

May 27, 1930.

R. G. LOCKETT

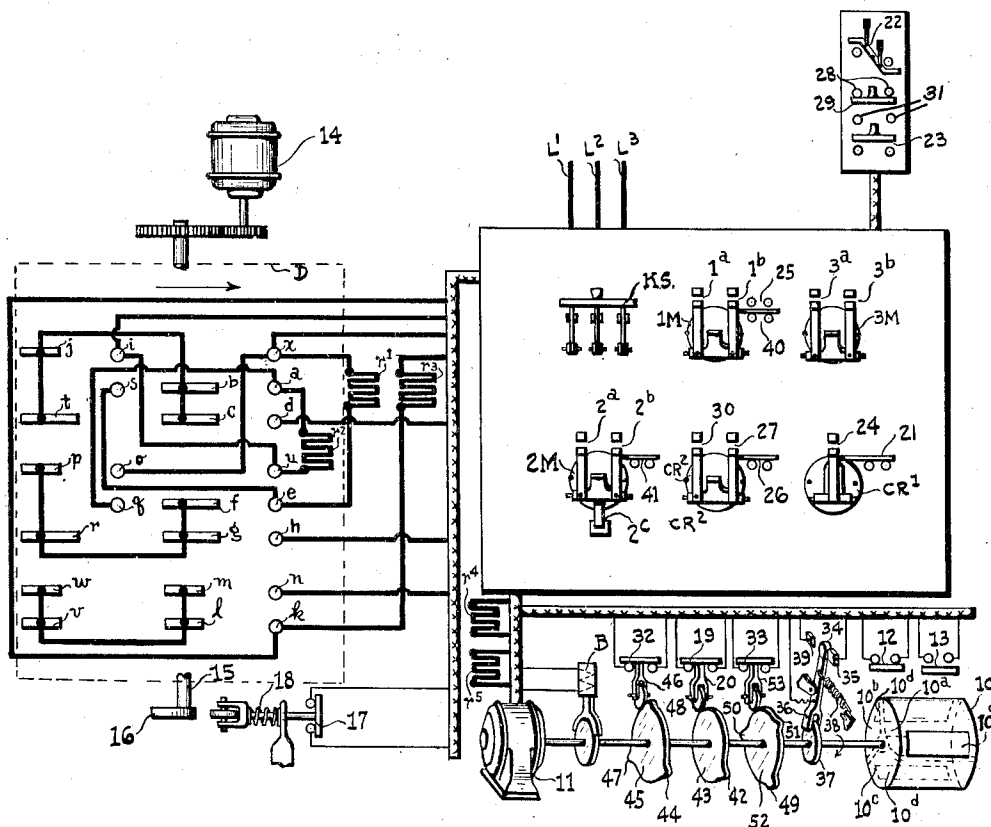
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CONTROL MEANS FOR MOTOR DRIVEN DEVICES

Filed Dec. 23, 1927

2 Sheets-Sheet 1

Fig. 1



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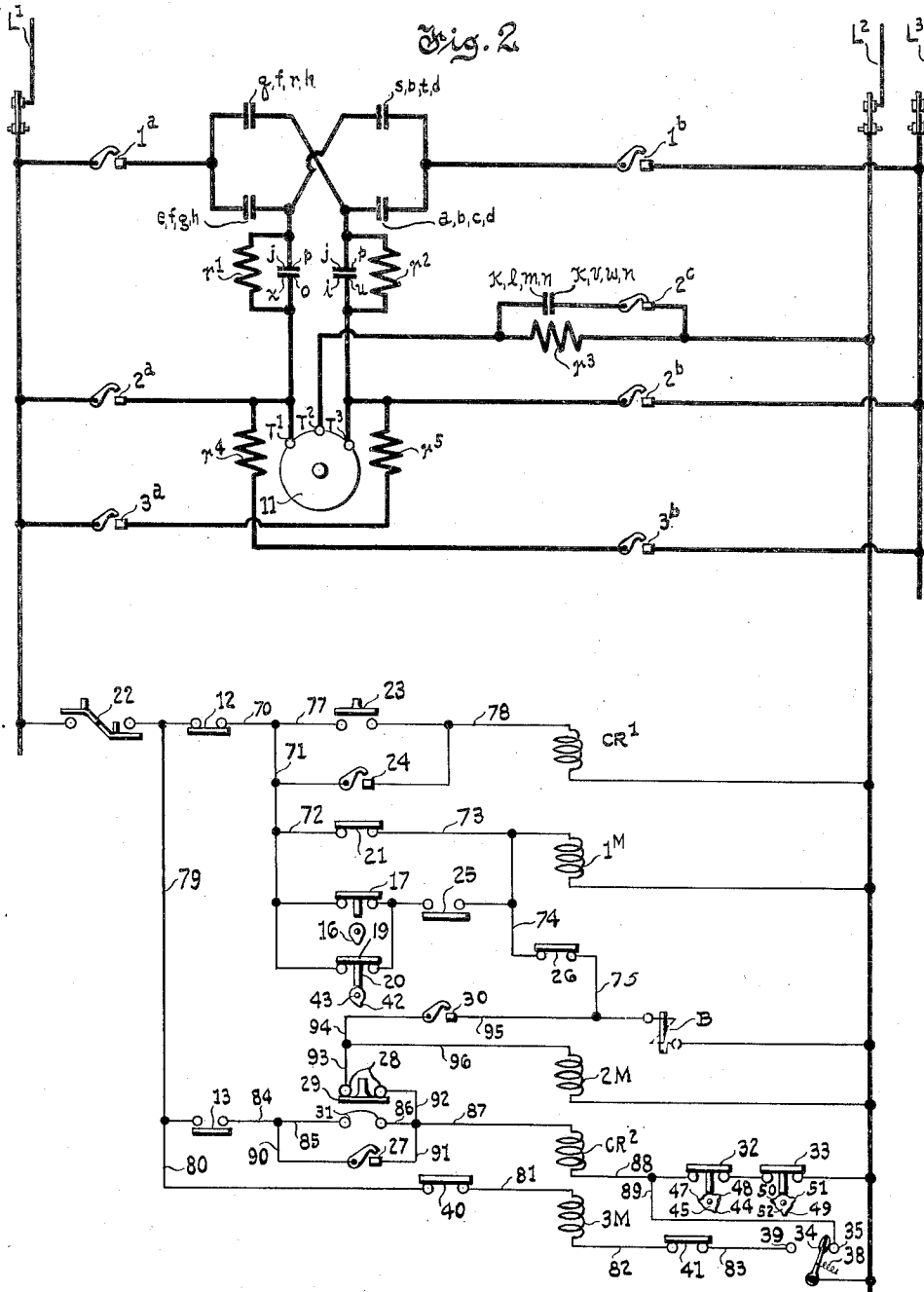
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CONTROL MEANS FOR MOTOR DRIVEN DEVICES

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

RALPH G. LOCKETT, OF WAUWATOSA, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO CUTLER-HAMMER, INC., A CORPORATION OF DELAWARE

CONTROL MEANS FOR MOTOR-DRIVEN DEVICES

Application filed December 23, 1927. Serial No. 242,147.

This invention relates to improvements in control means for motor driven devices, and more particularly to improvements in control means for washing machines of the multiple compartment type referred to in my Patent No. 1,638,861, dated August 16, 1927.

An object of the invention is to provide improved and simplified control means of the aforementioned character.

Another object is to provide novel control means including means for insuring ability to complete the motor circuit for inching after the prime stop or any subsequent stop, irrespective of the position of any of the limit switches employed.

Another object is to provide such control means utilizing a continuously operating power driven member for communicating the motor circuit connections under given conditions, whereby a single driving means may be employed in conjunction with any desired number of commutating members.

Another object is to provide control means of the aforementioned character including means for effecting the prime stop and each subsequent stop of the driven member under insured conditions of unidirectional operation of the latter, said means including means for effecting stopping of the driving motor by plugging.

Another and more specific object is to provide means normally biased to a position to render ineffective certain of the limit switches employed, said means being responsive to a given speed and direction of operation of the driving motor to thereupon render such limit switches effective.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention which will now be described, it being understood that the embodiment illustrated is susceptible of modification in the details of construction and operation thereof without departing from the scope of the appended claims.

In the drawings, Figure 1 illustrates schematically and diagrammatically a controller embodying the present invention, and

Fig. 2 is an across-the-line diagram of the

circuit connections for the controller illustrated in Fig. 1.

Referring first to Fig. 1, the numeral 10 designates the cylinder of a washing machine of a suitable or well known construction,— said cylinder (as shown in dotted lines) having a plurality of partition walls forming compartments 10^a, 10^b and 10^c, each compartment being provided with the usual opening and a movable closure therefor as indicated at 10^d, respectively. Cylinder 10 is rotatable within the usual stationary tub or casing (not shown) by means of a reversible motor 11. Said tub is likewise provided with a movable closure or closures with which said compartment closures are adapted to register under predetermined conditions hereinafter set forth. A multiple compartment washing machine of the general type herein contemplated is disclosed in my prior Patent No. 1,638,861, dated August 16, 1927.

For purposes hereinafter more fully described I provide a pair of switches 12 and 13, said switches being associated with the tub door or closure in such manner that switch 12 is closed and the switch 13 opened when the tub door is closed, and upon opening of the tub door switch 12 is opened and switch 13 is closed. Switches of the character just referred to, and means for operating the same, are disclosed in Patent No. 1,643,197, dated Sept. 20, 1927, to E. J. Carroll, and further description thereof herein is deemed unnecessary.

The motor 11 is subject to control by the various instrumentalities illustrated, including a drum shown diagrammatically at D which is continuously rotatable unidirectionally by means of an electric motor 14 or other suitable source of power. Drum D is provided with relatively movable contactors and segments *a* to *x*, inclusive, which co-operate with the contacts 1^a and 1^b of a normally open electromagnetically operable switch 1M, whereby the circuit of motor 11 is commutated for effecting operation of the latter alternately in reverse directions. Certain of the contactors and segments of drum D are likewise adapted to provide for initial inclusion and subsequent exclusion of resistance sections *r*¹, *r*²

and r^3 , whereby motor 11 is accelerated after each reversal of operation thereof.

Carried by the shaft 15 or other movable part of drum D is a cam 16 or the like adapted upon given operative positioning of drum D (which position in the present instance corresponds with full speed operation of motor 11 in a predetermined direction) to effect opening of a set of normally closed contacts 17, against the action of a spring 18. As hereinafter more fully described said contacts 17 co-operate with contacts 19 of a cam operated limit switch 20 and with the normally closed auxiliary contacts 21 of a relay CR¹ to maintain an energizing circuit for the winding of switch 1M pending simultaneous opening of all of said contacts. Initial energization of the winding of switch 1M is dependent upon closure of a manually operable snap switch 22 and is also dependent upon closure of switch 12 through closure of the tub door in the manner aforescribed, the auxiliary contacts 21 of relay CR¹ being normally closed as aforesaid.

The normally closed main contacts 2° of switch 2M co-operate with certain of the contactors and segments of drum D to commutate the resistance section r^3 . Thus assuming energization and closure of switch 1M, the elements thus far described provide for continuous operation of motor 11 (and cylinder 10 driven thereby) alternately in reverse directions,—the duration of operation of the motor in each direction and the rate of acceleration of the latter being dependent upon the rate of operation of the motor 14 driving drum D.

Stopping of motor 11 is initiated by closure of a normally open push button switch 23, thereby completing an energizing circuit for the winding of relay CR¹,—the main contacts 24 of the latter thereupon closing to maintain said energizing circuit independently of push button switch 23. The normally closed auxiliary contacts 21 of said relay are likewise opened to provide for de-energization of the winding of switch 1M upon simultaneous opening of contacts 17 and 19,—it being noted that the normally open auxiliary contacts 25 of switch 1M are closed under the conditions just mentioned. As hereinafter more fully described the arrangement is such that contacts 17 will not be opened until the motor 11 is operating at substantially full speed in a forward direction, whereas contacts 19 will not be opened until a predetermined one of the compartments of cylinder 10 is in a given angular relation to the tub door. A brake coil B is included in circuit in parallel with the winding of switch 1M through the normally closed auxiliary contacts 26 of a relay CR², whereby said coil is energized to release the brake and de-energized to apply the brake simultaneously with

the energization and de-energization of said winding of switch 1M.

When rotation of cylinder 10 is stopped in the manner just mentioned the tub door may be opened, thereby effecting opening of switch 12 and closure of switch 13. Control of operation of the motor 11 is thus transferred from the drum D, switch 1M and contacts 2° of switch 2M to the contacts 2^a and 2^b of switch 2M and the contacts 3^a and 3^b of switch 3M. Energization of the winding of switch 2M is dependent upon closure of the normally open main contacts 27 of a relay CR² and reclosure of the normally closed “up” contacts 28 of a push button switch 29; whereas energization of the winding of relay CR² and closure of the normally open main contacts 27 and 30 thereof is dependent upon temporary closure of the “down” contacts 31 of push button switch 29, and simultaneous closure of a plurality of cam operated series related switches 32 and 33.

However, in view of the inherent possibility that one of said last mentioned switches (say switch 32) will be opened and will remain in open position when the aforementioned prime or initial stop of the cylinder is effected, I have provided means for positively insuring ability to complete the energizing circuit of the winding of relay CR² under the conditions just mentioned. Said means as shown may comprise a pivoted contactor 34 normally biased into engagement with a stationary contact 35, and operating means for said contactor comprising a magnet 36 and a disk 37 of non-magnetic material rotatable with respect thereto in accordance with the speed of motor 11. Thus upon operation of motor 11 in the direction indicated by the arrow (adjacent to the disk 37) in Fig. 1 the biasing spring 38 will maintain the contactor 34 in engagement with contact 35 pending attainment of a predetermined speed of disk 37 whereupon the magnetic drag effect produced by the rotating disk will cause pivotal movement of contactor 34 out of engagement with contact 35 and into engagement with stationary contact 39, for a purpose hereinafter described. The aforescribed device, which is responsive to the speed and direction of operation of motor 11, is shown as of the type disclosed in the Du Bois Patent No. 1,161,932, dated November 30, 1915; but it will be understood that any other suitable or equivalent speed responsive device, such as a fly-ball governor controlled switch or a fluid pressure operated switch, may be substituted therefor.

Also upon closure of the main contacts 30 of relay CR² and reclosure of the normally closed contacts 28 of push button switch 29 an energizing circuit for brake coil B is completed. The normally closed auxiliary contacts 40 of switch 1M and the contact 39 and contactor 34 of the speed responsive device are included

in the energizing circuit of the winding of switch 3M; completion of said energizing circuit being further dependent upon closure of the normally closed auxiliary contacts 41 of switch 2M. As will hereinafter more fully appear, the switch 3M is energized during each stopping operation of motor 11 (whether from high speed for the prime stop or from low speed during inching) thus insuring plugging connections for said motor in each instance to assist the brake in effecting accurately positioned stopping of the washer cylinder.

As aforeindicated the contacts 19 of switch 20 are opened only once during each revolution of the cylinder 10, such opening of said contacts being effected by means of a projection 42 on the rotary disk 43. Moreover, in practice the projection 44 on disk 45 will effect opening of contacts 32 of switch 46 substantially simultaneously with the opening of contacts 19 by said projection 42 on disk 43. Similarly it will be understood that projections 47 and 48 on disk 45 are each separated from the projection 44 by an angle of 120 degrees. The three projections 49, 50 and 51 are likewise equally spaced around the periphery of disk 52 to effect intermittent opening of contacts 33 of switch 53. However, each of the projections 49, 50 and 51 on disk 52 is angularly displaced with reference to the projections 44, 47 and 48, respectively, on disk 45 by an angle of approximately 50 degrees. It follows therefore that a single disk having six projections, with alternate spaces of 50 and 70 degrees therebetween, might be substituted for the disks 45 and 52. For practical reason, however, it is desirable to employ two disks, such as 45 and 52, with means whereby the angular relation of the individual projections may be adjusted as desired. Where six-position stopping of the cylinder 10 is not required or desired, the three projections may be removed from one of the disks 45 or 52, or said disk itself may be removed from the driving means.

Operation of the controller will now be described with particular reference to the diagram of Fig. 2. Thus assuming that each compartment of the cylinder 10 has been loaded with goods to be washed or otherwise treated and each of the compartment doors has been closed. If the snap switch 22 has been previously closed it is obvious that upon closure of the tub door the contacts 12 controlled thereby will be closed to complete an energizing circuit for the winding of switch 1M. Said circuit may be traced from line L¹ through switch 22 and contacts 12, conductors 70, 71 and 72, normally closed auxiliary contacts 21 of relay CR¹, conductor 73 through said winding to line L². This effects closure of the main contacts 1^a and 1^b and auxiliary contacts 25 of switch 1M, as well as opening of the auxiliary contacts 40 of the

latter. At the same time an energizing circuit for the brake coil B is completed, said circuit extending from line L¹ to conductor 73 as just traced, conductor 74 through the normally closed auxiliary contacts 26 of relay CR², and by conductor 75 through said brake coil to line L². As aforestated the drum D (Fig. 1) is rotated continuously in the direction indicated, and hence said drum may be in any one of its rotary positions when the contacts 1^a and 1^b of switch 1M are closed.

It may be assumed for purposes of description that drum D is then in such position that only the groups of drum contactors and segments *a, b, c, d* and *e, f, g, h* are engaged, thus effecting connection of motor terminals T¹, T² and T³ with lines L¹, L² and L³, respectively, through the resistances *r*¹, *r*² and *r*³, whereby operation of motor 11 is started at low speed in a forward direction. Continued rotation of drum D will additionally effect engagement of groups of contactors and segments *o, p; k, l, m, n*, and *i, j*, thereby short circuiting resistances *r*¹, *r*² and *r*³ to increase the speed of motor 11. Thereafter all of the aforementioned groups of drum contactors and segments are disengaged and groups *q, f, r, h* and *s, b, t, d* are brought into engagement to reverse the line connections of terminals T¹ and T³ of the motor. Reversal of motor 11 is thus effected by plugging, with resistances *r*¹, *r*² and *r*³ initially included in the motor circuit. Thereafter engagement of the groups of drum contactors and segments *x, j; k, v, w, n* and *u, p* is effected, whereby resistances *r*¹, *r*² and *r*³ are again short circuited to increase the motor speed.

The aforedescribed cycle of operation is repeated automatically any desired number of times pending completion of the energizing circuit of the winding of relay CR¹ through temporary closure of switch 23. While I have shown switch 23 as of the manually operable push button type; it will be apparent that any suitable automatic timing means may be employed to effect closure of said switch 23 or of an additional switch in parallel with the latter. Assuming closure of push button switch 23, the resulting energizing circuit for the winding of relay CR¹ extends from line L¹ to conductor 70, thence by conductor 77 through the contacts of said switch 23, conductor 78 through said winding of relay CR¹ to line L². Main contacts 24 of relay CR¹ are thereupon closed to maintain said energizing circuit by shunting the push button switch 23, said maintaining circuit being obvious. At the same time the normally closed auxiliary contacts 21 of relay CR¹ are opened to render the winding of switch 1M subject to de-energization upon simultaneous open positioning of contacts 17 and 19,—auxiliary contacts 25 of switch 1M being closed as aforedescribed.

Also it will be remembered that contacts 17 will only be opened through the action of cam 16 when the drum D is in the position providing for full speed forward operation of motor 11, and contacts 19 will only be opened through the action of projection 42 on disk 43 when a predetermined one of the compartment closures on cylinder 10 is in a definite angular relation to the point at which it is desired to make the initial or prime stop, namely, in registration with the tub door. When such conditions coincide contacts 17 and 19 will be opened, thereby effecting de-energization and opening of switch 1M to disconnect motor 11 from the line; the aforescribed energizing circuit of brake coil B being simultaneously interrupted in an obvious manner to effect application of the brake.

Inasmuch as motor 11 is operating in a forward direction upon opening of switch 1M in the manner just described, it will be understood that the contactor 34 of the speed and direction responsive device is in engagement with contact 39. Hence upon reclosure of the normally closed auxiliary contacts 40 of switch 1M (auxiliary contacts 41 of switch 2M being then in their normally closed position) an energizing circuit will be completed for the winding of switch 3M, said circuit extending from line L^1 through switch 22, by conductors 79 and 80 through said auxiliary contacts 40, conductor 81 through said winding, conductor 82 through contacts 41 and by conductor 83 through said contact 39 and contactor 34 to line L^2 . Closure of contacts 3^a and 3^b of switch 3M thus completes the plugging connections for motor 11, resistances r^3 , r^4 and r^5 being included in the respective branches of the motor circuit. By the combined plugging and mechanical braking actions motor 11 is quickly brought to rest with the cylinder 10 in the aforementioned predetermined angular position; whereas upon a given reduction in speed of motor 11 (and preferably just before the motor comes to rest) the contactor 34 will be permitted to move automatically, under the action of its biasing means, to disengage the contact 39, whereby the reverse or plugging connections of the motor are interrupted; said contactor 34 at the same time moving into engagement with contact 35.

Let it be assumed that by the aforescribed prime or initial stop of cylinder 10 one of the compartments is brought into so-called "loading" position and in registration with the tub door. Thereupon the tub door may be opened to effect opening of contacts 12 and closure of contacts 13, and the closure or door of the aforementioned registering compartment may be opened. It is then desired to move said compartment through a predetermined angle (say 50 degrees) to "unloading" position, and I have provided means

for accomplishing this purpose. It may be noted in this connection that the projection 44 on the disk 45 and the projection 42 of disk 43 bear substantially the same relation to the initial stopping position of the cylinder 10, and in view of the fact that there is comparatively little drift of motor 11 during the stopping operation contacts 32 may be left in open position through the action of projection 44 after the cylinder 10 is stopped. Moreover, it is extremely difficult to accurately adjust the various projections on disks 45 and 52 to insure reclosure of both sets of contacts 32 and 33 after each stop of the cylinder 10. However, due to re-engagement of contactor 34 with contact 35 of the speed responsive device each time the cylinder 10 is stopped, it will be seen that a shunt circuit around contacts 32 and 33 is provided, and hence open positioning of either of said sets of contacts will not interfere with the subsequent steps in the cycle of operation of the control system.

Thus after the prime stop has been effected, the cylinder 10 may be moved to the next position by momentary depression of push button switch 29 to effect closure of the down contacts 31 of the latter; thereby completing an energizing circuit for the winding of relay CR^2 , which circuit extends from line L^1 through the contacts 13 (which are closed due to opening of the tub door), by conductors 84 and 85 through said down contacts 31, conductors 86 and 87 through said winding, and by conductors 88 and 89 through contact 35 and contactor 34 to line L^2 . Contacts 27 of relay CR^2 in closing provide a maintaining circuit for the latter, thereby permitting release of said push button switch 29. Upon reclosure of the up contacts 28 of push button switch 29 (the contacts 30 of relay CR^2 having been closed in the manner just described) an energizing circuit for the coil of brake B is likewise provided, said circuit extending from line L^1 to conductor 84, as previously traced, by conductor 90 through contacts 27 of relay CR^2 , conductors 91 and 92 through up contacts 28 of switch 29, conductors 93 and 94 through contacts 30 of relay CR^2 , and by conductor 95 through said brake coil to line L^2 .

At the same time an energizing circuit is completed for the winding of switch 2M, said circuit extending from line L^1 to conductor 93 as just traced, and by conductor 96 through said winding to line L^2 . Contacts 2^a and 2^b of switch 2M are thus closed to complete an energizing circuit for motor 11 for operation of the latter in a forward direction, contacts 2^c of switch 2M being simultaneously opened to insure against short circuiting of resistance r^3 under these conditions. It will of course be apparent to those skilled in the art that resistances corresponding with resistance r^3 might be

included in each of the other branches of the motor circuit to be controlled by said contacts 2^a and 2^b.

Within an appreciable time after the motor 11 is thus restarted for operation thereof in a forward direction, the speed of the motor will cause disengagement of contactor 34 from contact 35 and engagement of the former with contact 39,—during which time either of the switches 32 or 33 (if open at the time the motor was started) will be reclosed. The energizing circuit of relay CR² will therefore be maintained through contacts 32 and 33 pending movement of cylinder 10 through an angle of about 50 degrees from the point where the aforementioned prime stop was effected. Thus if as heretofore assumed the switch 32 was opened through the action of projection 44 on disk 45 at a time the prime stop of cylinder 10 was effected, it will be understood that projection 51 will then cause opening of contacts 33 when the cylinder has moved through an angle of about 50 degrees to bring the aforementioned compartment to unloading position. When switch 33 is thus opened the relay CR² is de-energized and the contacts 27 and 30 thereof open to effect de-energization of switch 2M for interrupting the motor circuit connections, and to simultaneously de-energize the coil of brake B whereby the latter is applied.

Moreover, upon reclosure of the normally closed contacts 41 of switch 2M, the aforedescribed energizing circuit for the winding of switch 3M is again completed,—it being understood that under the conditions just described auxiliary contacts 40 of switch 1M are closed and contactor 34 is in engagement with contact 39. Under the aforedescribed mechanical braking and plugging action motor 11 is brought to a stop with its first compartment in unloading position,—contactor 34 in the meantime having been returned to its normal position wherein it engages contact 35.

When the push button 29 is next momentarily depressed the aforedescribed circuits are completed to effect rotation of cylinder 10 through an angle of about 70 degrees to a point wherein the second compartment is in loading position whereupon the closure of said compartment is opened and button 29 is again depressed to move said compartment through about 50 degrees to unloading position. The next operation of button 29 results in movement of the third compartment to loading position, and the closure thereof is opened; whereupon button 29 is again depressed to cause movement of said compartment to unloading position. As will be obvious, the next operation of button 29 results in movement of the first compartment to loading position, which is the position at which the prime stop was effected. After

loading of the first compartment and closure of the door thereof, button 29 is again temporarily depressed to cause movement of said compartment to unloading position; and immediately upon arrival of said compartment at the unloading position said button may be again depressed to cause movement of the second compartment to loading position. The same procedure may be followed to bring the third compartment to loading position. Each of the compartments having been loaded in the manner just described and the respective doors thereof having been closed, it is obvious that upon reclosure of the tub door switch 12 will be reclosed thus initiating the cycle of operation in the manner first mentioned.

While I have not described in detail each step in the operation of my controller, it is believed that the foregoing description is sufficient to enable those skilled in the art to understand my invention and the mode of applying the same for accomplishment of the novel results aforementioned.

It is to be understood that in practice the washer cylinder 10 and cam disks 45, 43 and 52 (Fig. 1) are preferably driven by motor 11 through suitable interposed reduction gearing.

What I claim as new and desire to secure by Letters Patent is:

1. In a controller for a motor driven rotatable device, the combination with means for effecting a prime stop of said device when the latter is in a predetermined angular position, of means thereafter operable independently of said first mentioned means for effecting stopping of said device in other predetermined angular positions thereof sequentially, and means operable automatically to render said last mentioned stopping means ineffective pending attainment of a given speed of the driving motor.

2. In a controller for a motor driven rotatable device, the combination with means to direct stopping of said device, means subject to coincident predetermined conditions of speed, angular position and only one direction of rotation to effect a prime stop of said device in a predetermined angular position of the latter, means operable independently of said first mentioned means to thereafter direct stopping of said device in other predetermined angular positions sequentially, and means operable automatically to render said last mentioned means ineffective for stopping said device pending attainment of a given speed of the latter.

3. In a controller for a motor driven rotatable device, the combination with means, including a continuously operable control drum, for effecting periodic reversals of rotation of said device, means to direct stopping of the device, means subject to coincident predetermined conditions of speed, an-

gular position and only one direction of rotation of said device to effect a prime stop of the latter in a predetermined angular position, means operable independently of said first mentioned means to thereafter effect operation of said device and to direct stopping thereof in a plurality of other predetermined angular positions sequentially, said last mentioned means comprising a limit switch, and means comprising a switch operable independently of said limit switch after each stopping operation to temporarily render said limit switch ineffective for stopping said device.

4. In a controller for a motor driven rotatable device, the combination with means including a continuously operable control drum, for effecting periodic reversals of rotation of said device, means to direct stopping of the device, means subject to coincident predetermined conditions of speed, angular position and only one direction of rotation of said device to effect a prime stop of the latter in a predetermined angular position, means operable independently of said first mentioned means to thereafter effect operation of said device and to direct stopping thereof in a plurality of other predetermined angular positions sequentially, said last mentioned means comprising a limit switch, and means comprising a switch operable independently of said limit switch after each stopping operation to temporarily render said limit switch ineffective for stopping said device, said last mentioned switch being also operable automatically in response to a given speed of the device to render said limit switch effective.

5. In a controller for a motor driven device, in combination, continuously operable means normally adapted to effect periodic reversals of rotation of said device, means to direct stopping of said device, means for rendering said last mentioned means ineffective for stopping said device pending predetermined conditions of angular position and only one direction of rotation of the latter, associated means for thereafter effecting unidirectional rotation of said device and stopping thereof, in a plurality of other predetermined angular positions sequentially, said last mentioned means comprising a limit switch, a normally open push button switch in series with said limit switch, and a normally closed switch in parallel with the latter, said last mentioned switch being operable in response to a given speed of rotation of said device to render said limit switch effective for stopping the latter.

6. In a controller for a motor driven rotatable device, the combination with means for completing the motor circuit for effecting rotation of said device, said means comprising a switch normally biased to closed position, and a limit switch operable by said de-

vice, said limit switch being connected in parallel with said first mentioned switch and tending to interrupt the motor circuit upon rotation of said device to each of a plurality of angular positions sequentially, said first mentioned switch being operable automatically in response to a predetermined speed and direction of rotation of said device to render said limit switch effective for interrupting said circuit.

7. In a controller for a motor driven rotatable device, the combination with means for completing the motor circuit for effecting rotation of said device, said means comprising a switch normally biased to closed position, a limit switch operable by said device, said limit switch being connected in parallel with said first mentioned switch and tending to interrupt the motor circuit upon rotation of said device to any one of a number of predetermined angular positions, and means operable automatically in response to a given speed of said device to effect opening of said first mentioned switch whereby said limit switch is rendered effective for interrupting said motor circuit.

8. In a controller for a motor driven rotatable device, the combination with means for completing the motor circuit for effecting rotation of said device, said means including a switch normally biased to closed position, of associated means for restricting said device to rotation in only one direction, and a limit switch operable by said device and tending to interrupt the motor circuit upon rotation of said device to each of a plurality of angular positions sequentially, said first mentioned switch being operable automatically in response to a predetermined speed of rotation of said device to render said limit switch effective for interrupting said circuit.

9. In a motor operated washing machine, in combination, a rotating cylinder having a plurality of circumferentially arranged compartments, manually controllable means actuated by the machine during the washing operation for automatically effecting a prime stop of said cylinder in a predetermined angular position of the latter, associated means for thereafter effecting operation of said device under insured conditions of unidirectional rotation thereof and for effecting stopping of said device in a plurality of other predetermined angular positions of the latter, said last mentioned means comprising a limit switch operable with said device, a normally open push button switch in series with said limit switch, and a normally closed switch in parallel with the latter whereby said push button switch is rendered effective for initiating operation of said device independently of said limit switch, said normally closed switch being adapted to open in response to a given speed of operation of said device whereby

said limit switch is rendered effective for stopping the latter.

electromechanical braking means and said plugging means being utilized for such stopping.

In witness whereof, I have hereunto subscribed my name.

RALPH G. LOCKETT.

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5 10. In a motor operated washing machine, in combination, a washer cylinder having a plurality of circumferentially arranged compartments, an electric motor for rotatably driving said cylinder, continuously operable means normally adapted to effect periodic reversals of rotation of said motor, means
10 for directing stopping of said motor, means for rendering said last mentioned means ineffective for stopping pending coincident predetermined conditions of angular position and speed of rotation of said cylinder in one
15 direction, said stopping means including electromechanical braking means and means tending to effect stopping of said motor by plugging, manually controllable means operable after initial stopping of said motor to
20 effect operation of the latter independently of said reversing means, said manually controllable means including a normally open push button switch, a limit switch in series with said push button switch, and a speed
25 responsive device having normally closed contacts in parallel with said limit switch whereby said push button switch is rendered effective for initiating operation of said motor independently of said limit switch, said device being operable to open its normally
30 closed contacts in response to a given speed of said motor whereby said limit switch is rendered effective for stopping the latter in the next succeeding predetermined angular
35 position of said cylinder.

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11. In a motor operated washing machine, in combination, a washer cylinder having a plurality of circumferentially arranged compartments, an electric motor for rotatably
40 driving said cylinder, continuously operable means normally adapted to effect periodic reversals of rotation of said motor, means for directing stopping of said motor, means for rendering said last mentioned means ineffective for stopping pending coincident
45 predetermined conditions of angular position and speed of rotation of said cylinder in one direction, said stopping means including electromechanical braking means and means tending to effect stopping of said motor by
50 plugging, manually controllable means operable after initial stopping of said motor to effect operation of the latter independently of said reversing means, said manually controllable means including a normally
55 open push button switch, a limit switch in series with said push button switch, and a speed responsive device having normally closed contacts in parallel with said limit switch, said device being operable to open its
60 normally closed contacts in response to a given speed of said motor whereby said limit switch is rendered effective for stopping the latter in the next succeeding predetermined angular
65 position of said cylinder, said elec-

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