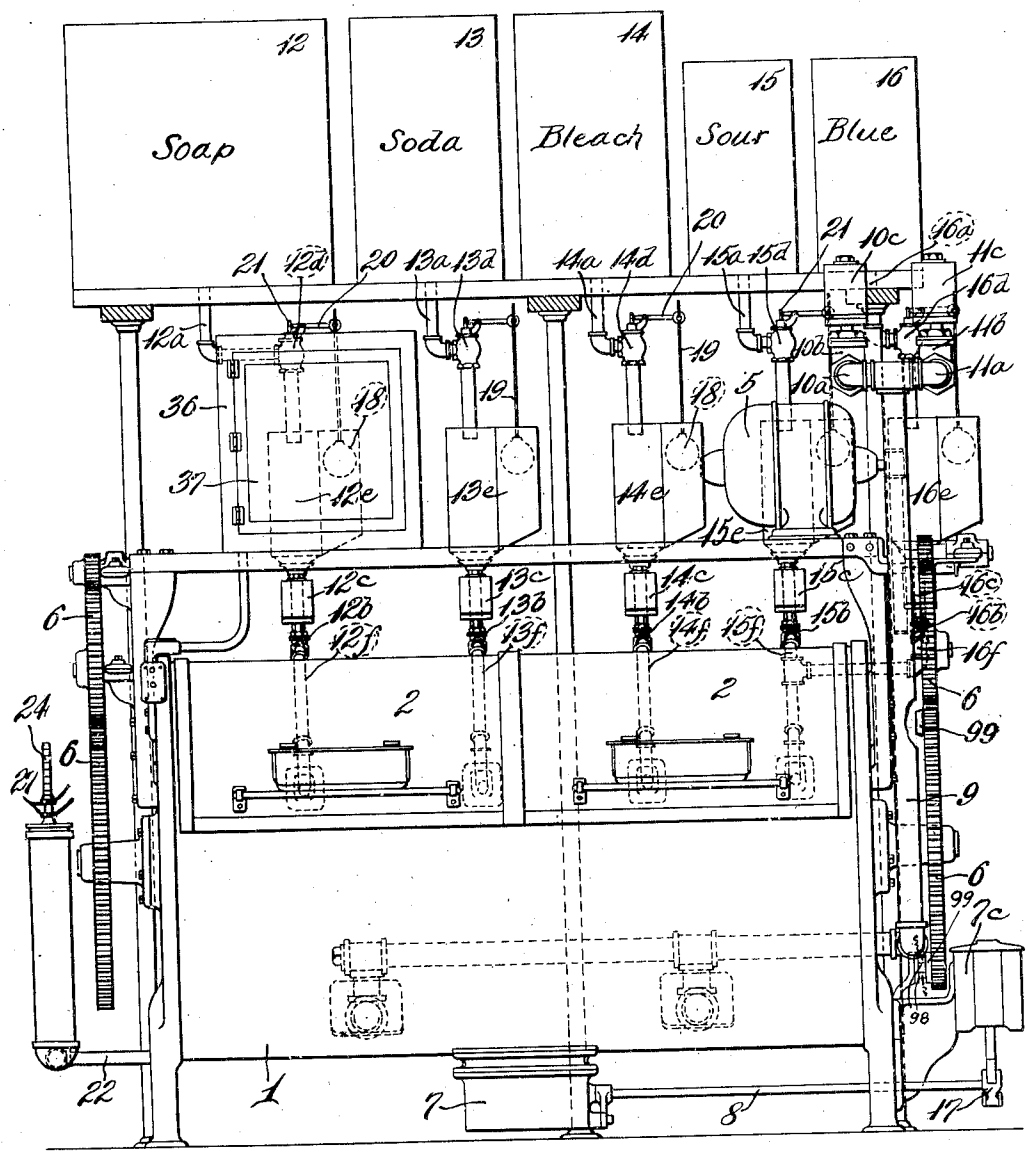
Aug. 16, 1927. 1,639,368

E. J. CARROLL

AUTOMATIC WASHING MACHINE

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Fig. 1.



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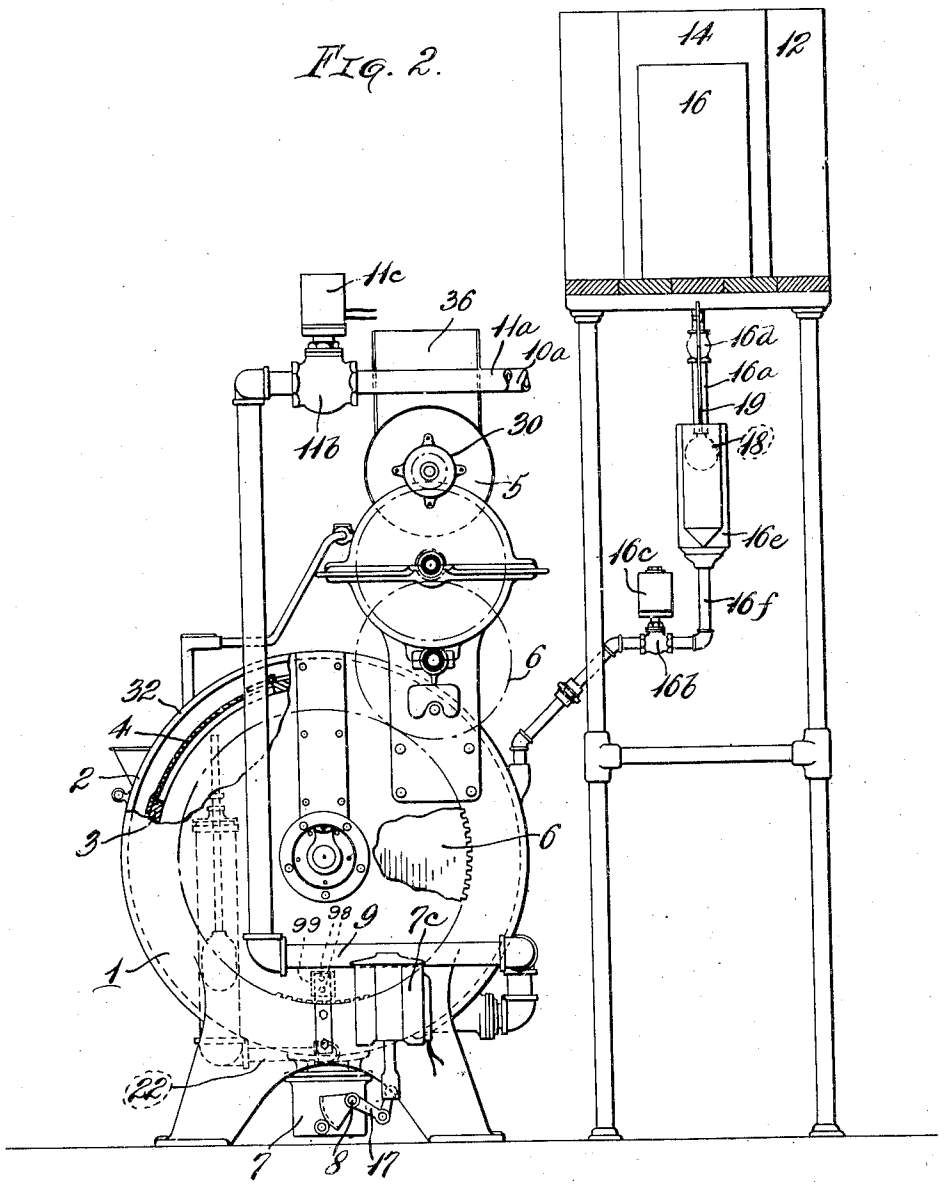
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AUTOMATIC WASHING MACHINE

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Fig. 2.



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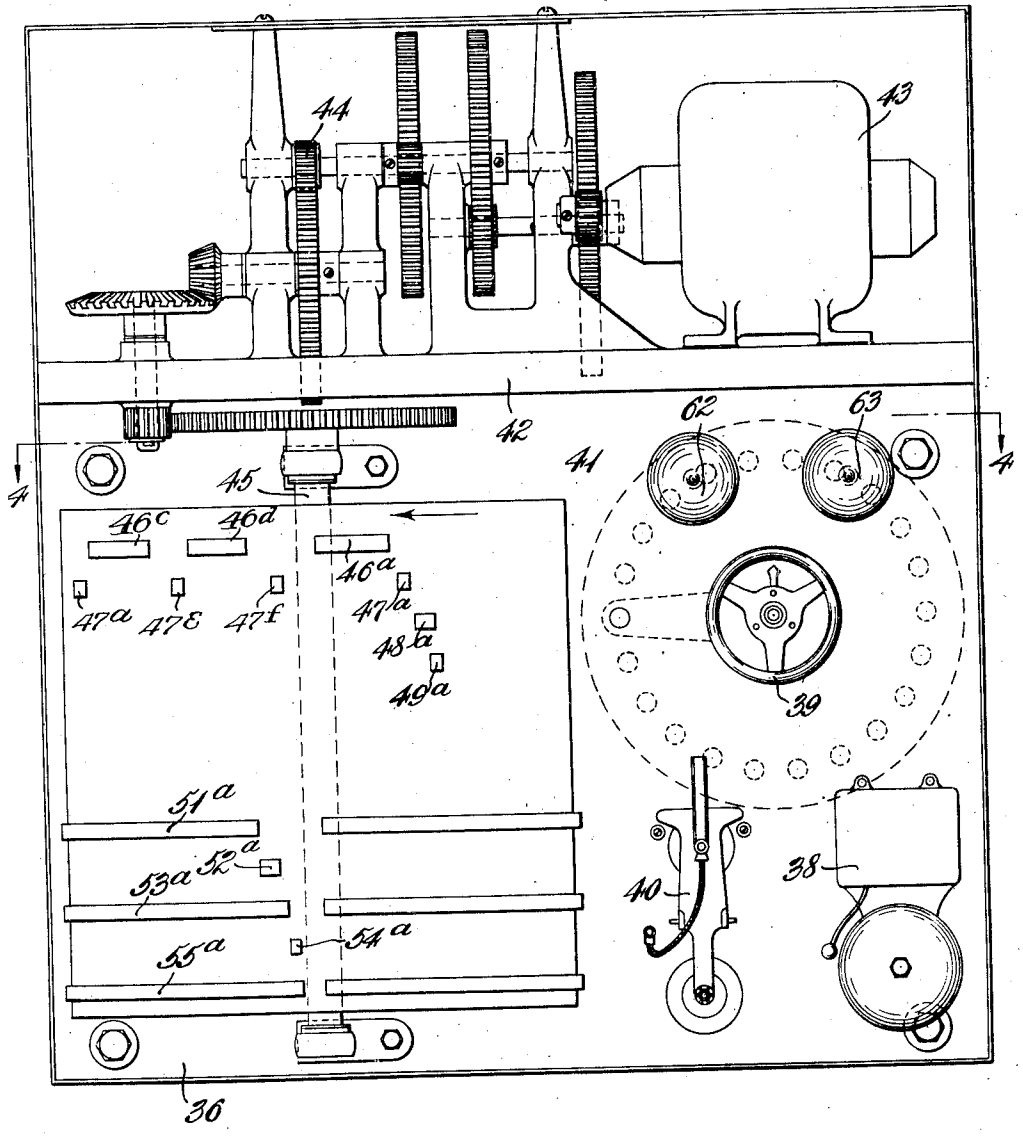
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AUTOMATIC WASHING MACHINE

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FIG. 3.



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AUTOMATIC WASHING MACHINE

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FIG. 4.

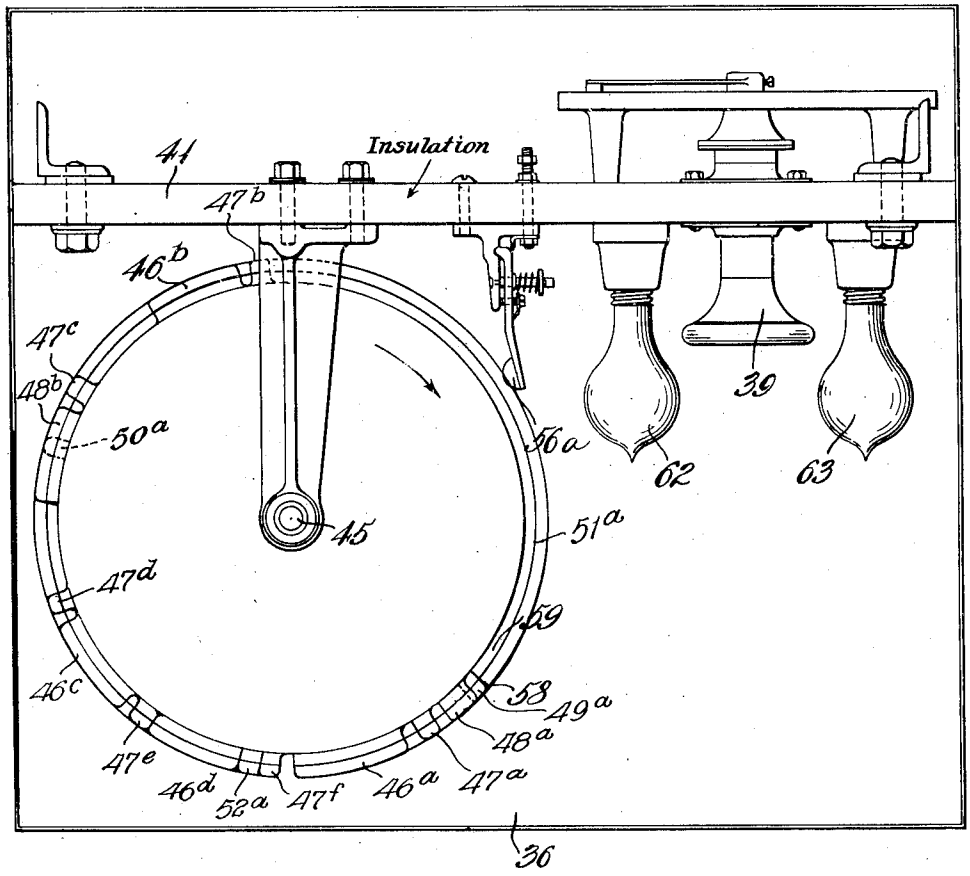


FIG. 7.

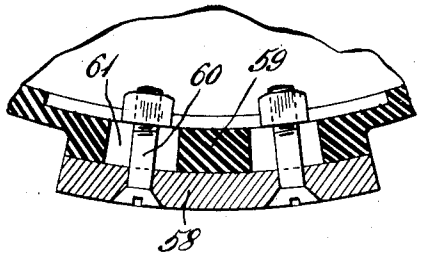
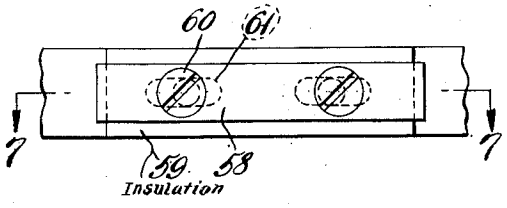


FIG. 6.



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AUTOMATIC WASHING MACHINE

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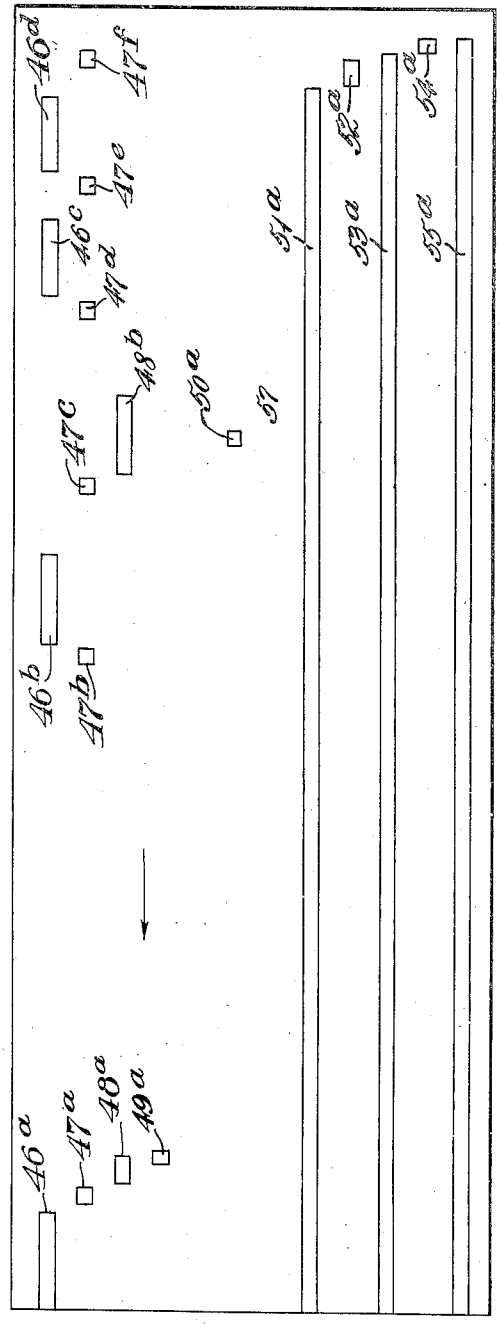


Fig. 5.

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AUTOMATIC WASHING MACHINE

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FIG. 8.

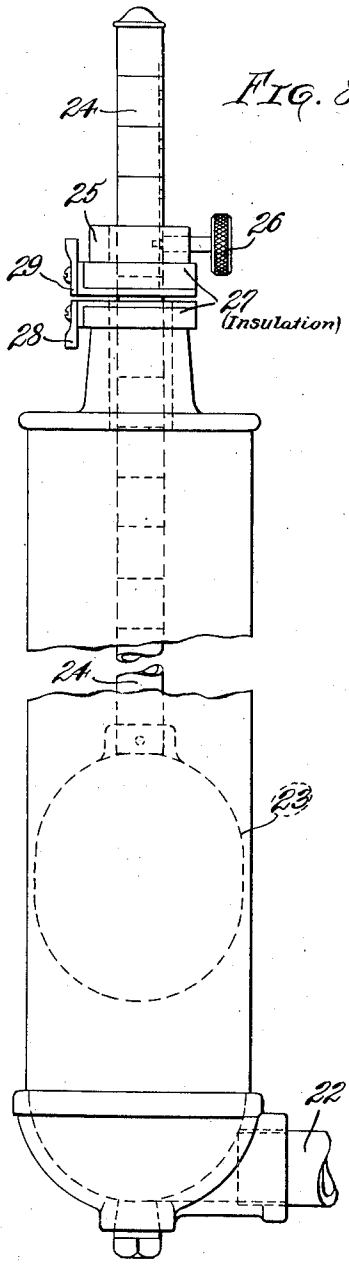


FIG. 10.

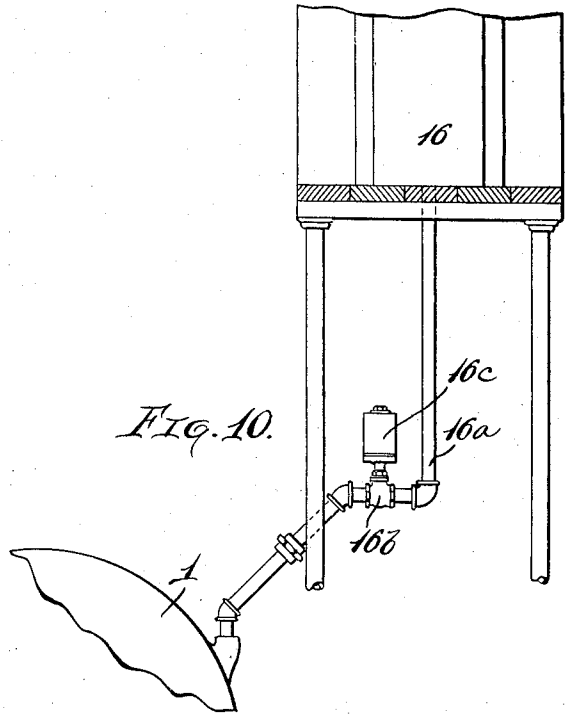
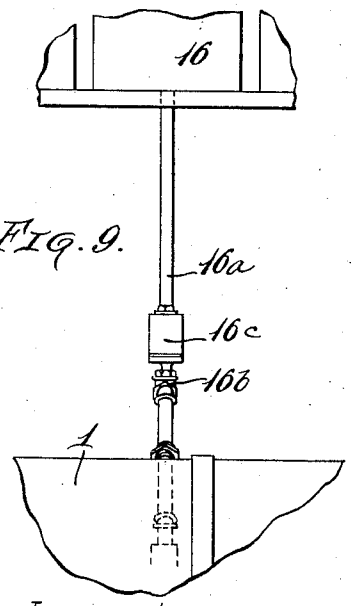


FIG. 9.



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AUTOMATIC WASHING MACHINE

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FIG. 11.

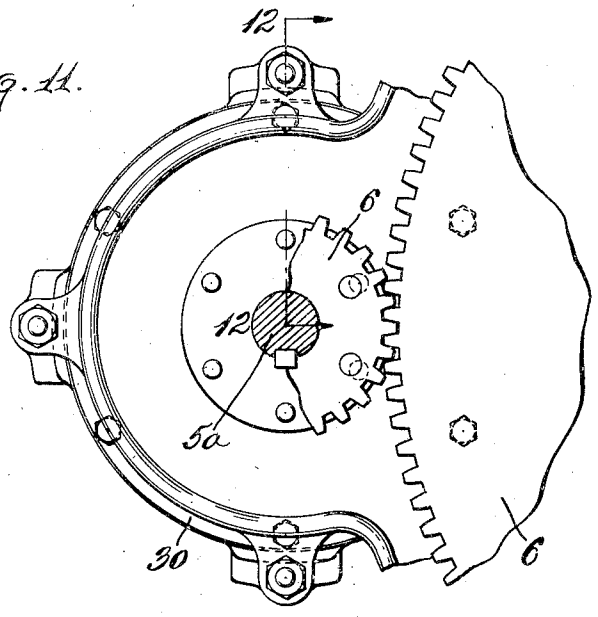
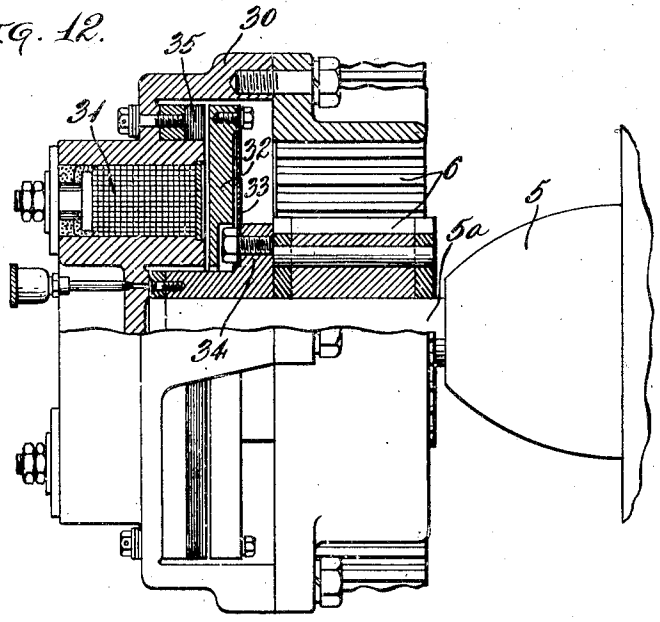


FIG. 12.



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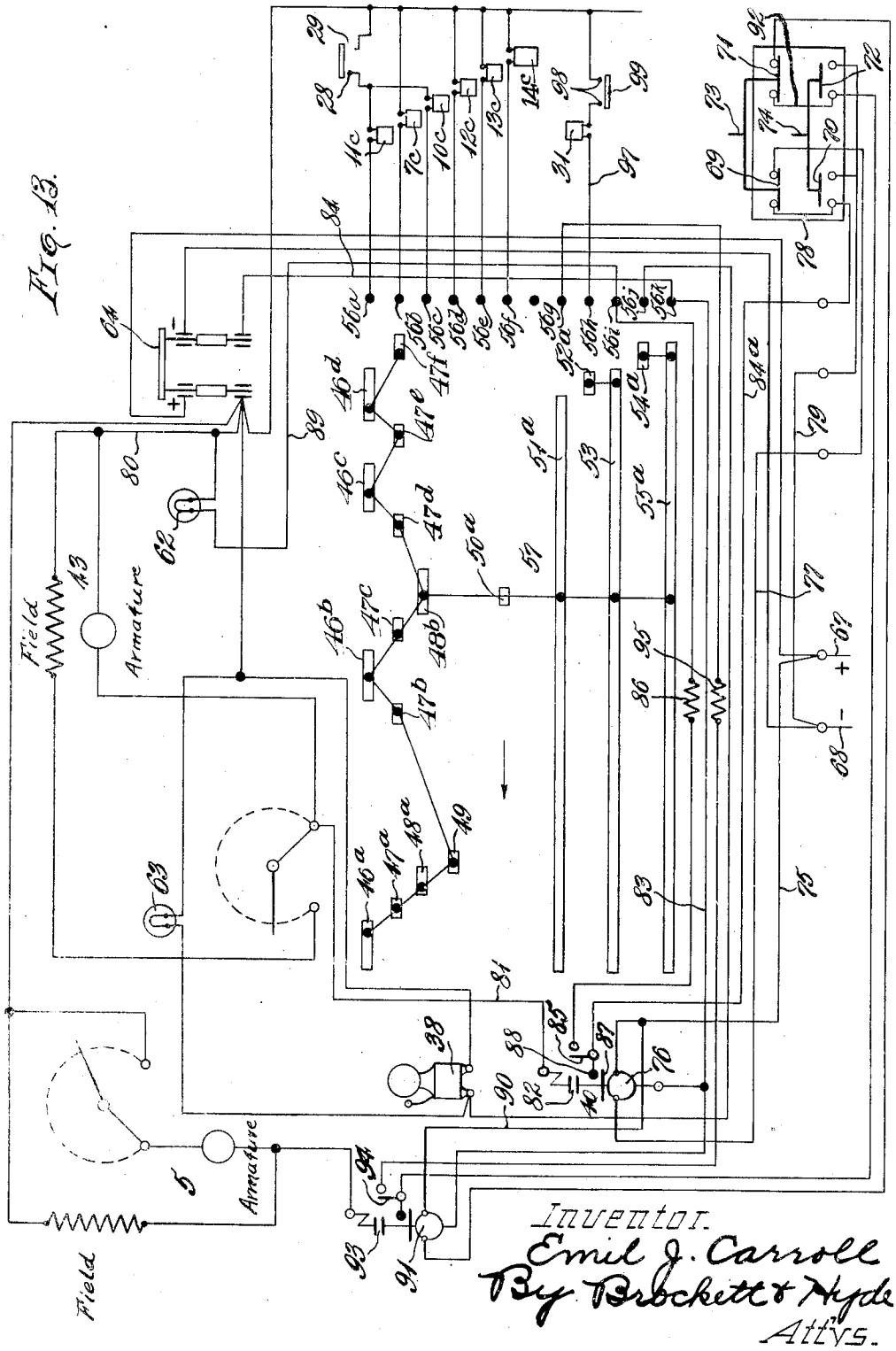
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AUTOMATIC WASHING MACHINE

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Fig. 13.



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Patented Aug. 16, 1927. 1,639,368

UNITED STATES PATENT OFFICE.

EMIL J. CARROLL, OF CINCINNATI, OHIO, ASSIGNOR TO THE AMERICAN LAUNDRY MACHINERY COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

AUTOMATIC WASHING MACHINE.

Application filed August 23, 1920. Serial No. 405,274.

This invention relates to laundry machines, and more particularly to washing machines.

In the operation of washing machines in commercial and other laundries it is usually the practice to subject a batch of clothing or other material to be washed to a definite formula or cycle of treatment and operations, which formula may vary according to the nature of the particular work, but is, nevertheless, more or less definite for each batch. This formula involves the treatment of a batch with various kinds of liquids, such as hot and cold water, soap solution and the like, each treatment being continued for a definite period, and the addition to the liquid or the treatment of the batch with special materials, such as bleach, sour, bluing or the like. While these formulas or cycles of treatment have been more or less definite, as stated, they have always been under the control of and regulated by an attendant, who operates the several valves at the proper times to change the solutions and to produce the proper steps in the treatment of the batch.

The present invention has for its object to provide improved apparatus which automatically takes care of all of the necessary steps in the washing operation, not only determining the period of each, but also changing the solutions and producing other necessary results so as to enable a given batch of material to be subjected to any predetermined and definite cycle of operations, all with a view of either controlling one or a series of washers and possibly other laundry machines from a central station, or of enabling an operator, after seeing that the washing machine is loaded, to initiate the cycle of washing operations and then give undivided attention to other duties with the certainty that a definite cycle of operations will be completed before the washing machine again requires attention.

A further object of the invention is to provide improved control devices, mechanism and means for producing the foregoing results, and to arrange the same for convenient adaptation to a complete laundry system in which all of the various machines involved in washing, ironing and finishing clothing in a laundry are co-related for centralized or automatic control and for operation in the most efficient manner.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

In the drawings, 1 represents a front view of a washing machine embodying the invention; Fig. 2 is an end view thereof from the right in Fig. 1; Fig. 3 is a front view of one form of control unit for the electrical circuits, the cover or casing being omitted; Fig. 4 is a sectional plan view on the line 4—4, Fig. 3; Fig. 5 is a development of the surface of the controlling drum; Fig. 6 is a detail elevation, illustrating an adjustable drum contact; Fig. 7 is a sectional view on the line 7—7, Fig. 6; Fig. 8 is an elevation, on a larger scale, illustrating the device for controlling the level of liquid in the washer; Fig. 9 is a detail view corresponding to Fig. 1, illustrating another arrangement for controlling the flow of liquid material delivered to the washing tub; Fig. 10 is a side elevation thereof; Fig. 11 is an end view of a motor brake; Fig. 12 is in part a front elevation, and in part a section on the line 12—12, Fig. 11; and Fig. 13 is a diagrammatic view of the electrical circuits.

The particular construction of the washing machine is immaterial, as the invention is more intimately concerned with the control of the cycle of washing operations and the various treatments or operations to which the machine subjects the clothing rather than to the manner in which the clothing is manipulated in the machine during the washing operation.

The washing machine shown in the drawings is of a common type involving an outer casing or tub 1, the chamber in which is accessible through one or a pair of suitable doors, such as the sliding doors 2. The tub 1 is of cylindrical form and contains a washing drum 3 of cage form in which the material to be washed is placed. This drum has the usual door or doors 4 which are registered with the doors 2 to enable material to be loaded into or removed from the drum. Said drum is operated by suitable mechanism, usually of a character to rotate it first in one direction and then in the other. The mechanism shown for this purpose includes an electric motor 5 connected by suitable gearing 6 to the drum shaft. 7 represents the casing of a suitable drain valve actuated by a shaft 8, while 9 indicates a pipe for

supplying the tub with water, said pipe communicating with hot and cold water supplies delivered thereto respectively by the pipes 10^a and 11^a, so that either hot or cold water, or both, may be supplied to the tub.

To carry out the principles of the present invention the washing machine is also connected with suitable sources of supply of such other materials as are necessary in the washing operation. While powdered, granular, or other materials may be used, the drawings show these materials supplied in liquid form from a suitable number of supply tanks, marked respectively 12, 13, 14, 15 and 16, of various sizes, and which contain supplies of different materials, as indicated by the legends in Fig. 1. The several supply tanks communicate with the washing machine tub by a series of pipes or conduits marked respectively 12^a, 13^a, 14^a, etc.

The automatic control of the washing machine requires the drain valve and the supplies of hot and cold water and the several washing agents in the tanks 12, 13, etc., to be automatically controlled. For this purpose the several pipes 10^a, 11^a, 12^a, etc., are provided with valves of any suitable form and marked respectively 10^b, 11^b, 12^b, etc., and suitable means is provided for automatically actuating these supply valves and the drain valve at the bottom of the tub. These valves may be actuated by automatically controlled mechanical means, but the drawings show them actuated by suitable electromagnets.

7^c represents a suitably supported electromagnet, the movable core of which is connected to an arm 17 on the shaft 8, so that operative movement of said core when the electromagnet is energized turns the shaft and opens the drain valve in a manner that will be readily understood without further description.

10^c, 11^c, 12^c, etc., represent a series of similar electromagnets, each of which comprises a coil and a suitable core suitably connected so that when said coil is energized, elevating movement of the core opens the corresponding valve 10^b, 11^b, 12^b, etc., and upon de-energization the core drops by gravity or a spring and the valve closes. Such electromagnetically operated or solenoid valves can be purchased in the open market and require no further description.

The quantity of hot or cold water and of each of the several liquids delivered to the tub from the supply tanks 12, 13, etc., is controlled by or depends upon the period of time each valve 10^b, 11^b, 12^b, etc., remains open. The head of the hot and cold water supplies remains constant so that the period of opening of the valves 10^b, 11^b accurately determines the quantities of these liquids. When the pipes 12^a, 13^a, etc., from the several supply tanks lead directly to the tub, as in Figs. 9 and 10, the heads of liquids in these tanks will be gradually reduced as the liquids are used up and consequently there may be a slight variation in the quantities of these liquids. To secure more accurate measurement of these other liquids suitable means may be provided for maintaining a constant head. As shown in Figs. 1 and 2 the several pipes 12^a, 13^a, etc., deliver through valves 12^d, 13^d, etc., into intermediate tanks 12^e, 13^e, etc., from which the pipes 12^f, 13^f, etc., deliver through the magnetically controlled valves 12^b, etc., into the tub. In each tank is a float 18 carried by a rod 19 adjustably connected to a lever 20 pivoted on the valve body and adapted to actuate the valve stem 21. This arrangement operates on the same principle as the common flush tank. Pipes 12^f, 13^f, etc., are slightly smaller than the pipes 12^a, 13^a, etc., and the float controlled valves 12^d, 13^d, etc., maintain a uniform head of liquid in each intermediate tank even while the valves 12^b, 13^b, etc., are open and allowing liquid to flow to the tub. With this arrangement a definite period of opening of a valve discharges an accurately measured quantity of liquid into the tub.

Fig. 8 represents an enlarged view of an automatic controller for preventing the liquid supplied to the washing machine from rising above a definite predetermined level. This device comprises a receptacle communicating through a pipe 22 with the washing machine tub. In said receptacle is a float 23 naving a rod 24 extending out through an opening in the receptacle top, where it is provided with an adjustable collar or ring 25 which may be secured at various positions on the rod 24 by a set screw 26. The collar 25 and top of the receptacle are provided with insulating rings 27 carrying contacts 28, 29, which, when the float is in its lowest position, complete a circuit which includes the electromagnets 10^c, 11^c controlling the hot and cold water supplies. The collar 25 is adjusted on the rod 24 so that the float lies at a level where it will be lifted by the rising water in the tub and thereby separate the contacts 28, 29 and open the circuits to the electromagnets controlling the hot and cold water supplies. Therefore, by properly adjusting the collar on the rod the float can be made to shut off the water supply and prevent the quantity of water in the tub from exceeding a definite amount.

Figs. 11 and 12 represent a suitable form of electromagnetic brake for the motor which rotates the washing machine drum. An electromagnetic brake is preferably utilized in order to enable the braking power to be applied automatically so as to stop the rotation of the washing machine drum in such position that its door 4 will be in registra-

tion with the door 2 of the tub, making it unnecessary to provide suitable mechanism for enabling the operator to manually rotate the tub and register the doors with each other. While any suitable automatic brake may be used, the one in the drawings comprises an outer casing or frame 30 attached to a stationary part of the machine and provided with a cavity in which is located coil 31 lying opposite an armature shown as a metallic ring 32 attached to the outer periphery of a flexible resilient diaphragm 33, whose inner edge is attached to a sleeve 34 fastened to the shaft 5^a of motor 5. 35 represents one of a series of brake shoes spaced around the periphery of the disc 32. When the coil is energized it attracts the ring 32, causing the latter to bear against the brake shoes 35 and thereby create a drag or frictional effect upon said disc and upon the rotating motor shaft to which it is attached, thus bringing the motor and the washing machine drum operated thereby to rest. When the coil has been de-energized the resiliency of the member 33 returns the ring 32 to its normal position.

The controlling mechanism for the machine may be of any suitable description so long as it is designed to cause the various elements of the apparatus to perform their functions in the proper order and manner.

In the drawings, 36, Fig. 1, represents the casing of the electrical control mechanism shown in detail in Figs. 3 to 7, inclusive. Casing 36 is provided with a suitable door 37 by opening which access may be had to the mechanism. Within this casing is located a rotary automatically operated controller which controls both the order and periods of the washing operations and controls the rotation of the washing machine drum. It also contains an alarm bell 38, to be referred to, and the controlling handle 39 of the starting resistance for the timing motor, as well as a clapper switch 40, to be referred to.

The rotary controller may be of any suitable description and is shown as of the drum type with a series of segments arranged as the drum rotates to engage stationary contacts and complete circuits which control the several operations. As illustrated, within the casing 36 is located an insulating support 41 provided with a plate or shelf 42 for supporting the governing or timing motor 43 connected by suitable gearing, represented generally at 44 to actuate the drum shaft 45. This drum is provided with a series of conducting segments marked respectively 46^a etc. to 55^a etc., inclusive, which separately cooperate with a series of stationary yielding contacts of suitable form, one of which is marked 56^a in Fig. 4, and all of which will be identical in form. These contacts are marked 56^a to 56^k, inclusive, in Fig. 13. 57 represents a vacant zone or band around the drum to receive an extra segment or segments for controlling other washing machine operations by electromagnet 14^e if desired. The several drum segments are all of the form illustrated in Figs. 6 and 7, each thereof including a body 58 of conducting material held to an insulating portion 59 of the drum by clamping bolts 60 passing through elongated slots 61. This arrangement enables the segments to be adjusted circumferentially of the drum for timing the various operations and by so adjusting them and by selecting segments of the proper length, any desired effect may be obtained. All of the segments in the drum are electrically connected with each other but are insulated from the drum body.

62 and 63 represent two signal lights, the first of which is called the "running" light and is illuminated while the series of washing operations is going on. The second light 63 is a "warning" light which becomes illuminated when the series of washing operations is completed. This light and the bell 38 advise the operator that the cycle is completed. Lamps 62 and 63 may be visible through suitable windows in the casing or may be exposed outside the same, and may be of different colors, such as white and red, as will be obvious.

Referring to Fig. 13 which diagrammatically represents the electrical circuits, 64 represents the main line switch in circuit with the lead wires 67, 68. In describing the various circuits the current will be assumed to flow from positive to negative. 69 and 70 represent "stop" and "start" switches for the timing motor 43, while 71 and 72 represent stop and start buttons for the drum rotating motor 5. These start and stop buttons may be of any suitable form and may be arranged for individual operation, but as shown, the two stop switches are actuated by a common button 73 and the two starting switches by a common button 74.

When the starting switch 70 is closed current will flow from the positive lead wire 67 by way of wire 75 through coil 76 of the clapper switch 40, wire 77, stop switch 69, wire 78, start switch 70 and wire 79 to negative. Energization of coil 76 closes a switch 82 and completes a circuit as follows:

From the positive side of the main switch 64 through wire 80 to the armature and field of the timing motor 43 by way of wire 81 and through the switch 82 to wire 83, thence to stationary contact 56^k which is permanently connected by wire 84 to the negative. The closing of the circuit causes the timing motor 43 to begin rotating and to turn the controlling drum. The circuits just established are therefore called the starting circuits, as the operation of the timing motor depends wholly upon holding the starting

switch 70 closed to maintain the coil 76 energized and thereby keep switch 82 closed. However, when the controlling drum rotates far enough by holding the starting circuits closed, the running segment 53^a reaches the stationary contact 56^l and completes a permanent circuit through the coil 76, so that the timing motor will continue to run after the starting switch 70 is released. In Fig. 13 the drum is rotating from right to left so that the left hand ends of the several drum segments are the ones which first engage the stationary contacts. The permanent circuit includes a switch 85 which is closed by an arm 87 of the clapper switch 40 engaging and operating an insulated arm 88 of the lever of switch 85. The permanent circuit for the coil 76 is then as follows:

From the positive lead 67 through coil 76, stop switch 69, wire 78, wire 84^a, switch 85, resistance 86, contact 56^l and to running segment 53^a, thence to the negative segment 55^a and by way of contact 56^k to the negative lead wire. The circuits just described maintain the timing motor in operation.

Fig. 5 illustrates a development of the drum surface with the several segments illustrated thereon. While the drum revolves each of these segments engages its respective stationary contact and completes a circuit through an electromagnet to energize the same and maintain it energized for the proper length of time to operate a valve or other device and produce a washing machine operation. The drum segments, as before stated, may be of any suitable length and may be adjusted circumferentially of the drum and may be arranged in any order relative to each other so as to produce any desired cycle of operations. In other words, by selecting drum segments of proper length and distributing and adjusting them circumferentially of the drum, the machine may be adapted to and caused to perform any desired washing formula or process involving any number of repeated rinses with hot or cold water and applications of and treatments with various detergents or cleaning materials, such as soap, bleach or the like, with any desired duration for any one of said treatments and with all necessary draining of the tub between successive steps of the process. According to the arrangement shown in Fig. 5, assuming the cycle of operations to start at the left, the segment 46^a first engages the stationary contact 56^a which is in a circuit through the coil 11^c which actuates the cold water supply valve. Cold water is therefore allowed to flow into the tub to produce a cold water rinse of the garments. The circuit through the magnet 11^c also includes the switch 28, 29 of the automatic liquid level controller shown in Fig. 8, so that regardless of the length of a segment 46^a or the like the level of the liquid will never exceed a definite amount. After a short interval the segment 47^a engages a contact 56^b and completes a circuit through the coil 7^c which actuates the drain valve. Next the segment 48^a engages its contact 56^c and completes a circuit through a coil 10^c which actuates the hot water valve. This hot water supply circuit also includes the contacts 28, 29 so that the amount of hot water as well as cold water can never exceed a definite amount. Next a segment 49^a engages a contact 56^d and completes a circuit through the coil 12^c which actuates the valve for controlling the supply of soap. The washing operation then proceeds for some time after which the drain valve is opened by segment 47^b and cold water is again supplied by 46^b. The cold water is then drained off by 47^c and hot water is supplied by 48^b and also the segment 50^a engages contact 56^f and supplies some bleaching solution. The tub is then drained by 47^b and supplied with cold water for rinsing by 46^c and again drained by 47^e and supplied with cold water by 46^d, after which it is drained by 47^f. During all of this time the running segment 53^a has been engaged with its contact 56^l with a circuit completed through said segment to the running light 62 by way of wire 89.

When the end of the segment 53 leaves its contact 56^l the permanent circuit through the coil 76 is broken and switches 82 and 85 automatically open either by gravity or a spring, as is usual, so that the circuit through the timing motor is opened and said motor stops running, leaving the controlling drum stationary with the drain segment 47^f and a segment 54^a in contacting relation with their contacts 56^b and 56^j. The drain valve is therefore open and as segment 54^a completes a circuit including the bell 38 and warning lamp 63, said bell rings and the warning lamp is illuminated to advise the operator that the washing operation is concluded.

The operation of motor 5 which rotates the washing machine drum may be controlled independently of the other circuits, such as by suitable manually operated switches. As shown, however, the circuit for this motor is also controlled by the rotary controlling drum, the control circuit being similar to the circuit for the timing motor. When the starting switch 72 is closed it completes a circuit as follows: from the positive lead wire 67 by way of wires 75 and 90 through the coil 91 of a clapper switch similar to the clapper switch 40, thence through the stop switch 71, wire 92, start switch 72, and wire 79 to negative. Energization of coil 91 closes the switches 93, 94 and completes a permanent circuit for the coil 91 through a resistance 95 to the contact 56^g which cooperates with a segment 51^a of the drum. The temporary holding circuit for the motor

5 is maintained closed by holding down the start button until the drum completes a permanent circuit by engagement of segment 51^a with contact 56^g. The segment 51^a terminates short of the end of segment 53^a so that the circuit through the motor 5 is automatically opened and the washing machine drum stops before the controlling drum comes to rest. Also, segment 52^a engages its contact 56^h and completes, so far as it can, a circuit through the wire 97 which includes the coil 31 of the magnetic brake for the motor 5. In the same circuit are two contacts 98 on a stationary part of the tub or casing in position to be engaged by a contact or segment 99 carried by but insulated from the drum driving gear 6. This segment 99 is located upon the gear 6 in such position that when it engages contacts 98 the door 4 of the rotating drum will be in registry with the outer door 2 of the tub or casing. Consequently, when the segment 52^a engages its contact 56^h it does not immediately complete the circuit 97 but prepares said circuit to be completed by the contact 99. Segment 52^a is made long enough so that before it leaves the contact 56^h the washing machine drum will have had time to make a complete revolution if necessary, to permit closing of the circuit 97 by the contact 99. When this circuit is completed the brake is instantaneously applied and the washing machine drum is stopped with the doors in proper registering relation. Immediately thereafter the timing drum stops, as before described, and the operator is notified that the machine is ready for unloading and reloading. After it is loaded pressure on the start button will initiate and cause the completion of another similar cycle of operations.

What I claim is:

1. A washing machine, comprising an outer casing having a door, a hollow movable washing member therein having a door, means for moving said member for the washing operation, and automatic electrical means for stopping said member with its door in registry with the casing door.

2. A washing machine, comprising an outer casing having a door, a hollow movable washing member therein having a door, means for moving said member for the washing operation, and automatic electrically controlled brake means governed by the movement of said member for stopping the same with its door in registry with the casing door.

3. A washing machine, comprising an outer casing having a door, a hollow movable washing member therein having a door, an operator for said member, means for delivering washing material to said machine, a controller for said means, means for stopping said member, means for causing said stopping means to operate in timed relation with said controller, and controlling means for said stopping means associated with said member and located in proper angular relation with respect to its door to cause said member to stop with its door in registry with the casing door.

4. A washing machine, comprising an outer casing having a door, a hollow movable washing member therein having a door, an operator for said member, means for delivering washing material to said machine, draining means for said casing, a controller for one of said means, means for stopping said member, means for causing said stopping means to operate in timed relation with said controller, and controlling means for said stopping means associated with said member and located in proper angular relation with respect to its door to cause said member to stop with its door in registry with the casing door.

5. A washing machine, comprising an outer casing having a door, a hollow movable washing member therein having a door, driving means for said member, means for delivering washing material to said machine, means for interrupting the drive for said member, brake means sensitive to the angular position of said member for producing a braking effect to stop said member with its door in registration with the casing door, and a controller for said delivering means operatively associated with said interrupting means and said brake means and adapted by its operation to set the braking means for production of its braking effect.

6. A washing machine, comprising an outer casing having a door, a hollow movable washing member therein having a door, operating devices for said member, devices for delivering washing material to said machine, stop means for said member, a controller for one of said devices and for said stop means, and positioning means sensitive to the angular position of said member for also controlling said stop means, whereby the conjoint action of said controller and positioning means produces registration of said doors during each stopping operation.

7. A washing machine, comprising an outer casing having a door, a hollow movable washing member therein having a door, operating means for said member, means for delivering washing material to said machine, means adapted when actuated to stop said member with its door in registry with the casing door, a controller for said delivering means and said stopping means, and positioning means sensitive to the angular position of said member and associated with said stopping means to control the same, whereby conjoint action of said controller and positioning means produces registration

of said doors during each stopping operation.

8. A washing machine, comprising an outer casing having a door, a hollow movable washing member therein having a door, operating devices for said member, devices for delivering washing material to said machine, brake means for producing a braking effect to stop said member, a controller for one of said devices and for said brake means, and positioning means sensitive to the angular position of said member for also controlling said brake means, whereby the conjoint action of said controller and positioning means produces registration of said doors during each stopping operation.

In testimony whereof I hereby affix my signature.

EMIL J. CARROLL.