozzle at the upper end of the tub.

Figure 5 is a sectional view of the pump taken along line 5—5 in Figure 2.

Figure 6 is a sectional view taken along line 6—6 in Figure 5 showing the arrangement of the impeller within the pump.

Referring to the drawings and particularly to Figure 1, the improved washing machine comprises an outer cylindrical shell 10 which is supported on legs 11 and an inner shell 12 in the form of a tub in which the water and clothes being washed are adapted to be retained. Tub 12 is preferably of circular cross-section with the

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sidewall 13 tapering inwardly from top to bottom. The bottom wall 14 of the tub slopes downwardly toward the center and is provided with a drain fitting 15 through which the water in the tub is discharged. The tub is also provided with a perforated false bottom 16 spaced above bottom wall 14 and on which the clothes are retained during the draining operation. Drain 15 is connected by an elbow shaped conduit 17 with the inlet 18 of a rotary pump 19. The outlet 20 of pump 19 extends upwardly and connects with a jet manifold 21 which is secured to bottom wall 14 of the tub directly above outlet 20. The flow of fluid from the pump to the jet manifold 21 is arranged to be controlled by a gate valve 22 in the passage between outlet 20 and the jet manifold. Valve 22 is operated by a slide rod 23 which extends outwardly from valve 22 beyond outer shell 10.

Jet manifold 21 is provided with a plurality of tubular outlets 24, preferably three in number, which extend radially outwardly from the manifold and upwardly between the inner and outer shells to jets 25 projecting through and spaced circumferentially of the wall 13 of the tub. Jets 25 are arranged around the lower portion of tub 12, each at a different level. As is shown more clearly in Figure 3, the jets are disposed angularly with respect to a wall 13 of the tub so as to direct streams of water horizontally into the tub and impart a swirling motion to the water and clothes retained therein.

It will be seen that with pump 19 operating and valve 22 opened, the water within the tub will be continually drawn out through the perforated bottom 16 and pumped back into the tub through jets 25. I have found that by spacing the jets 25 at different distances from the bottom of the tub as shown and by having the sidewall 13 tapering inwardly from top to bottom, the clothes within the tub are subjected to a very efficient washing action by the continually circulating water. This arrangement produces a circular and vertical movement as well as a combination of these two movements within the tub. The streams of water emanating from jets 25 and directed at the clothes from different levels produce circular agitation and prevent the clothes from impacting. The clothes are caused to circulate loosely while the water is drawn through them and over them. At the same time the provision of a slight taper in the wall of the tub overcomes the tendency for the clothes to settle at the bottom of the tub due to the natural flow of the water in the tub which is being voided

through the perforated bottom. The clothes travel a circular path at a rate slower than the rotating water and tend to settle around the bottom of the tub. However, the action as shown by tests is such that they are drawn to the center and rise to the top where they are again directed by the rotating water outwardly around the sidewall of the tub.

Pump 19 is also provided with an outlet 26 at the lower end thereof for draining the tub after the washing or rinsing operation. A valve 27 suitable for attachment with a hose connector is connected with outlet 26 for directing the drained water down a trap or into another receptacle if desired. An auxiliary movable jet 23 at the upper edge of the tub 12 is also connected as by a conduit 29 to outlet 26. During the draining operation pump 19 directs water through jet 23 and effects a removal of the scum around the periphery of the tub which invariably results after subsidence of the clothes. Jet 23 is pivoted at the end of conduit 29 as at 30 so that the stream therefrom may be directed against the inner surface of wall 13 at any level. A valve 31 is arranged in conduit 29 for controlling the flow through jet 23. A filling spout in the form of a stationary jet 35 is also provided at the upper edge of the tub 12. Jet 35 is connected with a conduit 36 extending downwardly between the inner and outer shell and projecting through outer shell 10 for connection with a hose from a source of water for filling the tub.

I have found it desirable to incorporate a drier 37 in my washing machine. Drier 37 may be a vacuum pump of conventional design with a capacity for delivering a large volume of air. The inlet 38 of drier 37 is connected to drain conduit 17 ahead of the pump inlet 18 and is provided with a valve 39 for closing inlet 38 when water is being discharged from the tub through drain 15. Valve 39 is arranged to be controlled by an actuating rod 40 which projects through outer shell 10 so as to be easily accessible.

It will be appreciated that efficient operation of the machine can be realized only if pump 19 is capable of delivering a large volume of water at a relatively high pressure. If the capacity of the pump is not large enough the agitation of the clothes within the tub will be insufficient to provide the washing action necessary. At the same time the size of pump must be limited so that it may be operated by a motor connected with an electrical power source ordinarily available in homes. The pump may, of course, be operated by a gasoline motor, but even with that type of motor it must be relatively small in size. The pump of my design meets with both of these requirements. As is best shown in Figures 5 and 6, the pump 19 is of the rotating impellor type, having a housing 45 which encloses a rotor 46 mounted on a shaft 47. Shaft 47 is journaled in a water tight gland 48 at one side of housing 45 and is connected with the driving shaft 49 of motor 50. At a point just beyond outlet 20 (assuming counterclockwise rotation of rotor 46 as viewed in Figure 5) a tapered step 51 is arranged on the inner periphery of housing 45 so as to provide a cam surface on said periphery increasing in height from the end adjacent outlet 20 to the other end 52 of the step.

Fluid is delivered through the pump by a plurality of flexible vanes 53 pivoted on the rotor as by pins 54. Behind each vane 53 rotor 46 is provided with studs 55 adjacent pins 54 which limit the pivotal movement of the vanes and

cause them to assume the flexed position shown in Figure 5 with the free ends of the vanes wiping against in the inner periphery of housing 45 and forming a plurality of independent rotating chambers 56. Vanes 53 must be flexible enough to ride up cam surface 51 without consuming too much power and must be highly resilient so as to rapidly spring back to their normal contour as they trip over end 52 of step 51. I have found that vanes made of treated rubber are ideal for this purpose.

The inlet pipe 18 of the pump projects centrally through one side of housing 45 and extends across the housing to rotor disc 57. At the side opposite outlet 20 inlet pipe 18 is provided with a restricted opening 58 through which fluid is admitted to the pump housing 45. Inlet opening 58 is arranged such that water is admitted to the chambers formed by vanes 53 just after the vanes have discharged water through outlet 20 and at the moment they trip over the high end of cam 51. As vanes 53 flex in traveling over cam 51, the chambers 56 adjacent the cam are gradually reduced in volume until the forward vane of the chamber reaches the end 52 of cam 51. As the vane trips over this end of the cam, it tends to spring back to its original contour and in so doing creates a partial vacuum in the chamber behind it which causes a mechanical suction of water through inlet opening 58. Opening 58 is preferably in the range of 100-150° and I have found that with an opening of approximately 120° the pump attains its maximum efficiency. Openings considerably less than 120° present too short a period for the entrance of water into the chambers formed by the vanes and openings in excess of 150° admit water over too wide a range and the water being voided at outlet 20 would therefore not be subjected to the desirable effect of the centrifugal force generated by rotor 46.

Theoretically the water from inlet 58 should be available to the rotor vanes at the exact moment they trip over the high end of cam 51, that is, at the moment the chambers between the vanes are subjected to the suction effect produced by the tendency for the vanes to spring back to their original contour. In practice I have found that a lag occurs and that best performance is obtained if the opening is advanced slightly in the cycle, so that water is actually admitted to a chamber just before its forward vane trips over the high end of cam 51 as is shown in Figure 5.

In operation the machine is filled with water to the desired level by connecting conduit 36 with a source of water. After soap and the clothes are added motor 50 is switched on to start the operation of the pump 19. At this time valve 22 is open and valve 39 is closed. Water is drawn through the perforated bottom 16 and into pump inlet 18. The pump discharges the water through outlet 20 in the manner previously described and into jet manifold 21 from which it is returned to the tub under relatively high pressure through jets 25. After the washing operation is completed the tub is voided of soapy water by closing valve 22 and opening drain valve 27. At this time valve 31 may also be opened so that a part of the water flows through jet 28 and removes the soap scum from around the inside of the tub. After the soapy water has been drained, valves 27 and 31 are closed and valve 22 is opened. Sufficient clear water is again admitted through jet 35 and the clothes are rinsed in the same manner as they are washed, after which the tub is again drained. It will be observed that if the fluid passing

through pump 19 is air, the pump operates as a vacuum pump. I have found that if after the tub is drained, the operation of pump 19 is continued for a short time it serves to withdraw a substantial amount of surplus moisture remaining in the sodden clothes. When the excess moisture has been removed in this manner, drier 37 may be utilized to further dry the clothes. Suitable means (not shown) may be provided for starting the drier and stopping the pump motor 50 simultaneously with the opening of valve 39. Drier 37 draws a large volume of air through the clothes in the tub and dries them to the degree necessary without the use of a wringer and to such an extent that they may be ironed without hanging up to dry.

It will thus be seen that I have provided a machine in which clothes may be washed in a simple and efficient manner and with much less wear and tear than the clothes are subjected to in washing machines having mechanical agitators of one type or another. The efficient washing action is provided by the streams of water which agitate the clothes and at the same time flow over and through the clothes. The agitation is further promoted by the draining action through the perforated bottom in conjunction with the slight taper of the sidewall of the tub. This washing action is efficient, however, only if pump 19 is capable of delivering a large volume of water at relatively high pressure. With a small pump of limited size such as is adapted for use on a washer of this type the provision of the tapered step 51 within the pump housing together with the flexible vanes 53 and the restricted opening 58 of the pump inlet are essential for satisfactory operation of the washing machine. The pump of my invention is also unique in that during operation the action of the flexible vanes in passing over the tapered step creates a positive suction which results in the efficient removal of surplus water from the sodden clothes in a manner not obtainable with a pump of ordinary construction.

I claim:

1. In a washing machine a tub having a bottom and side walls, a drain in said bottom wall, a pump having an inlet connected with said drain, a plurality of jets spaced circumferentially around the side walls of said tub, conduits connecting

said jets with the outlet of said pump, a conduit connected with said outlet for discharging water from said tub to a point exterior of the tub, valves in said first and second mentioned conduits for selectively directing the water from said outlet to said jets or exteriorly of the tub through said second mentioned conduit, an auxiliary jet positioned in said tub above said other jets and adjacent the upper end of the tub, said last mentioned jet comprising a nozzle positioned to direct a stream of water against the side walls of the tub around the upper end thereof, and a conduit connecting said last mentioned jet into said discharge conduit intermediate the ends thereof.

2. The combination set forth in claim 1 wherein said last mentioned jet is supported for pivotal movement on said tub to enable directing a stream of water from said jet in different directions against the side walls of said tub.

3. The combination set forth in claim 1 wherein one of said valves is disposed in said second mentioned conduit at a point beyond the connection between said second mentioned conduit and said auxiliary jet, another of said valves is disposed in said conduit connecting said auxiliary jet with said second mentioned conduit and a third valve is disposed between said outlet and said first mentioned conduits.

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