May 23, 1950 J. E. HOVERMALE 2,508,948

WASHING MACHINE

Filed Jan. 22, 1946 5 Sheets-Sheet 1

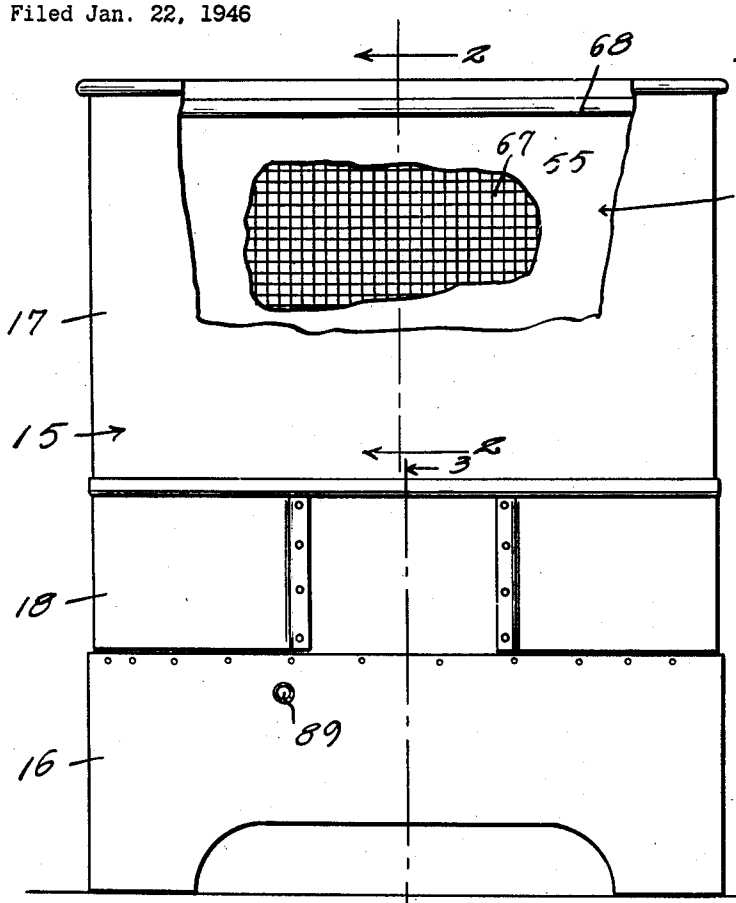



Fig. 1.

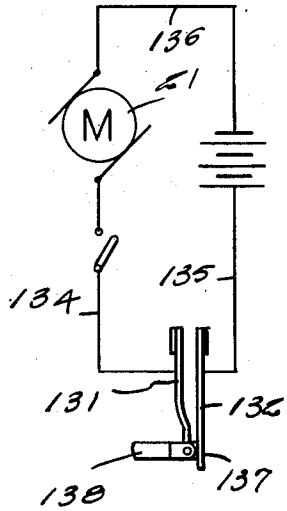



Fig. 10.

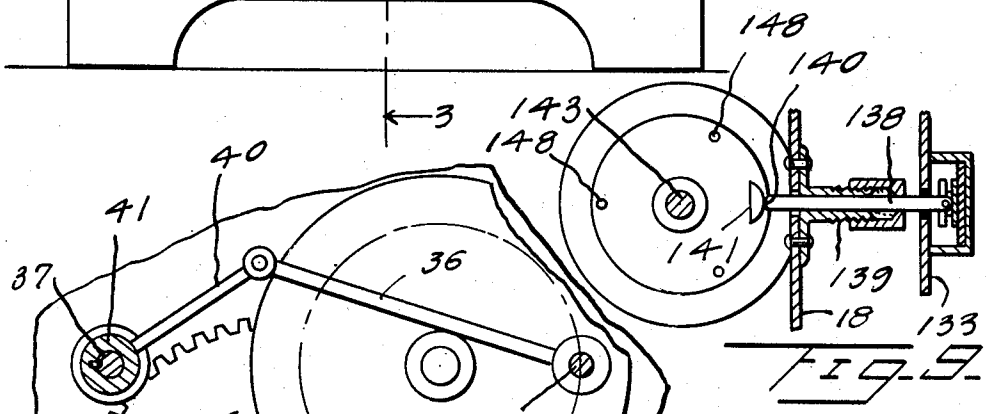



Fig. 9.




Fig. 8.

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WASHING MACHINE

Filed Jan. 22, 1946 5 Sheets-Sheet 2

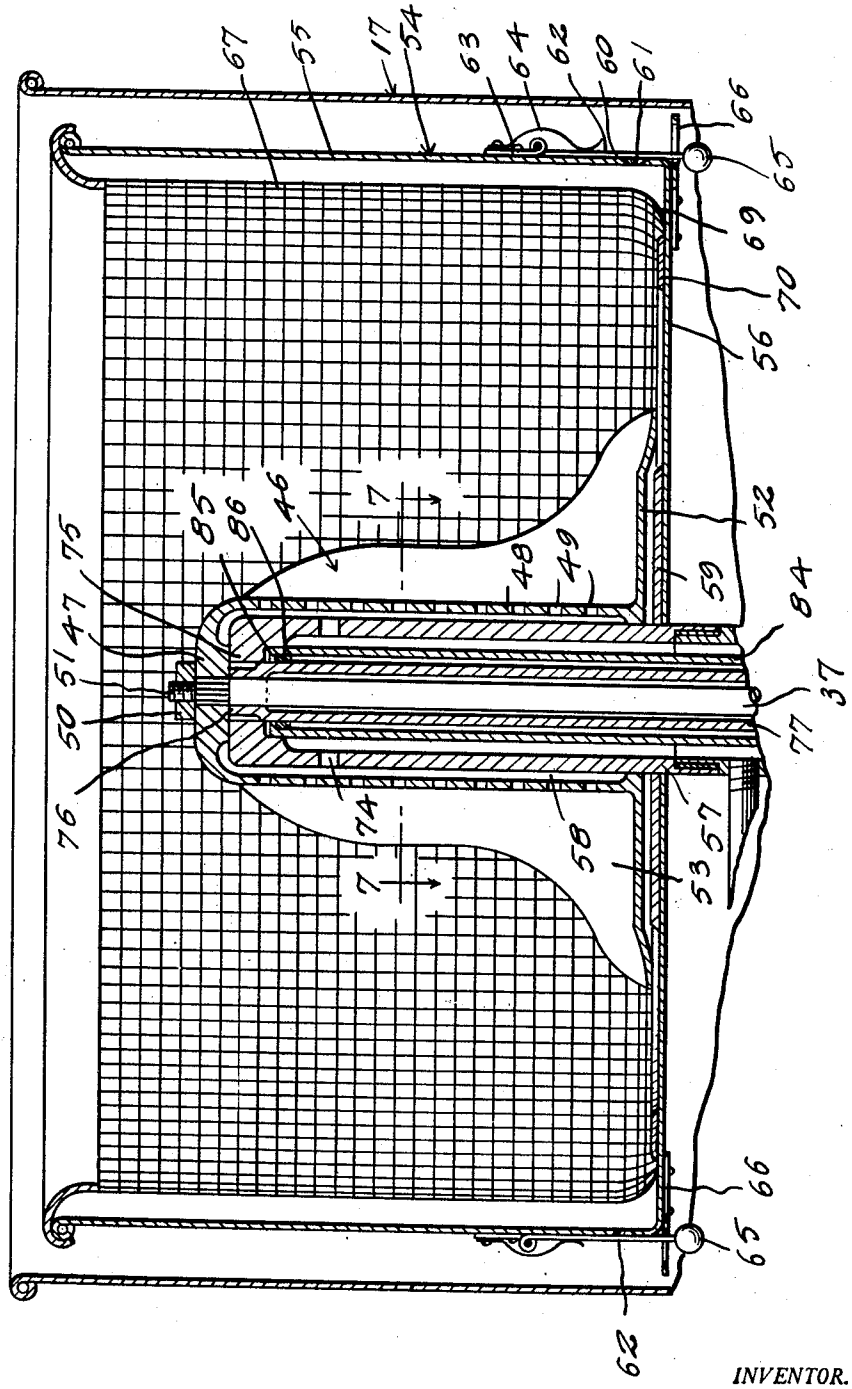



FIG. 2.

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WASHING MACHINE

Filed Jan. 22, 1946 5 Sheets-Sheet 3

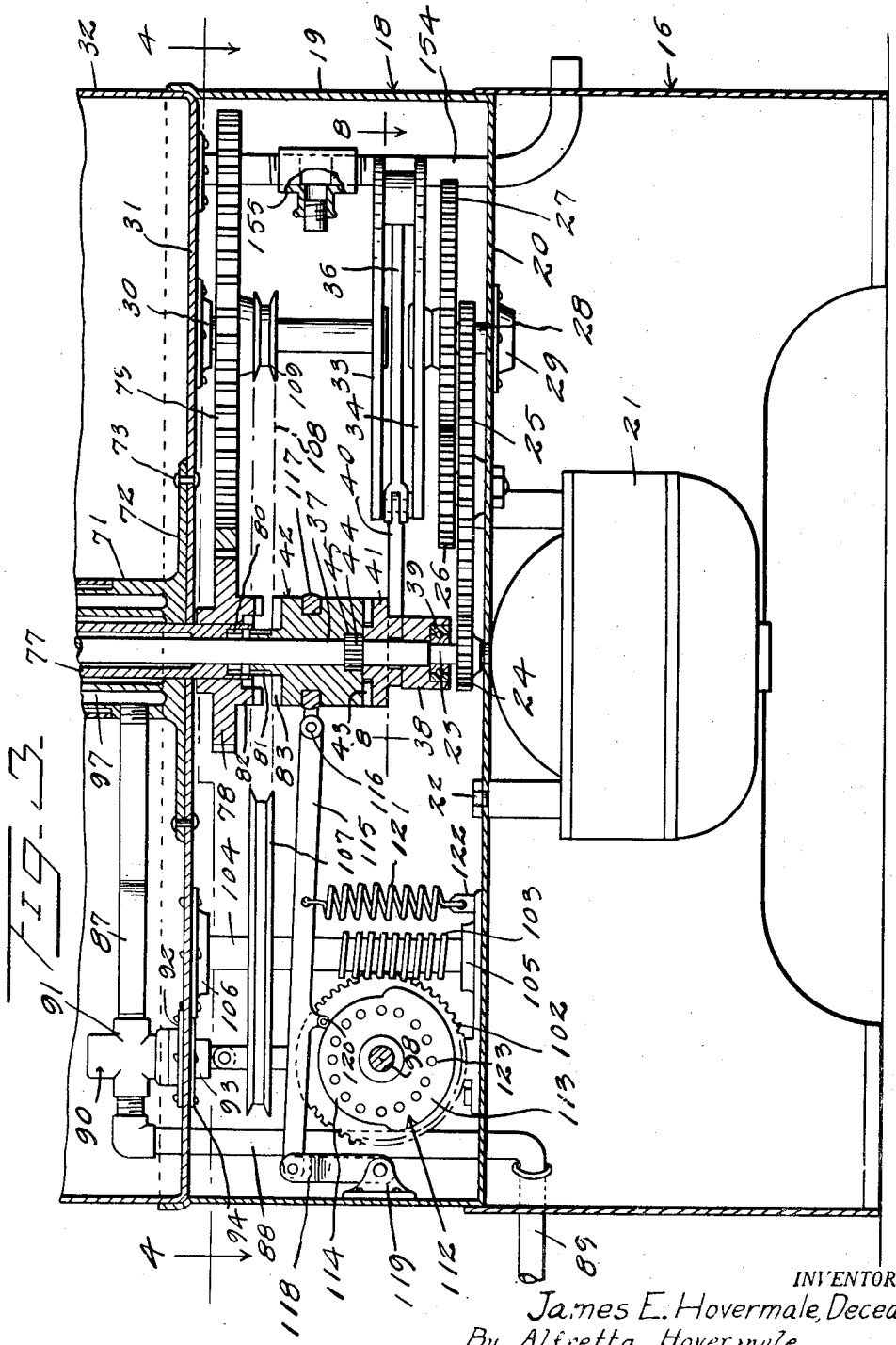


FIG. 3.

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WASHING MACHINE

Filed Jan. 22, 1946 5 Sheets-Sheet 4

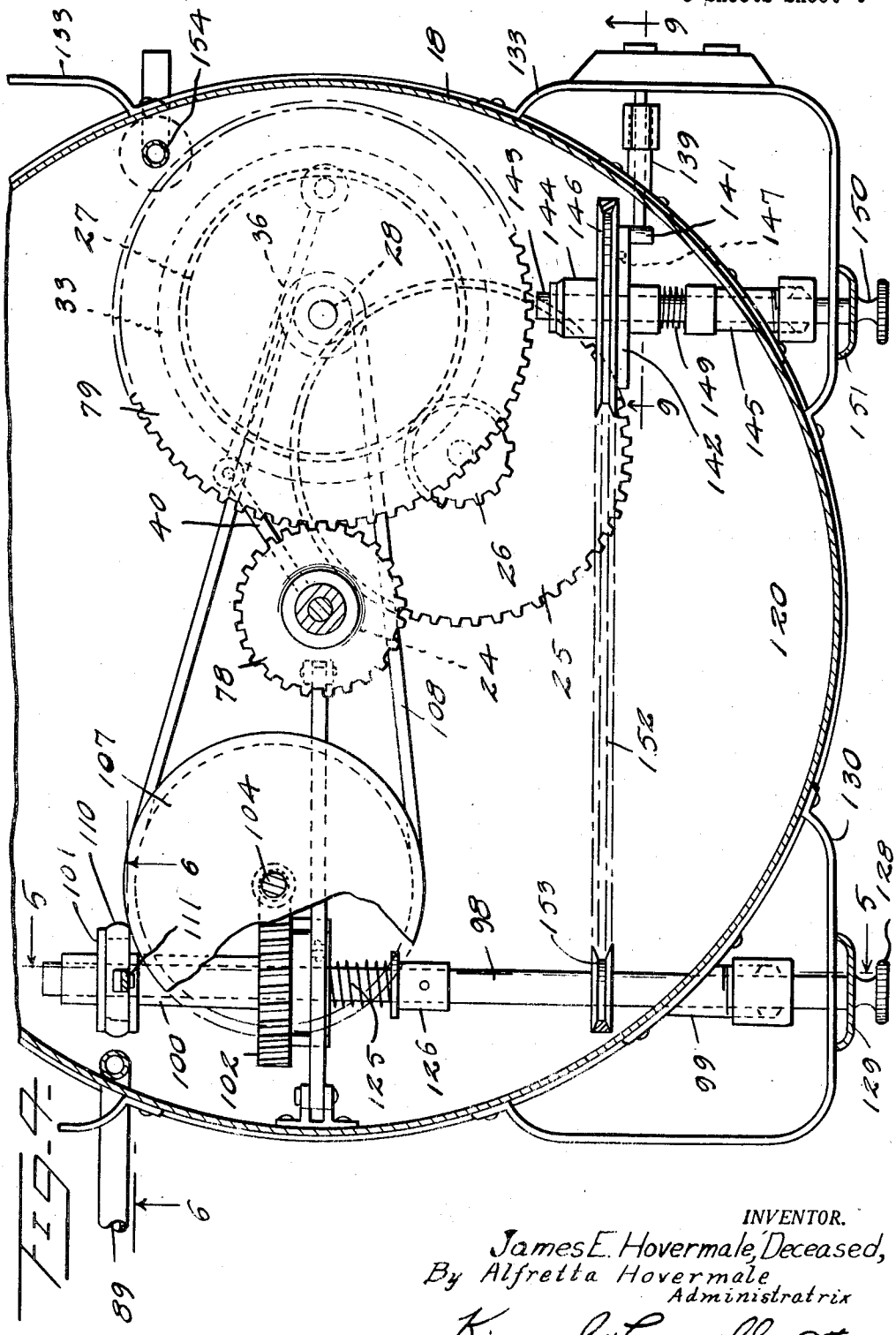



FIG. 4.

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WASHING MACHINE

Filed Jan. 22, 1946 5 Sheets-Sheet 5

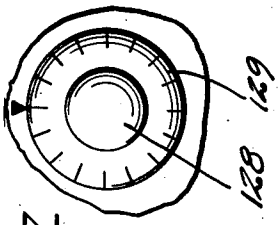



FIG-11

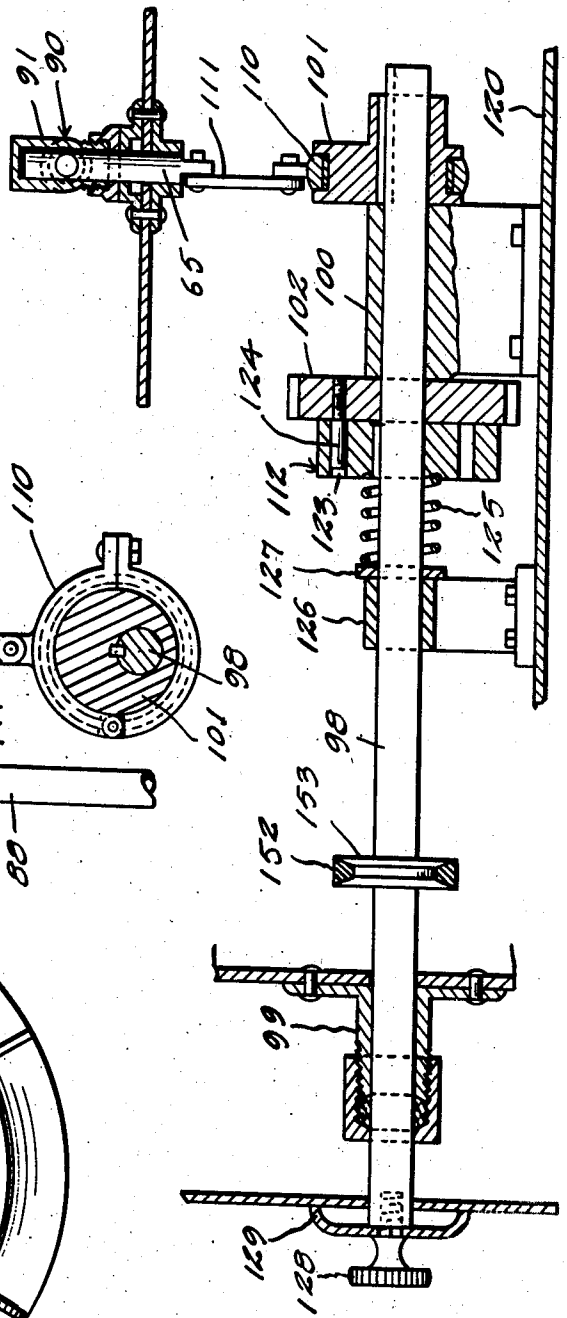



FIG-6

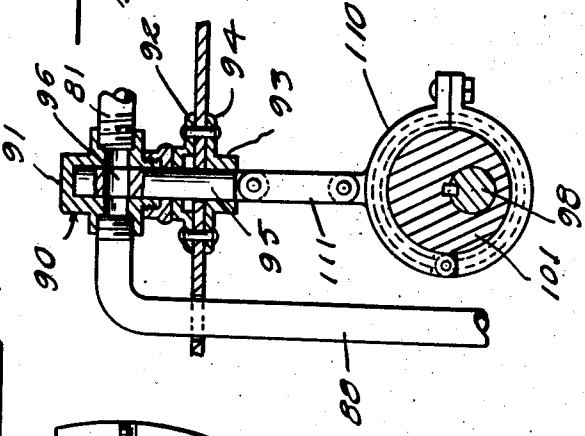



FIG-5

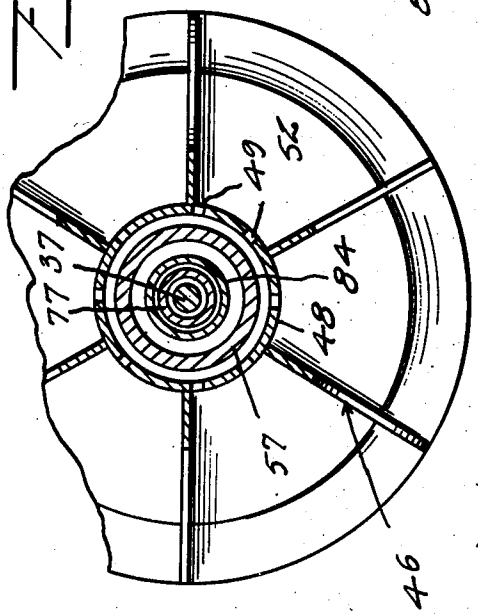



FIG-7

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Patented May 23, 1950

2,508,948

# UNITED STATES PATENT OFFICE

2,508,948

## WASHING MACHINE

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Application January 22, 1946, Serial No. 642,735

4 Claims. (Cl. 68—12)

1

This invention relates to washing machines.

An object of this invention is to provide a washing machine which is automatically operable and which can be regulated in its operation to provide for the timed washing of the articles and the subsequent rinsing and wringing thereof.

Another object of this invention is to provide a device of this kind which can have the cycles thereof readily changed, so that different kinds of articles may be cleaned in the proper manner for such articles.

A further object of this invention is to provide a washing machine which includes centrifugally operated drain valves for the tub, so that these valves will be normally maintained in closed position during the normal washing and rinsing operation, but will be moved to open position during the wringing operation.

A further object of this invention is to provide a washing machine of this kind, which includes means not only for effecting cyclic operation of the machine to provide for washing, rinsing and wringing of the article, but also for cutting off the operation of the motor when the necessary cycles have been completed.

To the foregoing objects and others which may hereinafter more fully appear, the invention consists of the novel construction, combination and arrangement of parts, as will be more specifically referred to and illustrated in the accompanying drawings, but it is to be understood that changes, variations, and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a detail side elevation, partly broken away, of a washing machine constructed according to an embodiment of this invention.

Figure 2 is a fragmentary sectional view taken on the line 2—2 of Figure 1 showing the tub construction.

Figure 3 is a fragmentary sectional view taken on the line 3—3 of Figure 1 showing the driving mechanism.

Figure 4 is a fragmentary sectional view taken on the line 4—4 of Figure 3 showing the driving mechanism.

Figure 5 is a fragmentary sectional view taken on the line 5—5 of Figure 4 showing the valve regulating mechanism.

Figure 6 is a fragmentary sectional view taken on the line 6—6 of Figure 4 showing the water supply valve.

Figure 7 is a fragmentary sectional view taken on the line 7—7 of Figure 2 showing the agitator and supporting post.

Figure 8 is a fragmentary sectional view taken on the line 8—8 of Figure 3 showing the oscillating mechanism.

Figure 9 is a fragmentary sectional view taken on the line 9—9 of Figure 4 showing the motor regulating switch.

2

Figure 10 is a diagrammatic view of electric circuit connected to the motor.

Figure 11 is a fragmentary side elevation of the cycle adjusting member for the machine.

Referring to the drawings, the numeral 15 designates generally a cabinet, which includes a cylindrical base 16, an upper cylindrical member 17, and an intermediate housing 18.

The intermediate member 18 comprises a cylindrical side wall 19 and a bottom wall 20. A motor 21 is dependingly secured in the center of the bottom wall 20 by fastening members 22. The motor 21 includes a shaft 23, having a small gear 24 secured thereto. A large reduction gear 25 is rotatably carried by the bottom wall 20 and meshes with pinion 24. A small gear 26 is fixed relative to the large gear 25 and meshes with another large gear 27, which is secured to a crank shaft 28. The crank shaft 28 is vertically disposed, being journalled in bearings 29 and 30, the latter bearing being carried by a bottom wall 31 formed as part of the upper member 17. The upper member 17 also includes a cylindrical side wall 32, which may be formed integral with the bottom wall 31.

The crank shaft 28 includes a pair of spaced apart plates 33 and 34, having an offset shaft 35 disposed therebetween, and with which is connected one end of a pitman, or link, 36. A vertically disposed agitator operating shaft 37 is disposed in axial alignment with the motor shaft 23, being journalled in a bushing 38, extending upwardly from the motor shaft 23. Preferably an anti-friction bearing 39 is mounted in the bushing 38, and provides a means whereby the motor shaft 23 may be rotated independently of the bushing 38.

The link or pitman 36 has pivotally connected thereto a lever, or arm, 40, which is pivotally mounted on the shaft 37. The lever 40 has fixed relative thereto one element 41 of a toothed clutch, which is adapted to be engaged by the toothed lower end of a clutch collar 42, slidable on the shaft 37. The clutch collar 42 is formed with lower clutch teeth 43 for engagement with the teeth of clutch member 41, so that clutch member 42 will oscillate with the oscillation, or rocking, of the lever 40. In order to provide for the oscillation of shaft 37 with the oscillation, or rocking, of lever 40, the shaft 37 is provided with clutch teeth, or splines, 44 adjacent the clutch member 41, and the clutch member 42 is formed with a lower clutch element 45, engageable with the splines, or clutch member, 44.

Preferably the complementary clutch members 44 and 45 are of such length that these members will be initially engaged so as to lock the clutch collar 42 to the shaft 37 before the teeth 43 engage with the complementary teeth of clutch element 41. The shaft 37 has secured to the upper end thereof an agitating member, generally designated as 46, which is secured to the shaft 37

by providing complementary splines on the upper end of the shaft 37 and in a cap or top wall 47, which is carried by the agitator 46. The agitator 46 includes a sleeve 48 formed with a plurality of openings 49 through which water may be forced, and the cap or top wall 47 is secured to the shaft 37 by means of a nut 50 threaded onto a stud 51, carried by the upper end of shaft 37.

The agitator 46 includes a lower annular plate 52 and a plurality of radially arranged agitating blades 53 formed integral with the plate 52 and with the hub, or sleeve, 48.

A tub, generally designated as 54, is mounted within the upper housing member 17 and includes a cylindrical side wall 55 and a bottom wall 56. The bottom wall 56 is secured to a hollow shaft 57, which is disposed interiorly of the sleeve 48, and preferably there is a space 58 between the inside of the sleeve 48 and the hollow shaft 57. The shaft 57 has extending therefrom a flange 59, which may be secured in any suitable manner to the inside of the bottom wall 56 of the tub 54. The tub 54 is formed with a plurality of openings 60 in the side wall 55 thereof adjacent the lower end of the side wall, and the openings 60 are normally closed by means of closure members 61 carried by rock levers 62.

Rock levers 62 are rockably secured, as at 63, to the outer side of the side wall 55 and a spring 64 engages the lever, or closure carrier, 62 so as to normally hold the plug 61 in closed position. A weight 65 is carried by the lower end of the lever 62 and is disposed below a loop, or keeper, 66, which is fixed to the bottom wall 56 and extends outwardly of the side wall 55. The weight 65 provides a means whereby the plug 61 may be centrifugally moved to open position during the rapid rotation of the tub 54, so as to provide for draining of the water from the tub.

A perforate basket, or inner perforate tub, 67 is disposed within the tub 54 and is formed with an upper rim 68 which may be crimped, or otherwise extended over the upper edge of the side wall 55 of the tub 54. The lower end of the perforate inner tub member 67 is bent inwardly, as at 69, and is secured to the bottom wall 56 by means of a ring 70. The perforate inner tub 67 is adapted to rotate and move with the imperforate tub 54. The lower end of the hollow shaft 57 is rotatably carried by a hollow bushing 71 formed with a base plate 72, which is fixed by fastening members 73 to the bottom wall 31 of the upper cabinet 17. The hollow shaft 57 is provided with openings 74 communicating with the space 58, the purpose of which will be hereinafter described. The hollow shaft 57 includes a top wall 75, which is splined on the upper end 76 of a second hollow shaft 77 disposed loosely about the agitator shaft 37.

The hollow shaft 77 constitutes the drive shaft for rotating the tub 54 and is extended through the bottom wall 31. The shaft 77 has loosely mounted on the lower end thereof a spur gear 78, and this gear meshes with a driving gear 79 fixed on the crank shaft 28. In order to provide for coupling the gear 78 to the hollow tub shaft 77, the lower end of the shaft 77 on the inside thereof is provided with splines 80, forming one element of a clutch and the upper end of the clutch collar 42 is formed with a complementary clutch element 81. The gear 78 is also provided with a clutch element 82, and the clutch collar 42 is provided with a complementary clutch element 83, engageable with the clutch element 82.



The clutch elements 80 and 81 are adapted to become initially engaged before the elements 82 and 83 are engaged, so as to relieve the clutch elements 80 and 81 of the strain or torsion when clutch elements 82 and 83 are engaged. The base plate 72 for the bushing 71 has extending upwardly therefrom a tubular supporting member 84, engaging loosely about the hollow shaft 74 and interiorly of the hollow shaft 57. The supporting member 84 is formed with a cap 85 at the upper end thereof, and a sealing gasket 86 is adapted to seal the cap 85 and the upper end of the tubular member 84 with respect to the hollow shaft 77.

A water intake pipe 87 is connected at one end to the bushing 71 and is disposed between the bottom wall 56 of the tub 54 and the bottom wall 31 of the upper member 17. The pipe 87 has a branch 88 extending downwardly through the bottom wall 31 and through the gear housing formed by the intermediate member 18, and is then provided with an outwardly extending extension 89, which may be connected to a source of water supply. A valve member generally designated as 90 is interposed in the pipe 87 and comprises a housing 91, which is provided with a flange 92 secured to the inner side of the bottom wall 31.

A bushing 93, having a flange 94, is secured axially of the flange 92 and is positioned below the bottom wall 31. An endwise movable plug 95, having a port 96, is slidably carried by the housing 91 and extends through the bushing 93. When the plug 95 is in its uppermost position the plug is in the open position for permitting water to pass from the branch 88, through the pipe 87, into the space 97 between the tubular support 84, and the hollow shaft 57. A cam shaft 98 is journalled in bearings 99 and 100 carried by the gear housing 18, and has secured thereto a circular cam 101. The shaft 98 also has loose thereon a worm gear 102, which meshes with a worm 103, carried by a vertically disposed worm shaft 104 journalled in bearings 105 and 106, carried by the bottom walls 20 and 31, respectively.

The worm shaft 104 has fixed thereto a large grooved pulley 107, about which a belt 108 is trained. A grooved pulley 109 is fixed to the crank shaft 28 and the belt 108 is trained about pulley 109, so that worm shaft 104 will rotate at a reduced speed from crank shaft 28, and the worm and worm gear will provide an additional speed reducing means for the cam shaft 98. The cam 101 has disposed thereabout a collar, or band, 110 which is connected to the valve plug 95 by means of a link 111. In this manner valve plug 95 will be reciprocated upon rotation of cam 101 and cam shaft 98.

Cam shaft 98 also has fixed thereon a clutch operating cam generally designated as 112. The clutch operating cam 112 is provided with cam surfaces 113 and 114, which are of substantially equal length, the cam surface 114 constituting a means whereby the clutch collar 42 may be moved downwardly for engagement with clutch member 41, so as to provide for oscillation of the agitating member 46. A clutch collar shifting lever 115 is pivotally connected, as at 116, to a ring 117 loosely carried by the clutch member 42, and the other or outer end of the lever 115 is rockably mounted on the upper end of a link 118, which is rockably carried by a bracket, or bearing, 119, fixed to the side wall 19. The lever 115 has rotatably mounted on the lower side thereof, at a point between the opposite ends, a cam en-

gaging roller 120. The roller 120 is maintained in engagement with the cam member 112 by means of a spring 121, which is secured at one end to the lever 115, and at the opposite end to an ear 122, fixed relative to the bottom wall 20. When roller 120 engages cam surface 113, lever 107 is raised and clutch 42 is released from clutch 41 and engaged with clutch 82, clutch 81 also engaging clutch 80. Inner tub 54 will then be rapidly rotated through the rinsing and wringing cycle.

The cam member 112 is provided in one face thereof with a plurality of openings, or sockets, 123 within a selected one of which a pin 124, carried by the worm gear 102, is adapted to engage, so that the worm gear 102 will rotate with cam shaft 98. Cam member 112 is held in clutched engagement with worm gear 102 by means of a spring 125, bearing at one end against the cam 112, and at the other end against an intermediate bearing 126, which is fixed to the bottom wall 20. A washer 127 is interposed between the bearing 126 and the adjacent end of the spring 125.

A knob 128, having a dial 129 fixed thereto, is secured to the outer end of the cam shaft 98, which projects through a housing 130, carried by the gear housing 18. The dial 129 is provided so that the user can determine the position of valve plug 95, and by adjustment of cam 112 can shorten, cut off, or prolong the water delivery cycle.

In order to provide for the timed cutoff of the motor 21, there is provided a timed switch operating means, which is operated from the cam shaft 98. A switch, including opposed spring-pressed contacts 131 and 132, is carried by a housing 133 secured to the gear housing 18 and contact 131 is connected by means of a conductor 134 to one side of the motor 21. Contact 132 is connected by means of a conductor 135 to one side of a source of current supply and motor 21 is connected at the opposite side thereof by means of a conductor 136 to the opposite side of the current supply. The contacts 131 and 132 are normally biased to circuit closing position, and as shown in Figure 10, contact member 132 is formed with an extension 137 with which one end of a switch operating pin 138 is pivotally connected.

The pin 138 is slidable through a guide 139, carried by the housing 18 and the pin 139 is formed at its inner end with a rounded or cam shaped end 140. A pin operating cam, or lug, 141 is fixedly carried by a clutch plate 142, which is keyed to shaft 143, journalled in bearings 144 and 145, carried by the housing 18. A pulley 146 is loose on shaft 143 and has secured thereto a clutch pin 147, which is selectively engageable in one of a plurality of openings 148, formed in the clutch plate 142. A spring 149 disposed about shaft 143 constantly urges clutch plate 142 into clutching position, bearing at its outer end against bearing 145.

Shaft 143 projects outwardly of housing 133 and has secured thereto a knob, or operator, 150 carrying a dial 151. The pulley 146 has trained thereabout a belt 152, which is also trained about a driving pulley 153 fixed on the cam shaft 98. Pulley 153 is of a diameter reduced with respect to pulley 146, so that the latter will operate at a substantially reduced speed from pulley 153. At the present time clutch plate 142, as shown in Figure 9, is provided with three recesses 148, which are adapted to determine the timed operation of the motor with respect to the valve operator, so that there may be either one, two, or three changes of water in the tub 54 before the motor is stopped.



In the use and operation of this washing machine, the pipe 89 is connected to a source of water supply and the water is drained from the upper cabinet member 17, which constitutes an outer tub, by means of a drain pipe 154. The drain pipe 154 is open to the tub member 17, being connected to the bottom wall thereof, and a T connection 155 may be interposed in the drain 154, so that a pump, or the like, may be connected with the drain for forcibly withdrawing the water from the outer tub 17. Dial member 151 may be set to provide for the cyclic cut-off of motor 21 by adjusting the knob 150, shaft 143 being pulled outwardly against the tension of the spring 149, so as to position the pin 147 in a selected recess, or socket, 148. The tub 54 may be initially filled to provide water necessary for the first or washing cycle by turning shaft 98 until valve 90 has the plug 95 thereof in open position, at which time lever 107 may be raised by cam surface 113. During the initial filling operation, motor 21 will be disconnected from the supply source, or switch cam 141 may be in circuit breaking position.

Dial 129 may also be adjusted to provide for the cyclic oscillation and stoppage of the agitator 46 by turning knob 128, shaft 98 being moved endwise so as to release cam member 112 from clutch pin 124, carried by worm gear 102. During the initial operation of the machine, clutch collar 42 will be in its lowermost position, as shown in Figure 3, so as to connect oscillating shaft 37 with crank shaft 28. At this time cam member 112 will be in the position shown in Figure 3, and valve plug 95 will be in the cutoff position, so that no water will flow through pipe 87 into the inner tub 54.

After the machine has been in operation for a predetermined period of time, cam member 112 will be rotated so that the high portion thereof will engage roller 120, and thereby raise clutch lever 115. Raising of clutch lever 115 will shift clutch collar 42 upwardly to initially engage clutch members 80 and 81 and subsequently engage clutch members 82 and 83. At this time gear 78 will be coupled to hollow shaft 77 and inner tub member 54, which is coupled to hollow shaft 77, will be rotated with gear 78. As inner tub 54 rotates valve plugs 61 will be moved outwardly by centrifugal force to open position, and the water will drain through openings 60 from inner tub 54 to outer tub 17.

If desired, the cycle of oscillation, and the cycles of rinsing and wringing may be repeated by adjustment of timer shaft 143. If this latter shaft is adjusted to provide for only one cycle, when this cycle has been completed cam member 142 will be in a position engaging pin 138, and the switch formed by the two contacts 131 and 132 will be moved to an open or circuit breaking position. When the water is discharged by centrifugal force into outer tub 17, the water will drain through drain pipe 154.

The exact configuration illustrated is regarded as the optimum, but some of the desirable results inherent in this disclosure may be obtained by various slight modifications including some departure from the exact configuration shown, and it is therefore requested that the scope of the invention should be regarded as limited only by the terms of the claims.

What is claimed is:

1. A washing machine comprising an outer tub, an intermediate tub, an inner perforate tub fixed to said intermediate tub, a tubular shaft fixed to said intermediate tub, an agitator within said inner tub, a second shaft fixed to said agitator and extending through said tubular shaft, a clutch element fixed on said second shaft, a second clutch element fixed to said tubular shaft, a compound clutch element slidable on said second shaft between said first and second clutch elements, a clutch shifting lever connected at one end to said slidable element, power means, means connected to said first clutch element for oscillating said agitator, means connected to said second clutch means for rotating said intermediate tub, a countershaft connecting said oscillating means with said rotating means, a pulley on said countershaft, an operative connection between said power means and said countershaft, a timer shaft, an operative connection between said timer shaft and said pulley, a lever shifting cam fixed to said timer shaft and engageable with said clutch lever whereby to provide for cyclic rocking of said lever from a lower tub oscillating position to an upper tub rotating position, means for adjusting the circumferential position of said cam relative to said latter operative connection whereby the cyclic periods of rotation of said intermediate tub and oscillation of said agitator may be varied, means for delivering fluid to said inner and intermediate tub, and cam means on said timer shaft for effecting periodic delivery of fluid to said latter tubs.

2. A washing machine comprising an outer tub, an intermediate tub, an inner perforate tub fixed to said intermediate tub, a tubular shaft fixed to said intermediate tub, an agitator within said inner tub, an agitator shaft loosely disposed in said tubular shaft, a clutch element fixed to said agitator shaft, a second clutch element fixed to said tubular shaft, a compound clutch element slidable on said agitator shaft between said first and second clutch elements, a clutch shifting lever connected at one end to said slidable element, power means, means connected to said first clutch element for oscillating said agitator, means connected to said second clutch means for rotating said intermediate tub, a countershaft connecting said oscillating means with said rotating means, a pulley on said countershaft, an operative connection between said power means and said countershaft, a timer shaft, an operative connection between said timer shaft and said pulley, a lever shifting cam fixed to said timer shaft and engageable with said clutch shifting lever whereby to provide for cyclic rocking of said lever from a lower tub oscillating position to an upper tub rotating position, means for discharging water into said intermediate tub, a valve in said latter means, means carried by said timer shaft connected to said valve for moving said valve to open position for at least a portion of the cyclic period of rotation of said intermediate tub, and for also moving said valve to closed position during the oscillating cycle of said agitator and means for adjusting said latter means to thereby vary the periods of said intermediate tub and said agitator and also vary the opening and closing periods of said valve.

3. A washing machine comprising an outer tub, an intermediate tub, an inner perforate tub fixed to said intermediate tub, a tubular shaft fixed to said intermediate tub, an agitator within said inner tub, an agitator shaft loosely disposed in said tubular shaft, a clutch element fixed to said agitator shaft, a second clutch element fixed to said tubular shaft, a compound clutch element slidable on said agitator shaft between said first and second clutch elements, a clutch shifting lever connected at one end to said slidable element, power means, means connected to said first clutch element for oscillating said agitator, means connected to said second clutch means for rotating said intermediate tub, a countershaft connecting said oscillating means with said rotating means, a pulley on said countershaft, an operative connection between said power means and said countershaft, a timer shaft, an operative connection between said timer shaft and said pulley, a lever shifting cam fixed to said timer shaft and engageable with said clutch shifting lever whereby to provide for cyclic rocking of said lever from a lower tub oscillating position to an upper tub rotating position, means for discharging water into said intermediate tub, a valve in said latter means, cut-off means connected to said power means, and means connecting said cut-off means with said timer shaft for operation thereby.

4. A washing machine comprising an outer tub, an intermediate tub, an inner perforate tub fixed to said intermediate tub, a tubular shaft fixed to said intermediate tub, an agitator within said inner tub, an agitator shaft loosely disposed in said tubular shaft, a clutch element fixed to said agitator shaft, a second clutch element fixed to said tubular shaft, a compound clutch element slidable on said agitator shaft between said first and second clutch elements, a clutch shifting lever connected at one end to said slidable element, power means, means connected to said first clutch element for oscillating said agitator, means connected to said second clutch means for rotating said intermediate tub, a countershaft connecting said oscillating means with said rotating means, a pulley on said countershaft, an operative connection between said power means and said countershaft, a timer shaft, an operative connection between said timer shaft and said pulley, a lever shifting cam fixed to said timer shaft and engageable with said clutch shifting lever whereby to provide for cyclic rocking of said lever from a lower tub oscillating position to an upper tub rotating position, means for discharging water into said intermediate tub, a valve in said latter means, cut-off means connected to said power means, and means connecting said cut-off means with said timer shaft for operation thereby, said cut-off means including adjustable means whereby the period of cut-off may be varied.

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