





April 4, 1950

R. W. KNAPP

2,502,965

CLOTHES-WASHING MACHINE

Original Filed May 18, 1944

4 Sheets-Sheet 3

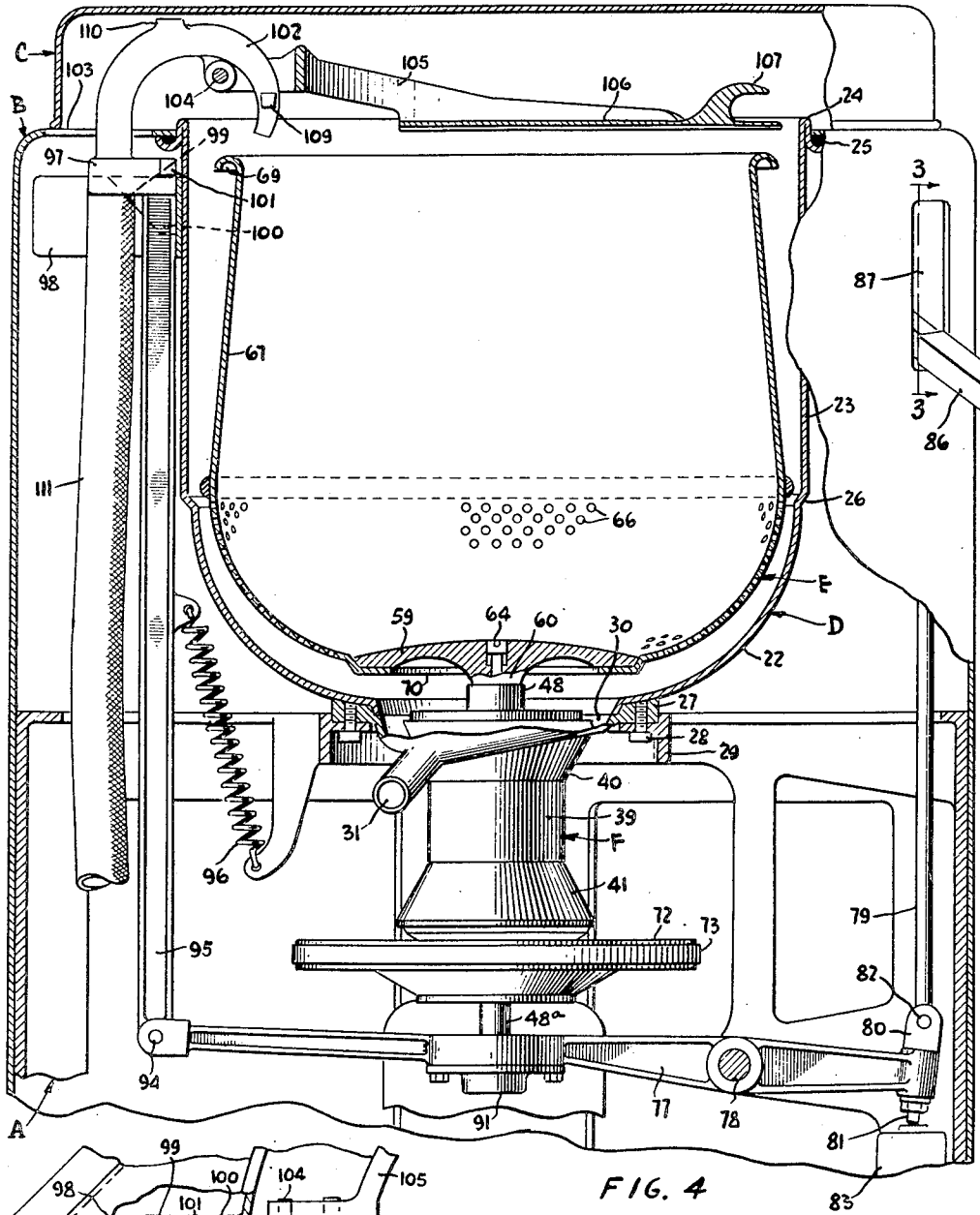


FIG. 4

Inventor  
ROLAND W. KNAPP

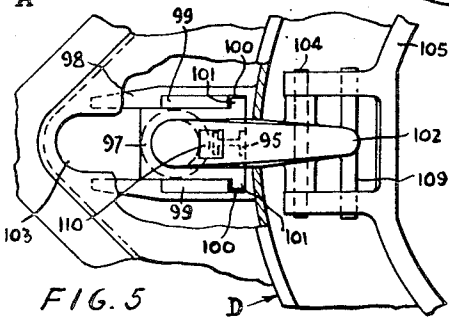


FIG. 5

By

Carlson & Hoyle

Attorneys

April 4, 1950

R. W. KNAPP

2,502,965

CLOTHES-WASHING MACHINE

Original Filed May 18, 1944

4 Sheets-Sheet 4

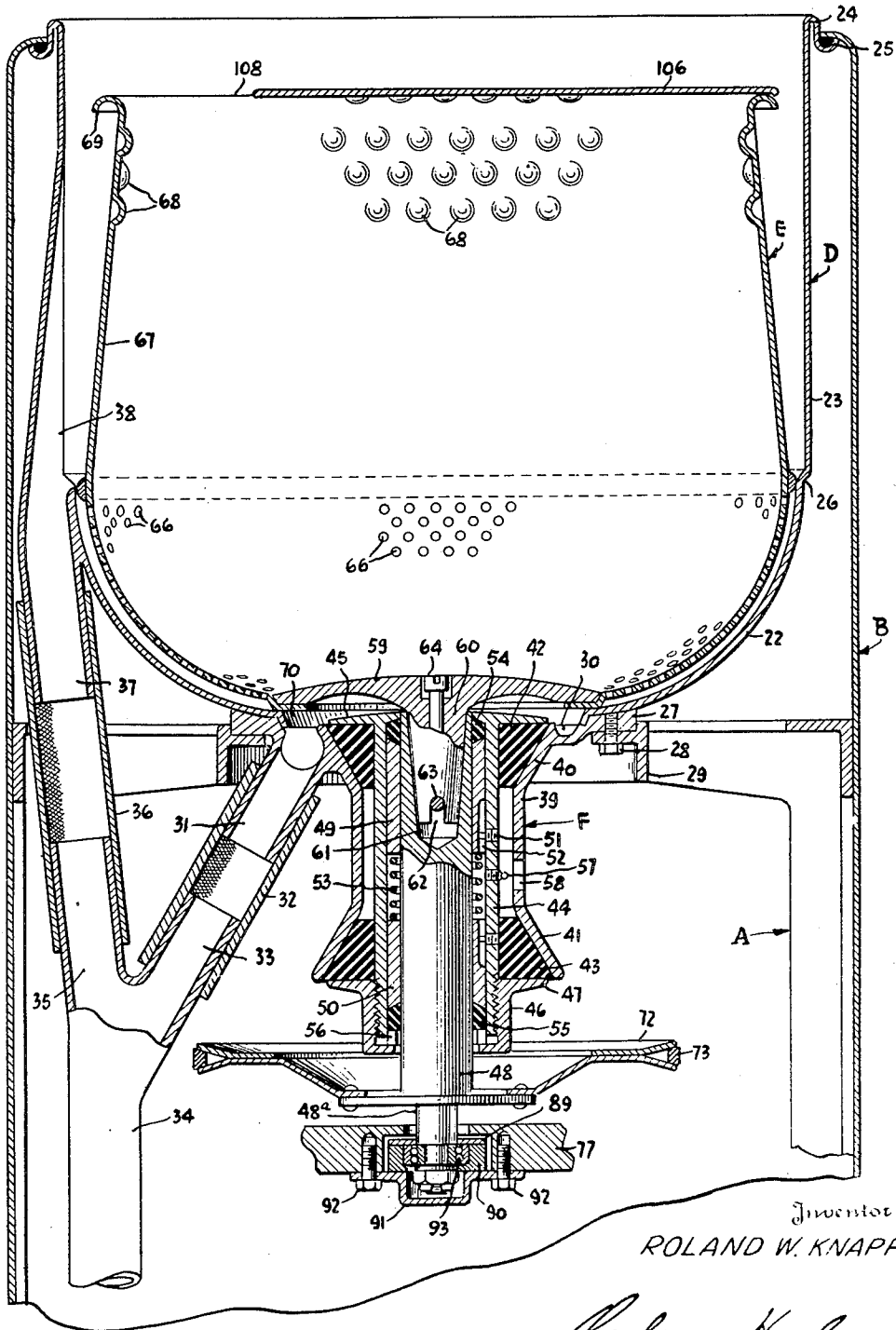


FIG. 6

334

*Carlson & Kagle*

Attorneys

# UNITED STATES PATENT OFFICE

2,502,965

## CLOTHES-WASHING MACHINE

Roland W. Knapp, Wayzata, Minn., assignor to  
Solar Corporation, Milwaukee, Wis., a corpora-  
tion of Delaware

Original application May 18, 1944, Serial No.  
536,143. Divided and this application May 5,  
1945, Serial No. 592,193

5 Claims. (Cl. 68—23)

1

This invention relates to domestic laundry equipment and the main object is to provide a comparatively simple, efficient and practical apparatus for washing, rinsing and drying clothes and other fabric articles usually washed in machines of this general type.

The present application is a division of my parent application for patent Serial No. 536,143, filed May 18, 1944, for Washing machine (subsequently abandoned), and to which parent application reference is made for a more complete understanding of the entire machine and particularly to such parts as are not embraced in the specific subject-matter of the present disclosure.

In the aforesaid application Serial No. 536,143, there is fully disclosed and described a washing machine in which a clothes receptacle is mounted for vertical adjustment and rotary motion within a tub, but the actual washing operation is performed, not by movement of the receptacle or an enclosed agitator, but by the action of a stream of water projected into the receptacle under pressure in a predetermined direction and in such manner that a very effective washing operation is produced.

The mechanism disclosed and claimed in this application does not directly concern itself with the specific washing operation as such, but does concern itself with the apparatus involved in adjusting the receptacle and associated parts, to give proper clearance, and then spinning or centrifuging the receptacle to extract moisture in the drying operation.

In the accompanying drawings, which illustrate a preferred embodiment of the invention: Fig. 1 is an elevation of the machine as seen from one side and with the major portion of the outer housing and parts of the tub unit in section for purpose of illustration.

Fig. 2 is an enlarged elevation partly in section through the upper part of the machine, and showing the clothes receptacle and nozzle with adjacent parts in their lowered positions.

Fig. 3 is a detail elevation of a control lever, this view being partly in section, as on line 3—3 in Fig. 4.

Fig. 4 is a sectional elevation similar to Fig. 2 but showing the clothes receptacle and nozzle, together with the inner lid for the receptacle, in their raised positions.

Fig. 5 is a detail plan view of the nozzle and adjacent parts as seen from above in Fig. 4, but with a portion of the upper cover broken away.

Fig. 6 is an enlarged diagrammatic sectional

2

elevation through the tub and clothes receptacle and through the spindle construction on which the receptacle is supported.

Referring to the drawings more particularly and by reference characters, A designates a skeleton frame, generally rectangular in form, and on which is mounted an outer shell or casing B having a cover C. The frame A forms a supporting base 21, at its bottom, and extends upwardly within the casing slightly more than half way of its length. Housed within the upper portion of the casing B and supported on the frame A, is a circular tub D within which is disposed the basket or clothes receptacle E. The lower part 22 of the tub is curved in cup-like formation while the upper part 23 is cylindrical, terminating in a reverse flange 24 that is sealed with respect to the upper annular opening in the casing B, as by a gasket 25. It may here be noted that the cylindrical part 23 of the tub is of greater diameter than the adjacent edge of the part 22, and is connected thereto by an integral, inwardly sloped flange 26.

The lower, open extremity of the tub is seated on an annular, but somewhat irregular casting unit F, having a circular rim portion 27 secured by bolts 28 to an adjacent circular part 29 of the frame A. Within the rim 27 the unit F is provided with an annular trough 30 which slopes toward one side, where it terminates in a drain spout 31, connected in turn by a coupling hose 32 to one arm 33 of a Y-shaped receiving pipe 34. The other arm, 35, of this pipe is coupled by a hose connection 36 to the outlet spout 37 of a vertically extending opening 38 in one side wall of the upper tub part 23.

The casting unit F (see Fig. 6) comprises an outer sleeve 39 having vertically opposed upper and lower cone parts 40 and 41 in which are placed resilient, circular, and trunco-conically shaped rings 42 and 43 serving to flexibly or yieldably support a cylindrical inner member 44. This member is provided, at its upper end, with an integral outwardly and inwardly flared flange 45 for engaging the upper surface of ring 42. At its lower end the member 44 is threaded to receive a cup-shaped nut 46 having a flange 47 bearing against the under surface of ring 43. Thus screwing the nut 46 upwardly on member 44 will operate to squeeze the rubber rings 42 and 43, and this adjustment may thus be used to tighten the entire assembly as may be required.

A spindle 48 disposed axially within the member 44 extends the length thereof and down through the nut 46. This spindle turns in a pair

3

of vertically spaced bushing sleeves 49 and 50 which are vertically adjustable in the member 44 but are held against rotation by screws 51 extending into slots 52. The bushings are yieldably urged in opposite vertical directions by a spring 53 which tightens the bushings against packing rings 54 and 55, which serve to prevent the escape of lubricant outwardly and the leakage of wash water downwardly. As will be noted the upper ring, 54, stops against the inner edge portion of flange 45. The lower ring, 55, is retained by a metal ring 56 disposed between it and the cup 46, this ring being within the member 44 and extending therebelow so as to provide clearance for adjustment by nut 46. The bushings 49-50 may be lubricated through a nipple 57, access to which may be had through an opening 58 in sleeve 39.

The clothes receptacle E is supported and rotated by the spindle 48, the receptacle being provided with a rigid bottom plate 59 having an integral, downwardly extending, tapered core 60 for engagement in a similarly tapered end recess 61 in the spindle 48. To insure rotation of the receptacle with the spindle the core 60 is provided with a transverse end slot 62 for engagement down over a pin 63 diametrically traversing the recess, and secured at its ends in the spindle. Should the core become wedged in the recess it can be forcibly released by a screw 64, threaded axially in the core, for engagement against pin 63 and having its upper end slotted for engagement by a screw driver. Thus, the clothes receptacle can easily be removed from tub D when desired for cleaning, repair or other purposes.

The lower portion 65 of the clothes receptacle E is bowl-shaped to conform with the curvature of the tub, and this portion of the receptacle is profusely perforated as shown at 66. The upper wall 67 of the receptacle converges inwardly and is imperforate, although, as suggested in Fig. 6, it may be provided with a plurality of inwardly embossed small bumps or projections 68. The upper edge of the wall is provided with an annular flange or flare 69.

At its bottom the receptacle is recessed to receive the plate 59, being provided with an angular flange 70 which annularly contacts the tub when the receptacle is in its lower position, as shown in Figs. 1, 2 and 6. When the tub is in its raised or centrifuging position, as illustrated in Fig. 4, the flange 70 is separated from the tub to provide free passage of water into the drain trough 30.

At the juncture of its walls 65 and 67 the receptacle E is provided with an annular rib 71, which, when the receptacle is raised (Fig. 4) clears contact with the lower reduced part of the tub; but, when lowered, guides within the shoulder 26 to establish peripheral contact with the tub, as shown in Figs. 1, 2 and 6.

The lower end of the spindle 48 is provided with a rigidly secured pulley 72 which is driven by a belt 73 from a smaller pulley 74 on the upper end of a vertical shaft 75 extending from a motor 76 mounted in frame A. The belt 73 is sufficiently flexible to permit the necessary vertical adjustments of pulley 72 with spindle 48 (see Fig. 1) but it will be noted that the two pulleys are horizontally aligned at the only time they are operated, namely when the pulley 72 is in raised position, as shown in Fig. 4.

Attention is now directed to the mechanism for raising and lowering the clothes receptacle

4

and associated parts, which includes a primary operating lever 77 disposed diagonally within the frame A and fulcrumed thereto at 78. The shorter end of this lever is connected to the lower end of an operating rod 79 by a universal connection including a swivel piece 80 which can turn in the lever about a vertical axis 81 and has a transverse pivot connection 82 with the rod 78. The pin 81 projects downwardly to engage a switch 83 controlling the circuit to motor 76. At its upper end the rod 79 pivots at 84 to one arm of a bell-crank lever 85 as shown in Fig. 3 (the parts 84 and 85 being disconnected in Fig. 2), the other arm 86 of which has a handle projecting through a slot 87 for manual operation from the outer side of casing B (see Figs. 3 and 4). The lever 85 is fulcrumed at 88, to the housing, and it will be noted, with particular reference to Fig. 3, that when the handle 86 is shifted to either of its two extreme positions the pivot 84 will pass dead center with respect to axes 88 and 82, with a result that the primary lever 77 will remain locked in either of its two positions until manually released and again shifted by the hand lever 86.

The longer arm of the lever 77 is provided, intermediate its ends, with an enlargement containing a rectangular pocket 89 in which is placed a bearing block 90, the same having freedom for limited longitudinal movement in the pocket. The block is releasably retained by a cover plate 91 secured by stud bolts 92. The block supports a self-aligning end-thrust bearing 93, which embraces the lower, reduced end portion 48<sup>a</sup> of spindle 48. It will thus be evident that when the lever 77 is raised and lowered it will correspondingly raise and lower the spindle 48, with its supported clothes receptacle, and the bearing structure just described will eliminate all possibility of binding.

The extreme end of the long arm of lever 77 is pivotally connected, at 94, to the lower end of a bar 95, which is yieldably spring held downwardly, and toward the tub D by a spring 96. The upper end of the bar 95 is fixed in a block 97, which is guided in a U-shaped yoke 98 fastened on the tub and with its two arms extending therefrom (Figs. 2, 4, 5). The inner faces of the bracket arms are recessed to provide inwardly inclined surfaces 99, terminating at their lower ends in slots 100. The block 97 has oppositely extended lugs 101 adapted to be seated in the slots 100, when the block is in its lowermost position, thus preventing movement of the block in a direction away from the tub. When the block is raised, however, it is free to move outwardly, the lugs sliding up on the surfaces 99. Conversely, when the block is lowered the surfaces 99 guide the lugs 101 back into the slots 100.

The block 97 rigidly mounts and carries a gooseneck shaped nozzle 102 which extends up through a slot 103 in the casing B, and curves over the top of tub D and receptacle E so as to discharge into the latter. The nozzle 102 also serves as a pivot support, at 104, for a crescent shaped bracket 105 of a lid 106 for the receptacle E, this lid having a handle 107 by which it may be conveniently opened after the cover C has first been swung open.

The lid 106, it will be noted, does not cover the entire basket or receptacle E but is sectioned out to provide a segment shaped opening 108, the purpose of which will presently be set forth. It will also be noted that the nozzle has a pair

5

of laterally extended fingers 109 arranged to engage under the bracket 105 and lift the lid 106 in parallelism with the top of the clothes receptacle, as shown in Fig. 4, when the block 97 is raised by bar 95. The purpose of this is to prevent contact between the lid and the receptacle when the latter is spun to dry the clothes therein. The nozzle may also be provided with a rest 110 which the bracket 105 may contact to support the lid when it is swung open. When the nozzle is in its lowermost position the fingers 109 will disengage the bracket 105 so that the lid can rest on the flange 69 of the receptacle (Figs. 1 and 2).

The nozzle element 102 extends below block 97 where it is connected to the upper end of a flexible supply hose 111, and the lower end of this hose attaches to the outlet side of a pump and valve assembly unit G.

The assembly G includes a centrifugal pump 113, the inlet side 114 of which connects directly with the pipe 34, and which pump is driven by a motor 117, all as more fully detailed in my aforesaid application Serial No. 536,143.

#### Operation

To wash a batch of clothes the operator opens the cover C and lid 106. Then with the receptacle E in its lower position a predetermined amount of water and soap is filled into the tub, the water level coming substantially to the top of basket E and within and outside thereof. If desired the fluid may then be circulated to dissolve the soap before the clothes are placed in the basket. In any event after the clothes or other articles to be laundered are inserted the lid and cover are closed, and the motor 117 is energized to start the pump 113.

The fluid in tubular members 38, 37, 36, 35 and 34 is then introduced into pump 113 from which it is expelled and forced up through hose 111 to nozzle 102. The nozzle is so shaped and arranged that it will discharge against the inner surface of the receptacle wall, as suggested in Figs. 1 and 2, and thereby create a strong down current at this side resulting in a rotary circulation in a generally vertical plane within the basket, as indicated by the arrows in Fig. 2. It should be noted that the nozzle is not directed into the clothes mass proper and does not play directly on the articles under treatment. It does, however, create a strong and concentrated down current immediately below the nozzle and it is found that as the clothes approach this area, by the spread and slower moving current into which the initial spray has been dissipated, the articles are virtually separated from each other, and with comparative violence are speedily forced down toward the bottom of the basket where they take a following position with respect to the clothes mass in advance. The turbulence thus produced does not result in tangling the clothes as is found when the nozzle is otherwise positioned. It is also important that the nozzle tip be in a correct vertical position with respect to the liquid surface and it is found that it functions best if extended approximately an inch therebelow. A higher position, and particularly if spaced above the water level, produces undesirable aeration and surplus froth or suds; while a lower position permits the water mass resistance to too quickly dissipate the force of the nozzle spray.

The lid 106 plays an important part in the washing operation and particularly since without

6

it there is a decided tendency for aeration to produce too great a volume of frothy or foamy suds. Since this lid contacts the water surface, however, it is found that foaming is reduced to a minimum, and the water surging upwardly into contact with the lid moves toward the opening 108 practically free of this objection.

As the volume of water exceeds the capacity of the receptacle E it escapes up through the opening 108 and over flange 69 into the space between the tub and the receptacle from which it drains through port 38 and circulates back to and through the pump. Any water escaping into the trough 30 will also return to the inlet side of the pump. It may be noted, however, that there will be no appreciable escape of fluid down through connection 32 during the washing operation. Some may seep through under the plate 59 as it is not intended, or necessary, that the plate contact there be absolutely tight. And since the rim 71 establishes substantial contact with the tub, below flange 26, the space between walls 22 and 65 will be practically dead, so there will be no circulation through perforations 66 when the receptacle is down.

When the washing operation has been completed the motor 117 is de-energized to stop the pump 113, and at such time the clothes may be inspected to determine if they are sufficiently clean or if further washing is necessary. In any event when cleansing is found to be satisfactory the tub is quickly drained under pump action, as more fully explained in my parent application.

To assist in draining off all the wash water the handle 86 is depressed to lift the basket and start the spinning motor 76. As the water level lowers and the clothes settle to the bottom of the basket the fluid is quickly expelled, and since receptacle wall 67 flares downwardly the tendency is for any moisture above the level of rib 71 to move down toward the perforations 66.

To rinse the clothes it is only necessary to restore the various parts to their initial positions and fill in clear water which is then circulated through the clothes in an identical manner, after which it, too, is drained off to leave the clothes ready for drying.

Drying the clothes is done by centrifuging in well known manner, and the mechanism here employed is operated as follows: The rinse water is drained off in the same manner as the wash water except that it is continued beyond the point of merely removing the free moisture. In fact by continuing the spinning practically all the water is removed so that the clothes are substantially moisture free.

It should here be noted that when the handle 86 is manipulated to raise the lever 77 the clothes receptacle will not only be raised in the tub, so as to free the rib 71 from frictional contact with the tub wall 22, but because of the relative remoteness of pivot 94 from fulcrum 78, the bar 95 will be raised a greater distance (than the basket) and consequently the nozzle 102 will be raised entirely clear of the receptacle E, as will also the lid 106, then resting on fingers 109. As a result the receptacle will have no contact with any stationary element and can spin freely while remaining entirely enclosed.

When drying has been completed the lever 77 is again released to lower the basket and stop the motor 76. The cover C is then opened and the lid 106 is swung back to permit removal of the washed, rinsed, and dried articles.

Should it be necessary to remove the clothes

7

receptacle for repair, cleaning, lubricating, or other purposes, the lever 77 is first lifted, but with the motor disconnected from its current source, and when that is done the lugs 101 will be released from the notches 100 thus permitting the block 97 together with nozzle 102 and the lid to be moved to the left, as viewed in Fig. 4. If the receptacle core 80 does not then easily release from the socket 61 the release bolt 64 may be turned to do so.

It is understood that suitable modifications may be made in the construction and details of the machine, as thus described, without departing from the spirit and scope of the appended claims. Having now therefore fully disclosed my invention, what I claim to be new and desire to protect by Letters Patent is:

1. In a washing machine, a tub, a perforated clothes receptacle normally nesting in the tub, means for circulating water in the receptacle to wash clothes therein, means for raising the receptacle in the tub to clear it from frictional contact therewith, a lid for the receptacle, means operated by said receptacle raising means for lifting the lid from frictional contact with the receptacle, and means for spinning the receptacle.

2. In a washing machine, a tub, a vertically adjustable clothes receptacle in the tub, means for spinning the receptacle, a lid for the receptacle, and means for simultaneously lifting the receptacle in the tub and removing the lid from contact with the receptacle.

3. In a washing machine, a tub, a clothes receptacle in the tub and normally having wall contact therewith, a lid for the receptacle normally resting thereon, means for simultaneously breaking contact between the tub and receptacle

8

and between the receptacle and its lid to free the receptacle for spinning, and means for rotating the receptacle.

4. In a washing machine, a tub, a clothes receptacle in the tub, a nozzle for directing fluid under pressure into the receptacle and mounted for adjustment into and out of operative position, control means operative to produce rotation of the receptacle, and means connected with and for operation by the control means for adjusting the nozzle into and out of operative position.

5. In a washing machine, a tub, a clothes receptacle in the tub, a nozzle for directing fluid under pressure into the receptacle and mounted for adjustment into and out of operative position, control means operative to produce rotation of the receptacle, a lid for the receptacle, and means operated by the control means to remove the lid from contact with the receptacle when the latter is rotated.

ROLAND W. KNAPP.

## REFERENCES CITED

The following references are of record in the file of this patent:

## UNITED STATES PATENTS

Number	Name	Date
1,705,779	Nelson	Mar. 19, 1929
1,748,296	Lombard	Feb. 25, 1930
1,911,903	Kirby	May 30, 1933
2,050,431	Gubler	Aug. 11, 1936
2,095,505	Kirby	Oct. 12, 1937
2,200,870	Armbruster	May 14, 1940
2,300,214	Fleming	Oct. 27, 1942
2,313,634	Forney	Mar. 9, 1943
2,381,894	Ferris	Aug. 14, 1945