Dec. 16, 1947. J. B. KIRBY 2,432,766

APPARATUS FOR WASHING CLOTHES

Filed April 23, 1942 2 Sheets-Sheet 1

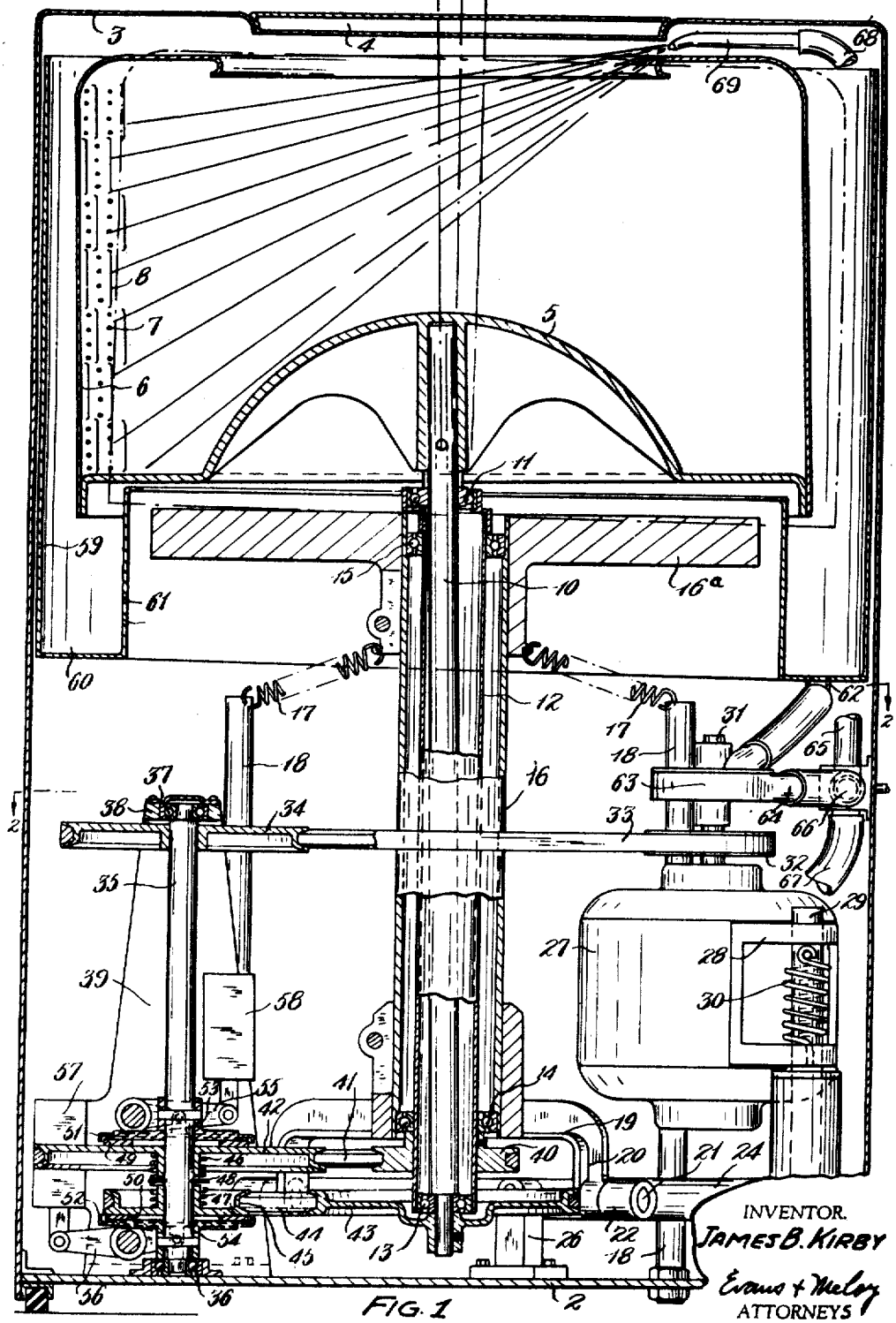

FIG. 1

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APPARATUS FOR WASHING CLOTHES

Filed April 23, 1942 2 Sheets-Sheet 2

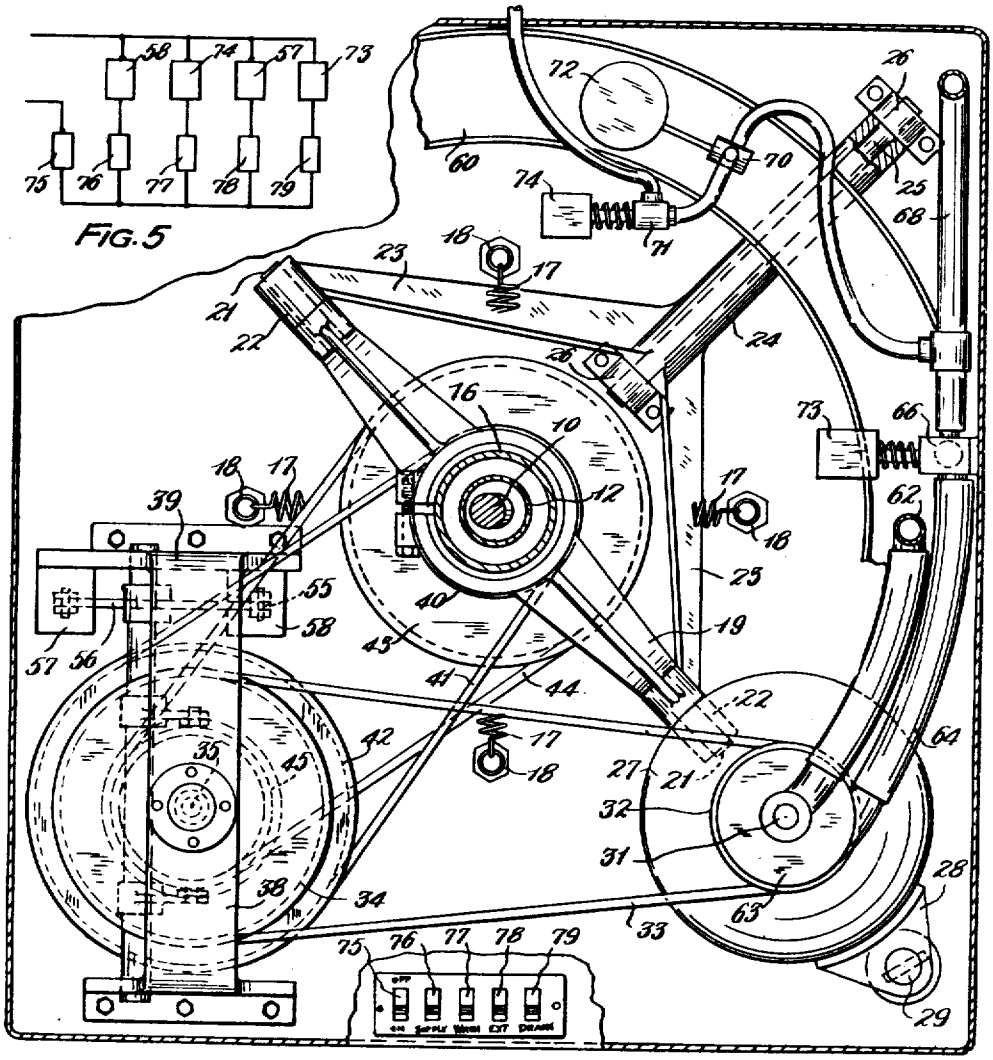

FIG. 5

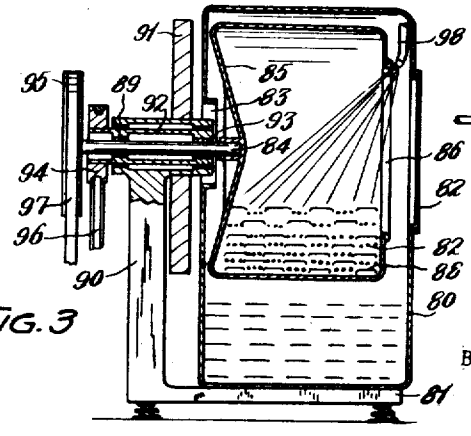

FIG. 3

FIG. 2

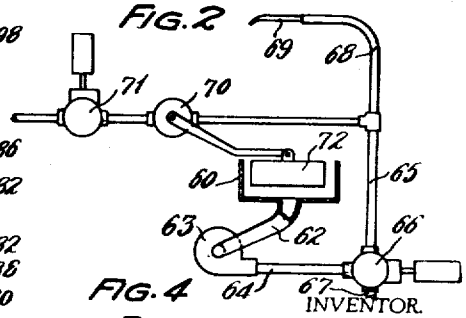

FIG. 4

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UNITED STATES PATENT OFFICE

2,432,766

APPARATUS FOR WASHING CLOTHES

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Application April 23, 1942, Serial No. 440,151

3 Claims. (Cl. 68—19)

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This invention relates to an improved apparatus for washing, rinsing and drying clothes. Numerous methods and combinations of methods have heretofore been proposed to effect the washing of clothes and recent developments have been directed toward a machine for domestic use in which the complete laundry operation comprising washing, rinsing and drying of the clothes is carried out in a single container so that the user of the machine is not burdened with the task of transferring the clothes from one container or machine to another between the washing, rinsing and drying phases of the laundry operation.

Such machines which are adapted to carry out all of the laundry operations in a single container are becoming known in the art as automatic machines inasmuch as they are particularly well adapted to be automatically controlled by timer mechanism, solenoids and the like to carry out the introduction of wash water, rinse water and effect the sequential operations of various mechanisms to automatically effect the complete laundry operation. Such machines ordinarily are designed with a view to duplicating washing, rinsing and extracting methods old in the art. For instance conventional automatic machines have an agitator or tumbling cylinder so as to wash the clothes. Thereafter the clothes are separated from the wash water by draining or by centrifugal extraction. Fresh rinse water is added and the clothes again agitated or tumbled to effect rinsing and thereafter the rinse water is removed from the clothes by draining and/or extracting and the clothes dried by centrifugal extraction or in some cases by pressure.

It will be appreciated from the above general reference to the prior art that in such automatic machines the washing action obtained either by an oscillating agitator or tumbling cylinder is the same washing action as that obtained in the old and well-known prior art machines. The rinsing also corresponds to the prior art methods of rinsing and the difference between the prior art and the automatic machines is directed to differences of structure which permit the draining or removal of the water from the clothes between laundry operations rather than the transfer of the clothes from a washing vat to a rinsing vat. Similarly the extracting method corresponds to prior art extraction and the difference again is one of structure which permits the centrifugal removal of the water from the same container which theretofore held the clothes for washing and rinsing.

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According to my invention it is proposed to wash, rinse and extract in a single container which may be subjected to the same mechanical movement throughout the washing, rinsing and extracting phases of the laundry operations. Generally speaking the method of washing which I have provided contemplates the utilization in combination of two forces, one force being gravity or centrifugal force and acting uniformly throughout the laundry operations and the other force being of an alternating character so that it becomes effective by reason of the differences in specific gravity between the clothes and water. More particularly, I have provided apparatus for washing clothes, wherein centrifugal force operates throughout the washing, rinsing and extracting operations to remove the water from the clothes centrifugally and that force which is alternating in character also operates throughout the washing, rinsing and extracting phases to separate the clothes from the water by taking advantage of the different inertia effects of the clothes and water.

Accordingly, it is among the objects of my invention to provide apparatus for washing clothes, in which centrifugal force is effective to distribute the clothes about the inner wall of a container and while the clothes are so distributed to rapidly oscillate or gyrate the container so that the impact of the container wall against the clothes moves the clothes inwardly away from the wall of the container and the water by its inertia is separated from the clothes.

It is a further object of my invention to provide apparatus in accordance with the preceding object, in which washing fluid and rinsing fluid are sequentially directed into the interior of the container so that the washing fluid and rinsing fluid progresses from the interior of the container through the clothes and thence to the wall of the container and thence to the exterior of the container, whereby there is a continuous movement of water through the clothes, and thence to the exterior of the container throughout the washing and rinsing phases of the laundry operation.

It is a further object of my invention to provide apparatus according to the preceding objects in which the flow of rinse water is terminated and the rinse water in the clothes removed therefrom by the same centrifugal force and inertia effects that were heretofore employed to effect a washing and rinsing.

It is a further object of my invention to provide apparatus for washing, rinsing and extract-

ing clothes in accordance with the preceding objects in which the clothes within the container are objected to a washing action by impact at the same time they are subjected to a washing action by the centrifugally responsive movement of water through the clothes and thereafter the clothes are subjected to a water removal action by impact at the same time they are subjected to water removal by centrifugal force.

Further objects and advantages relating to improved washability characteristics, simplicity in construction and economies in manufacture will appear from the following description and the appended drawings, wherein:

Figure 1 is a central vertical section through the combined washer and extractor embodying the invention;

Fig. 2 is a horizontal section taken on the broken line indicated at 2–2 in Fig. 1;

Fig. 3 is a vertical sectional view showing the modified embodiment of the invention;

Fig. 4 is a diagrammatic view showing the water circulating system; and

Fig. 5 is a wiring diagram showing a simple system of switch controlled solenoids for controlling the operation of the machine.

Generally speaking the apparatus to obtain the advantages and objects set forth comprises a perforated container that is provided with mechanism to rotate the container at a speed which is sufficient to cause the clothes to form a generally annular body adjacent the inner wall of the container. The container may be mounted on a vertical axis for rotation as in the preferred embodiment of Fig. 1 or on a horizontal axis as in the modified form of Fig. 3. The container also is provided with a mechanism which is adapted to cause the container to precess, oscillate or vibrate while it is being rotated. The size of the container and the speeds at which it is rotated and caused to precess, oscillate or gyrate may be varied within relatively wide limits, it being understood that with a larger diameter, a lower speed of rotation is effective to hold the clothes in an annular mass within the wall of the container than where a smaller diameter of container is employed.

The rate of precession, gyration or vibration of the container is preferably such that the container movement against the clothes therein will cause the inertia effect of the water in the clothes to overcome the capillary attraction of the clothes for the water and thus the clothes may be separated from the water.

With the above-described two motions imparted to the container, means is provided to sequentially introduce a soapy washing fluid to act on the clothes during the first phase of the laundry operation and a clear or non-detergent rinsing fluid to rinse the soapy water from the clothes after washing and thereafter terminate the flow of non-detergent fluid so that the clothes may be dried by the action of the two movements imparted to the container.

Various features disclosed herein, including the weight 16*a* or 91, and the mounting of the tube 16 or the standard 90, which are useful in other combinations than claimed herein, are claimed in my co-pending application Serial No. 725,032, filed January 29, 1947, which is in part a continuation of the present application.

In Figs. 1 and 2 of the accompanying drawings, an embodiment of the invention is shown in which a rectangular housing 1 has a base 2 which

provides a support for the mechanism, and a top 3 which is provided with a central removable closure member 4 through which clothes may be inserted or removed. All of the mechanism is supported solely by the base 2 so that the side and top walls of the housing are substantially free from vibration, and, since the housing walls carry only their own weight, they may be of very light construction. A clothes container 5 of the type commonly used in centrifugal extractors is mounted within the upper portion of the housing. Various forms of containers having a peripheral wall provided with liquid discharge passages may be used. As shown, the container 5 is provided with a peripheral wall 6 having discharge passages in the form of small openings 7 interspersed throughout its height and circumference, and short corrugations or ribs 8 extending vertically and projecting inwardly and also interspersed throughout the height and circumference of the wall. The low rounded ribs 8 provide a rubbing surface similar to that of a washboard. The container 5 is preferably provided with an arched bottom which serves to insure the movement of the clothes to the peripheral wall upon vibration of the container.

The container 5 is attached to the upper end of an upright supporting shaft 10 which is journaled immediately beneath the containers in a self-aligning ball bearing 11 which is eccentrically mounted in the upper end of an upright tubular shaft 12 which receives the shaft 10. The lower end of the shaft 10 is supported in a self-aligning ball bearing 13 mounted centrally in the lower end of the tubular shaft 12. The ball bearings 11 and 13 permit the shaft 10 to have a gyrating movement within the tubular shaft 12 when the shaft 12 is rotated. The tubular shaft 12 is mounted in ball bearings 14 and 15 adjacent its lower and upper ends in a tube 16 which carries a disc-shaped weight 16*a* at its upper end, which is normally held in horizontal position by means of a series of coil springs 17 attached at spaced points to the periphery of the weight 16*a* and to the upper end of posts 18 extending upwardly from the base 2. The lower end of the tube 16 is mounted in a universal support which will permit lateral movements of the tube 16 and gyratory movements of the tubular shaft 12 which is yieldingly held in upright position by the springs 17. The lower end of the tube 16 is secured to a cross bar 19 which has downturned end portions 20 provided with outwardly projecting aligned pivot pins 21. The pivot pins 21 are journaled in bearings 22 in the outer ends of diametrically opposite arms 23 which are attached to a sleeve 24 rotatably mounted upon a horizontal shaft 25 disposed at right angles to the axis of the pivot pins 21 and mounted in supporting brackets 26 attached to the base 2.

An electric motor 27 is mounted with its axis disposed vertically by means of a bracket 28 attached to the periphery of the motor housing and supported on a vertical pivot pin 29. A coil spring 30 is attached at one end to the supporting post and at the opposite end to the bracket 28 so as to exert a force tending to swing the motor in one direction about its pivot. The motor 27 is provided with a vertical shaft 31 upon which a pulley 32 is mounted above the motor. The pulley 32 receives a belt 33 which extends over the pulley 32 and over a pulley 34 on a countershaft 35. The countershaft 35 is mounted on lower bearings 36 on the base 2 and in upper bearings 37 mounted in a horizontal cross bar 38

forming the top of a U-shaped bracket 30 attached to the base 2. The countershaft 35 is driven by the motor 27 through the belt 33 and the spring 30 serves to maintain the tension of the driving belt 33. The tubular shaft 12 is provided with a pulley 40 attached to its lower end below the bearing 14 and supporting cross bar 19, and this pulley receives a belt 41 which extends over the pulley 40 and over a pulley 42 on the countershaft 35. The shaft 10 has a pulley 43 attached to its lower end below the lower end of the tubular shaft 12, which receives a belt 44 which runs over the pulley 43 and over a pulley 45 on the countershaft 35 below the pulley 42. The tubular shaft 12 and the shaft 10 may be continuously driven from the countershaft 35 by means of the belts 41 and 44. The pulleys 42 and 45 are preferably loosely mounted on the shaft 35 and suitable friction clutches are provided for connecting these pulleys to the shaft. The pulley 42 is pressed upwardly by means of a spring 46 and the pulley 45 is pressed downwardly by means of a spring 47, a disc 48 attached to the shaft 35 being interposed between the springs 46 and 47. The pulley 42 has a friction shoe 49 on its upper face and the pulley 45 has a friction shoe 50 on its bottom face. A clutch disc 51 is attached to the shaft 35 above the pulley 42 and a second clutch disc 52 is attached to the shaft 35 below the pulley 45. Upper and lower shifter rings 53 and 54 are engageable with the pulleys 42 and 45 outwardly of the peripheries of the discs 51 and 52 and these shifter rings are operated by levers 55 and 56 which are operated by suitably controlled solenoids 57 and 58 to engage or release the clutches. The action of the rotating tubular shaft 12 in imparting gyratory movement to the shaft 10 and orbital movement to the container 5 tends to impart a gyratory movement to the shaft 12. The heavy disc 16a by reason of its inertia reduces the amplitude of lateral movement of the upper end of the shaft 12 as the speed or rotation of the shaft 12 increases. It is desirable that the container be of light weight to avoid excessive gyratory movement of the shaft 12, and the container is preferably formed of a light weight metal such as aluminum.

The relatively long cross bar 19 and the long diverging arms 23 forming the universal support for the tubular shaft 12 and shaft 10 provide ample room for driving pulleys beneath the cross bar 19, and since the pivotal axis provided by the pivots 21 and shaft 25 are substantially in the plane of the lower pulley 43, the pulleys 40 and 43 will have a minimum of rocking movement due to oscillatory movements of the sleeve 12. When the shaft 10 and tubular shaft 12 are simultaneously driven the container 5 is continuously rotated about its axis by the shaft 10 and it has a simultaneous orbital movement by reason of the rotation of the tubular shaft 12 which carries the eccentrically mounted bearing 11 for the upper end of the shaft 10. The relative sizes of the driving pulleys are preferably such that the R. P. M. of the tubular shaft 12 is several times that of the shaft 10 and the container has several orbital rotations about a short radius during each revolution. The orbital rotation of the container 5 effects a lateral vibratory oscillating movement during rotation of the container which causes the clothes to slap against the wall and, since the direction of orbital movement is alternately in the direction of peripheral movement and in the opposite direction, the peripheral speed of the wall 6 is alternately accelerated and retarded,

causing a rubbing action between the clothes and wall 6. The periodic acceleration and retardation and the inward and outward movements of the peripheral wall against which the clothes are held by centrifugal force due to the orbital movement of the container causes a rapid vibratory movement of the container wall with respect to the clothes which rub and slap against the wall.

The container 5 is mounted within an annular casing 59 which has a cylindrical wall extending to the top of the container 5 and which is provided with a circular trough 60 which underlies the peripheral portion of the container 5, the trough being provided with an inner flange 61 which underlies the bottom of the container 5. A drain pipe 62 connects the bottom of the trough 60 with the inlet of a pump 63 mounted on the motor shaft 31 above the pulley 32. The pump 63 has a peripheral outlet 64 which connects with a vertical pipe 65 provided with a two-way valve 66 which is adapted to connect the outlet 64 with a downwardly extending drain portion 67 of the pipe or with an upwardly extending portion 68 which terminates in a horizontal discharge nozzle 69 which is positioned to direct a stream of water across the open upper end of the container 5 and against the clothes on the peripheral wall 6 of the container. A water supply pipe 69 is attached to the pipe 68 and is controlled by valves 70 and 71.

In the operation of the machine the clothes are placed in the receptacle 5 with sufficient soap or other detergent for the washing operation, the motor 27 is started into operation, and when up to speed the clutch solenoids 57 and 58 are operated either simultaneously or successively to connect the motor to the supporting shaft 10 and tubular shaft 12 to rotate the container 5 about its axis and orbitally. The valve 70 is operated to admit hot water to the pipe 68 and the valve 66 is operated to connect the pump outlet 64 with the pipe 68 and nozzle 69. A float 72 in the trough 60 operates to close the valve 70 when the liquid in the trough 60 rises to a predetermined height. After the valve 70 is closed the wash water is circulated by the pump 63. After the washing operation has continued for a sufficient length of time the valve 66 is operated to connect the pump outlet 64 to the drain pipe 67, which will cause discharge of the wash water into the drain. As the water level in the trough 60 falls, the float 72 falls, opening the valve 70 to supply water to the nozzle 69 to rinse the clothes. After the rinsing operation has continued for a sufficient length of time, the valve 71 is closed and continued rotation of the container will dry the clothes.

Any suitable manual or automatic control may be provided for the motor clutches and valves. As herein shown the valve 66 and 71 are provided with operating solenoids 73 and 74 and suitable switches 75, 76, 77, 78 and 79 are provided for controlling the motor 27 and solenoids 58, 74, 57 and 73 as shown in Fig. 5. The valve 66 may be normally held in the position in which it connects the pump outlet 64 to the drain 67 and shifted when the solenoid is energized to the position in which the outlet 64 is connected to the nozzle 69. The valve 71 may be normally closed and opened by energization of the solenoid 74.

In Fig. 3 of the drawings a modified embodiment of the invention is shown. In this modification a housing 80 is mounted upon a supporting frame 81 and is provided with a front closure

82 through which the clothes may be inserted and removed. The housing has a smaller opening 83 in its rear wall through which extends a horizontal shaft 84 which supports a cylindrical container 85 which has a central opening 86 at its front end aligned with the front closure 82. The peripheral wall of the container 85 has perforations 87 and short ribs 88 against which the clothes are adapted to rub during the washing operation. The shaft 84 is supported in a bearing 89 at the upper end of a standard 90 forming part of the supporting frame, and upon this bearing adjacent the standard there is mounted a disc-like weight 91 which serves to dampen vibrations in the frame. The shaft 84 is journaled eccentrically in a tubular shaft 92 which is rotatably mounted on the bearing portion 89 of the standard, the tubular shaft 92 having bearings 93 in which the shaft 84 is mounted. Pulleys 94 and 95 are mounted on the shaft 84 and tubular shaft 92 rearwardly of the standard 90 and these pulleys are driven from a suitable driving mechanism by means of belts 96 and 97. The belt 96 imparts continuous rotation to the container 85 and the tubular shaft 92 driven by the belt 97 imparts a continuous orbital movement to the container. As in the modification first described, the orbital movement of the container causes periodic acceleration and retardation of the peripheral speed of the container wall against which the clothes are held by centrifugal force, causing vibratory movement of the container with respect to the clothes and a scrubbing action of the clothes against the ribbed interior surface of the container.

As in the modification first described, the operation is controlled by controlling the delivery of water to the clothes receptacle. The wash water discharged from the container may be collected in the housing 80 and pumped back into the container through a nozzle 98. The pump, water delivery and drain connections are not shown but it will be readily apparent that these parts may be substantially like the corresponding parts shown in Figs. 1 and 2.

The control of the water supply to the nozzle 69 insures delivery of water to the clothes at a rate not greatly in excess of the rate of extraction, so that during the washing operation the clothes are sufficiently saturated with water to provide lubrication films of water upon the exterior of pieces of fabric which prevent sticking of the pieces of fabric together and the sticking of the pieces of fabric to the container wall. The rapid oscillating movements of the container maintain the clothes in a state of quivering motion so that the pieces of fabric scrub and slap against each other and against the container wall during the washing operation. This continuous flow of liquid through the quivering mass of clothes effects a very rapid cleansing action.

The inward movement of the clothes due to the lateral movement of the container with respect to its vertical axis, causes the clothes to be quickly and violently separated from the fluid contained therein by reason of the inertia of the fluid. The fluid as soon as freed from the fabric responds to the centrifugal force in the system and is expelled through the perforations of the container. Immediately following an inward movement of the clothes they respond to centrifugal force again and are moved outwardly where they are again subjected to the violently moving wall of the container. Thus additional fluid is removed from the clothes by impact and

centrifugal force as the clothes hit the wall of the container and travel outwardly. For force rotating speed and the oscillating speeds are preferably so selected that the clothes appear to be an annulus spaced inwardly from the wall of the container and suspended in this space by the constant impacting action of the inner wall of the container.

The slapping actions of the pieces of fabric against one another and against the container wall during rotation of the container prevent compacting of the clothes against the wall by centrifugal force, lessens the tendency of the fabric to retain liquid by capillary action, so that less centrifugal force is required for extraction, and the extractor may be operated at less speed.

It will be apparent that the present invention provides an extremely rapid washing operation and also rapid rinsing and drying operations, which are controlled solely by the manipulation of valves controlling the delivery of washing and rinsing liquids to the clothes container.

It is to be understood that variations and modifications of the specific devices herein shown and described for purposes of illustration may be made without departing from the spirit of the invention.

What I claim is:

1. A washing machine comprising a clothes container, a shaft supporting said container, a tubular shaft encircling the supporting shaft, an eccentric bearing continuously disposed between the supporting shaft and the tubular shaft, means for driving the supporting shaft to rotate the container, means for driving the tubular shaft at an R. P. M. substantially in excess of the R. P. M. of the supporting shaft to impart an orbital movement to said container, and means for concurrently driving the supporting shaft and tubular shaft at such speeds that the container will move several times in an orbital path during each revolution thereof about its axis.

2. A washing machine comprising a clothes container, a shaft supporting said container, a tubular shaft encircling the supporting shaft, an eccentric bearing continuously disposed between the supporting shaft and the tubular shaft, means for driving the supporting shaft to rotate the container, means for driving the tubular shaft at an R. P. M. substantially in excess of the R. P. M. of the supporting shaft to impart an orbital movement to said container, means for concurrently driving the supporting shaft and tubular shaft at such speeds that the container will move several times in an orbital path during each revolution thereof about its axis, and a weight mounted to move laterally with said tubular shaft adjacent the container base for resisting lateral movements of the tubular shaft.

3. A washing machine comprising a clothes container, a shaft supporting said container, a tubular shaft encircling the supporting shaft, an eccentric bearing continuously disposed between the supporting shaft and the tubular shaft, means for driving the supporting shaft to rotate the container, means for driving the tubular shaft at an R. P. M. substantially in excess of the R. P. M. of the supporting shaft to impart an orbital movement to said container, means for concurrently driving the supporting shaft and tubular shaft at such speed that the container will move several times in an orbital path during each revolution thereof about its axis, an outer non-rotatable tube rotatably supporting the

tubular shaft coaxially therewith, a disc shaped weight coaxially fixed to the tube adjacent the container base, and spring means yieldingly resisting lateral movements of the tube.

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REFERENCES CITED

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

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Number	Name	Date
1,683,555	Rankin	Oct. 23, 1928
300,545	Wiegand	June 17, 1884
1,618,779	Pleister	Feb. 22, 1927
2,268,204	Dunham	Dec. 30, 1941
1,710,095	Lamb	Apr. 23, 1929
1,602,138	Wappat	Oct. 5, 1926
1,834,829	Ditzler	Dec. 1, 1931
Re. 7,455	Fesca	Jan. 2, 1877
695,158	Lafferty	Mar. 11, 1902
309,826	Dolph et al.	Dec. 30, 1884
2,137,540	Motycka	Nov. 22, 1938
2,265,516	Chayie	Dec. 9, 1941
1,234,498	Seymour	July 24, 1917
1,330,801	Greenberg	Feb. 17, 1920
1,896,064	Boyar	Feb. 7, 1933
2,350,218	De Remer	May 30, 1944

Certificate of Correction

Patent No. 2,432,766. December 16, 1947.

JAMES B. KIRBY

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 2, line 52, for the word "heretofore" read *theretofore*; column 3, line 3, for "objected" read *subjected*; column 7, line 51, for "lubrication" read *lubricating*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of March, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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[SEAL]

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