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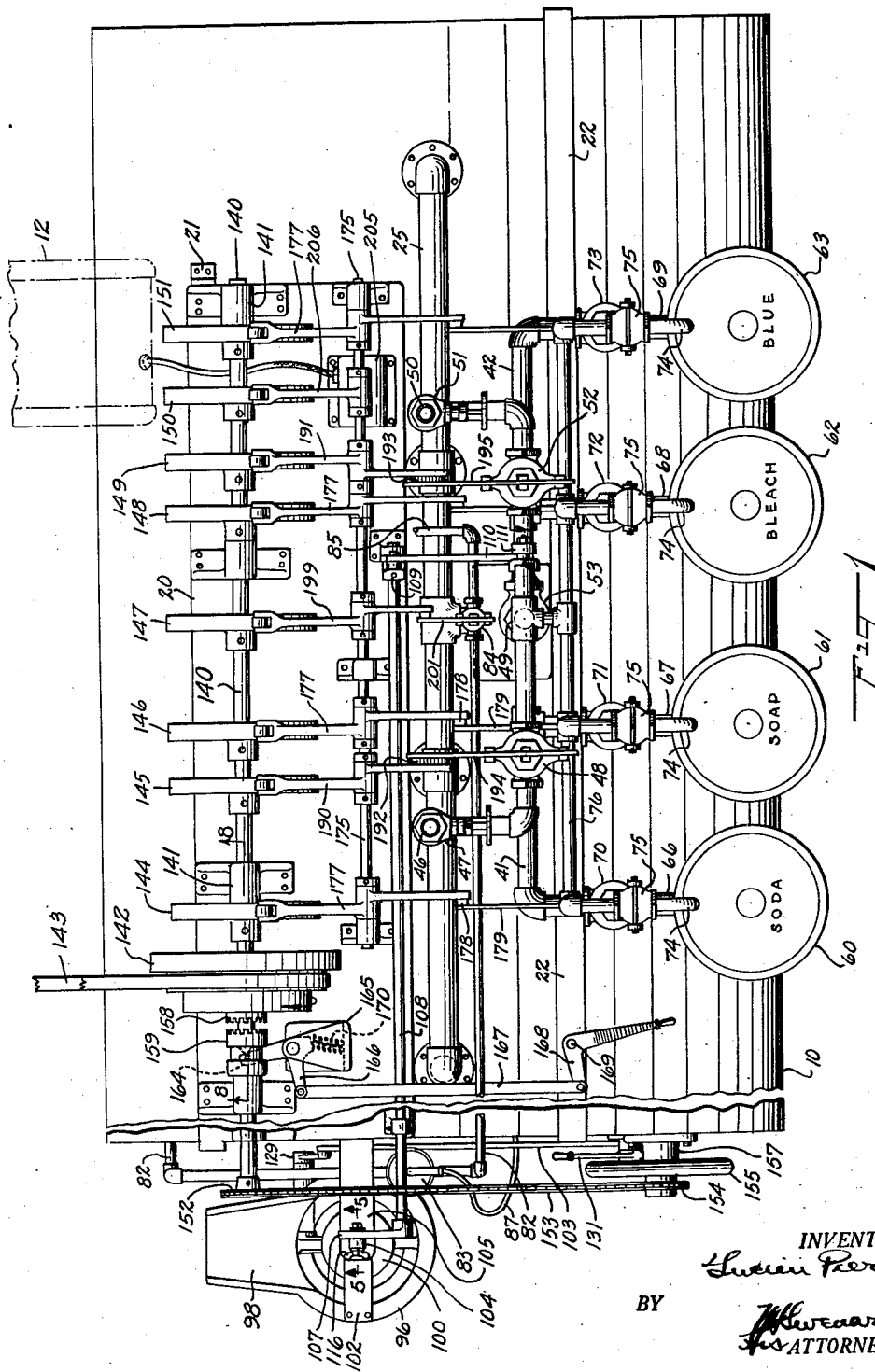
L. PIERCE

2,030,394

METHOD OF AND APPARATUS FOR WASHING FABRICS

Filed Jan. 4, 1930

10 Sheets-Sheet 1



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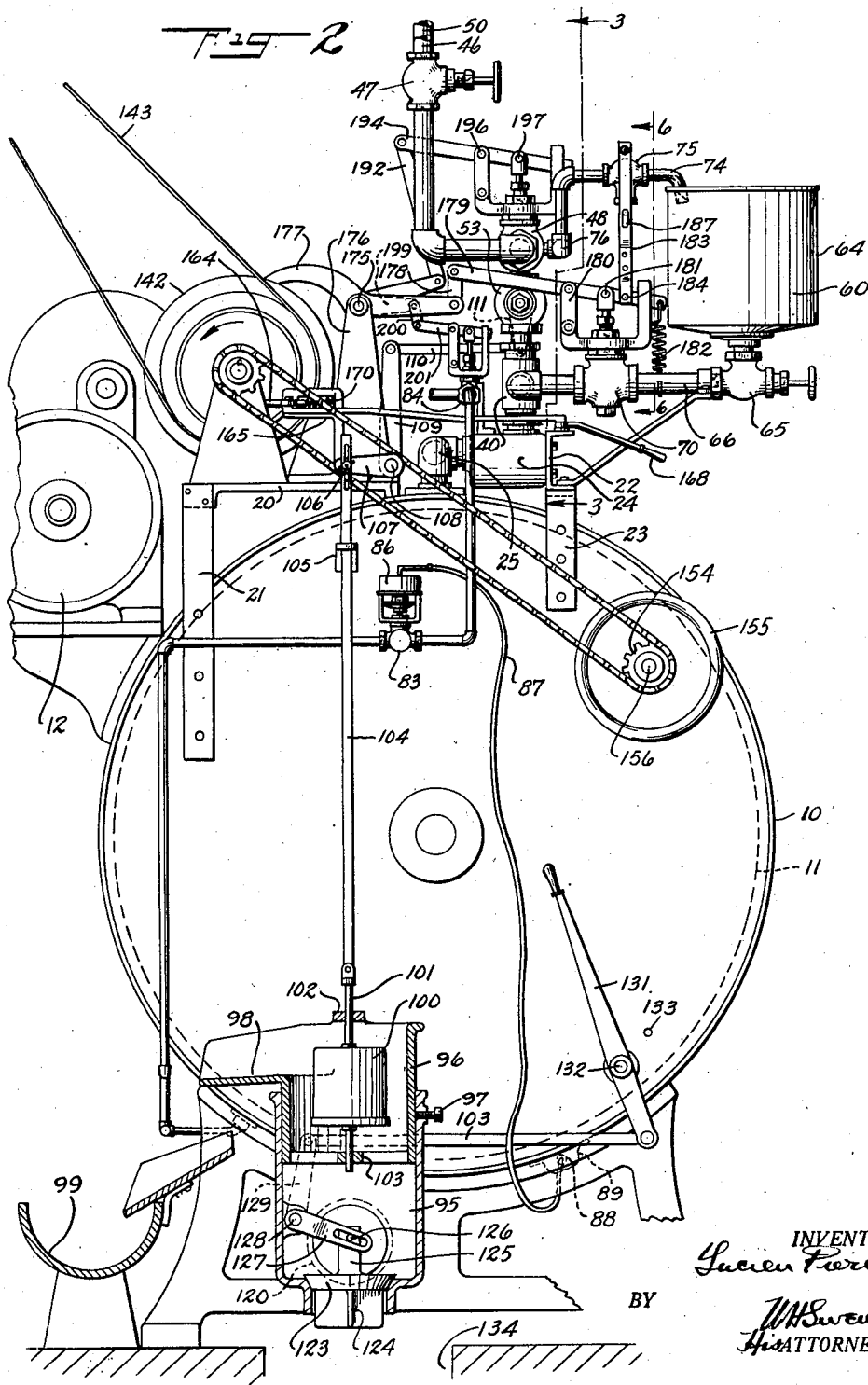
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2,030,394

METHOD OF AND APPARATUS FOR WASHING FABRICS

Filed Jan. 4, 1930

10 Sheets-Sheet 2



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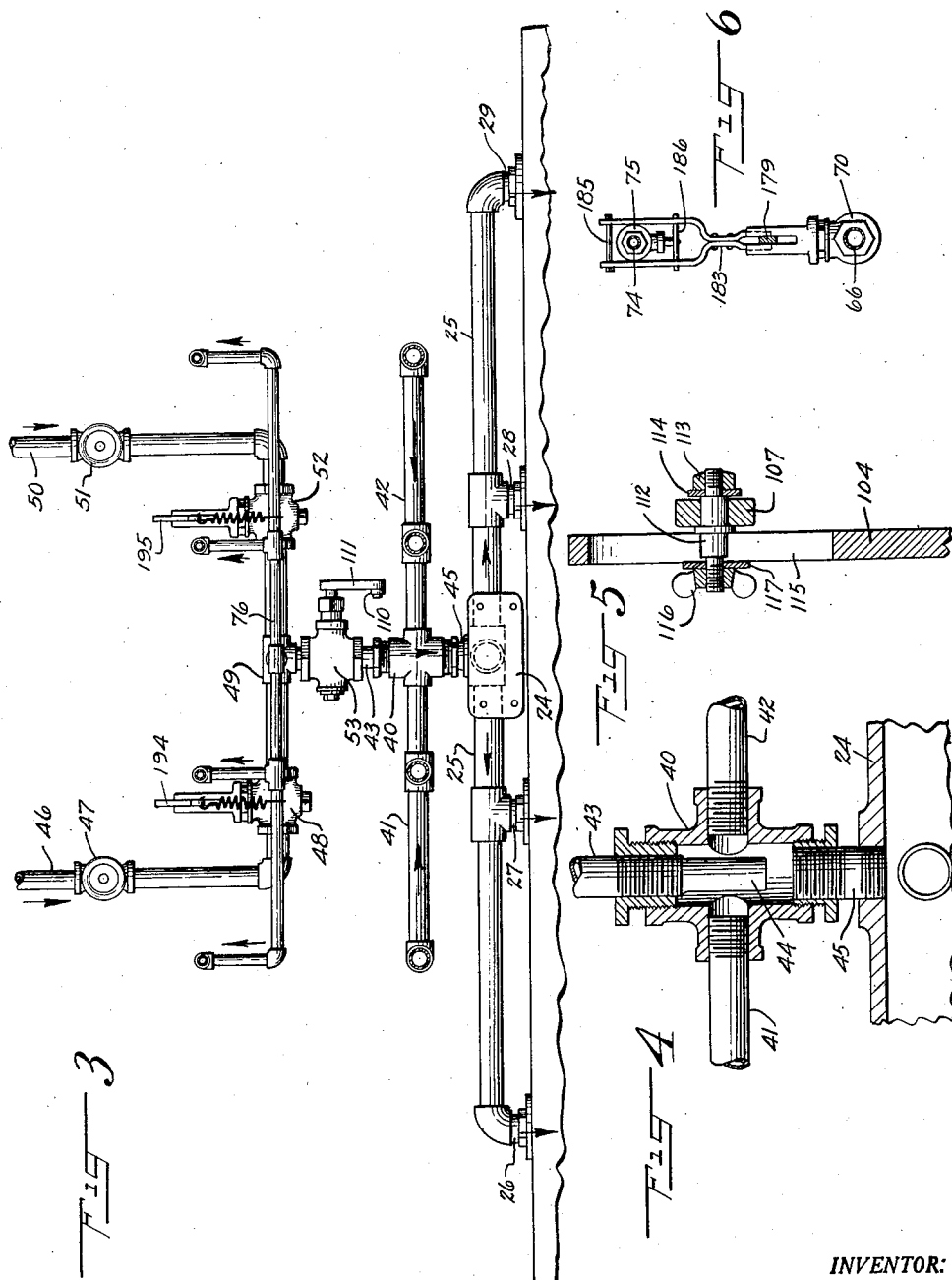
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METHOD OF AND APPARATUS FOR WASHING FABRICS

Filed Jan. 4, 1930

10 Sheets-Sheet 3



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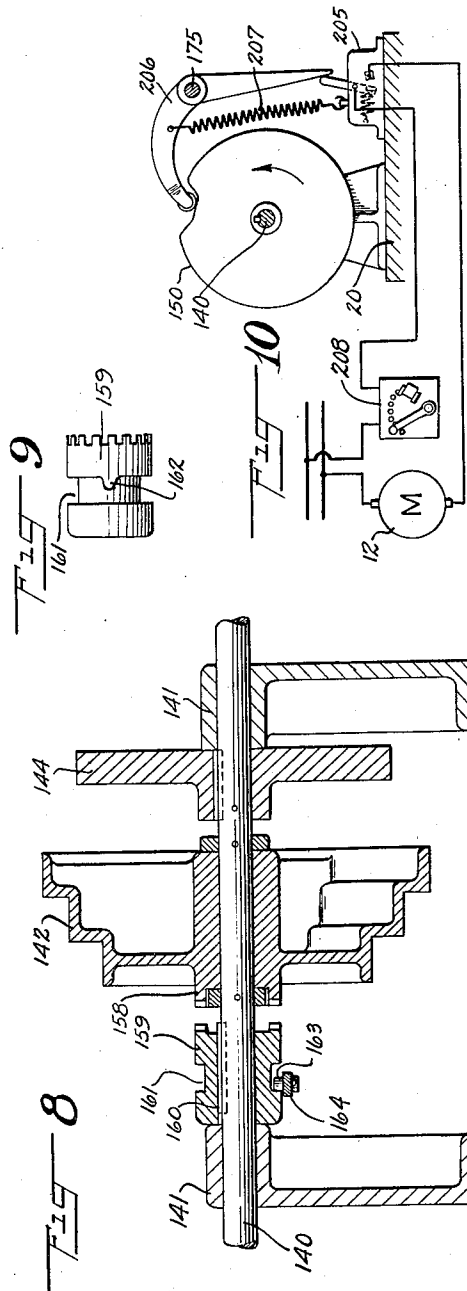
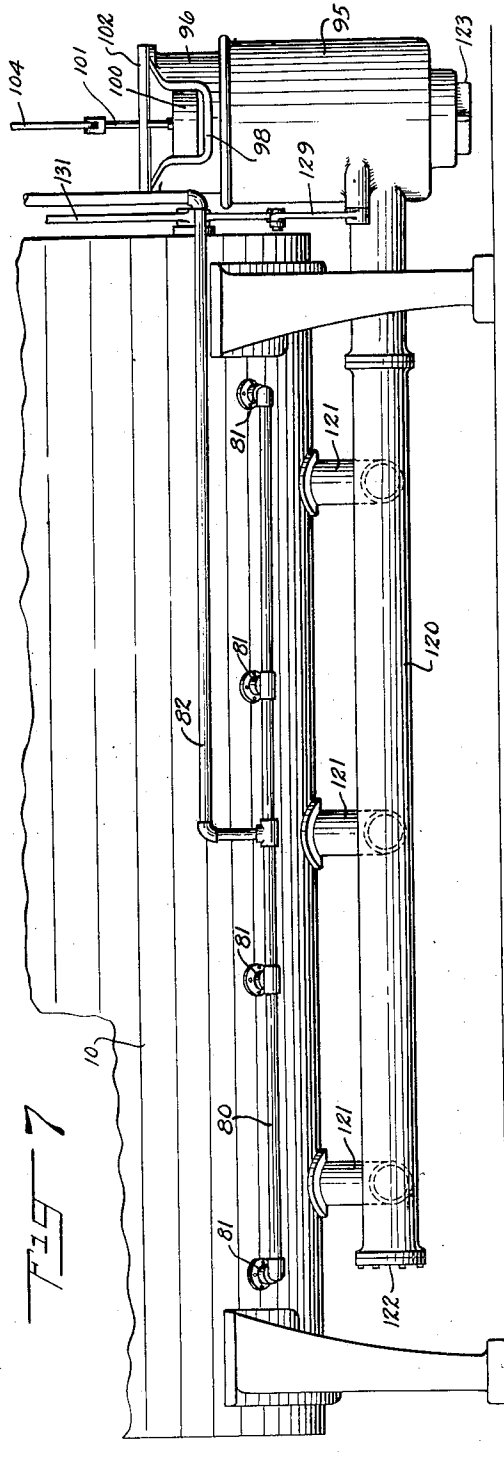
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METHOD OF AND APPARATUS FOR WASHING FABRICS

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10 Sheets-Sheet 4



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METHOD OF AND APPARATUS FOR WASHING FABRICS

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Fig 11

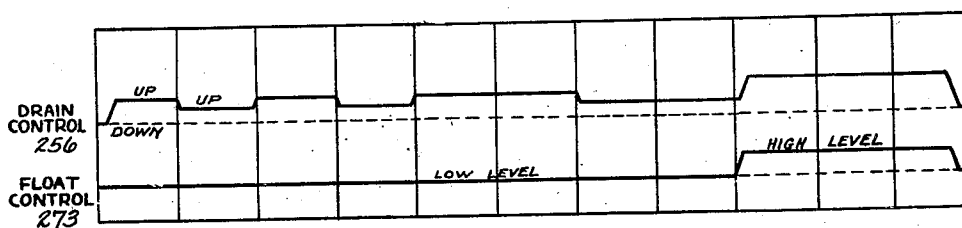
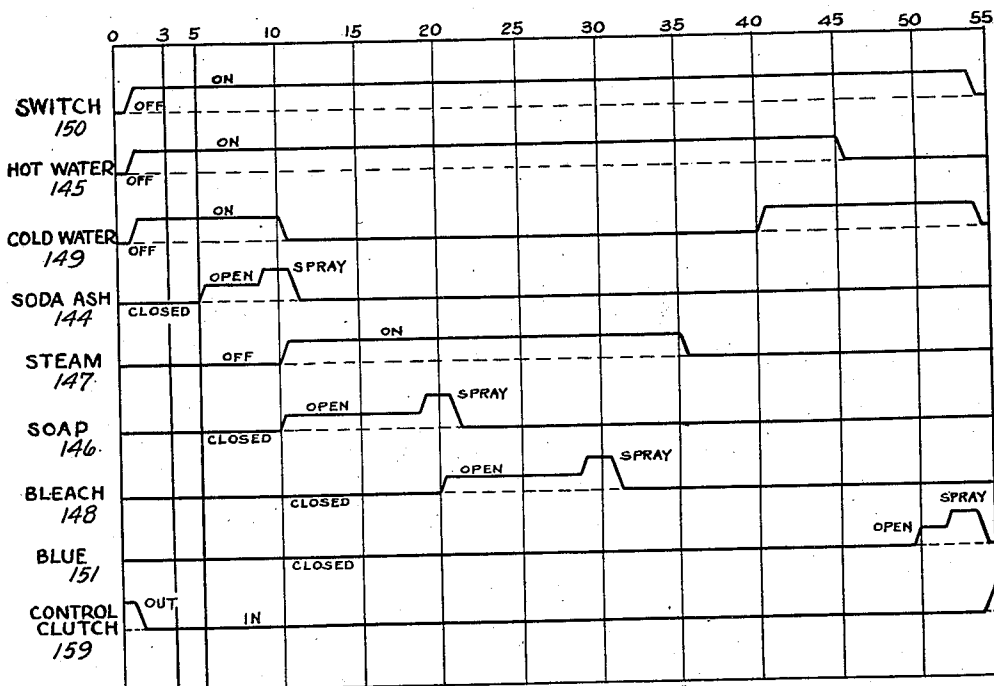


Fig 12

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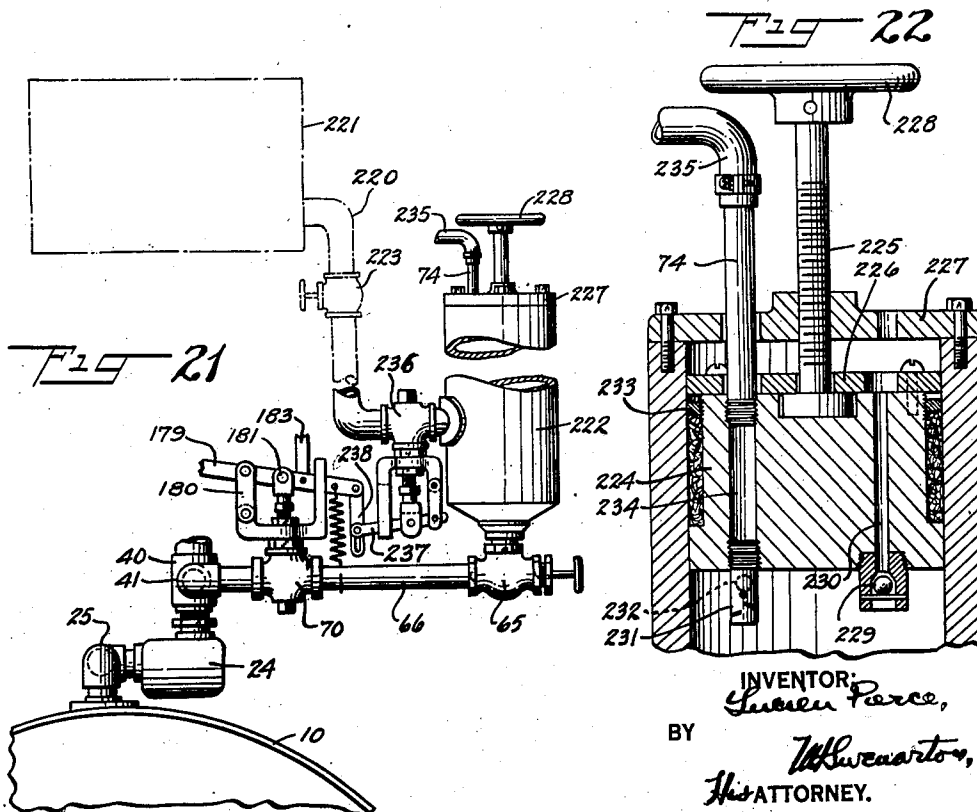
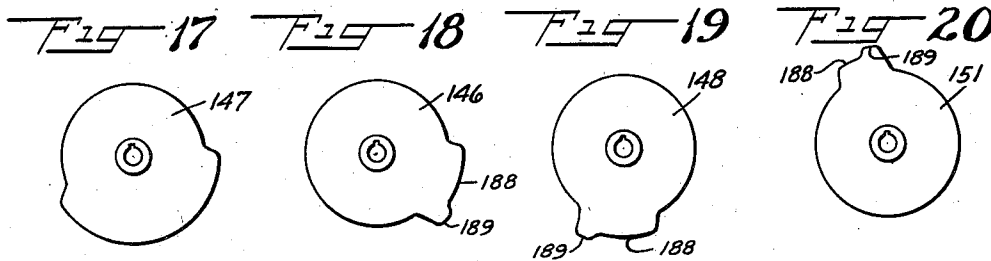
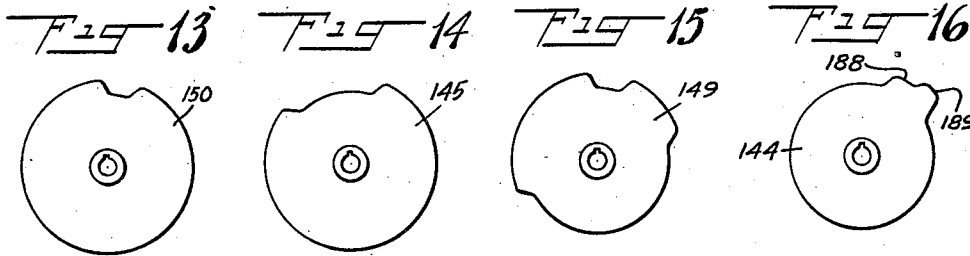
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METHOD OF AND APPARATUS FOR WASHING FABRICS

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10 Sheets-Sheet 6



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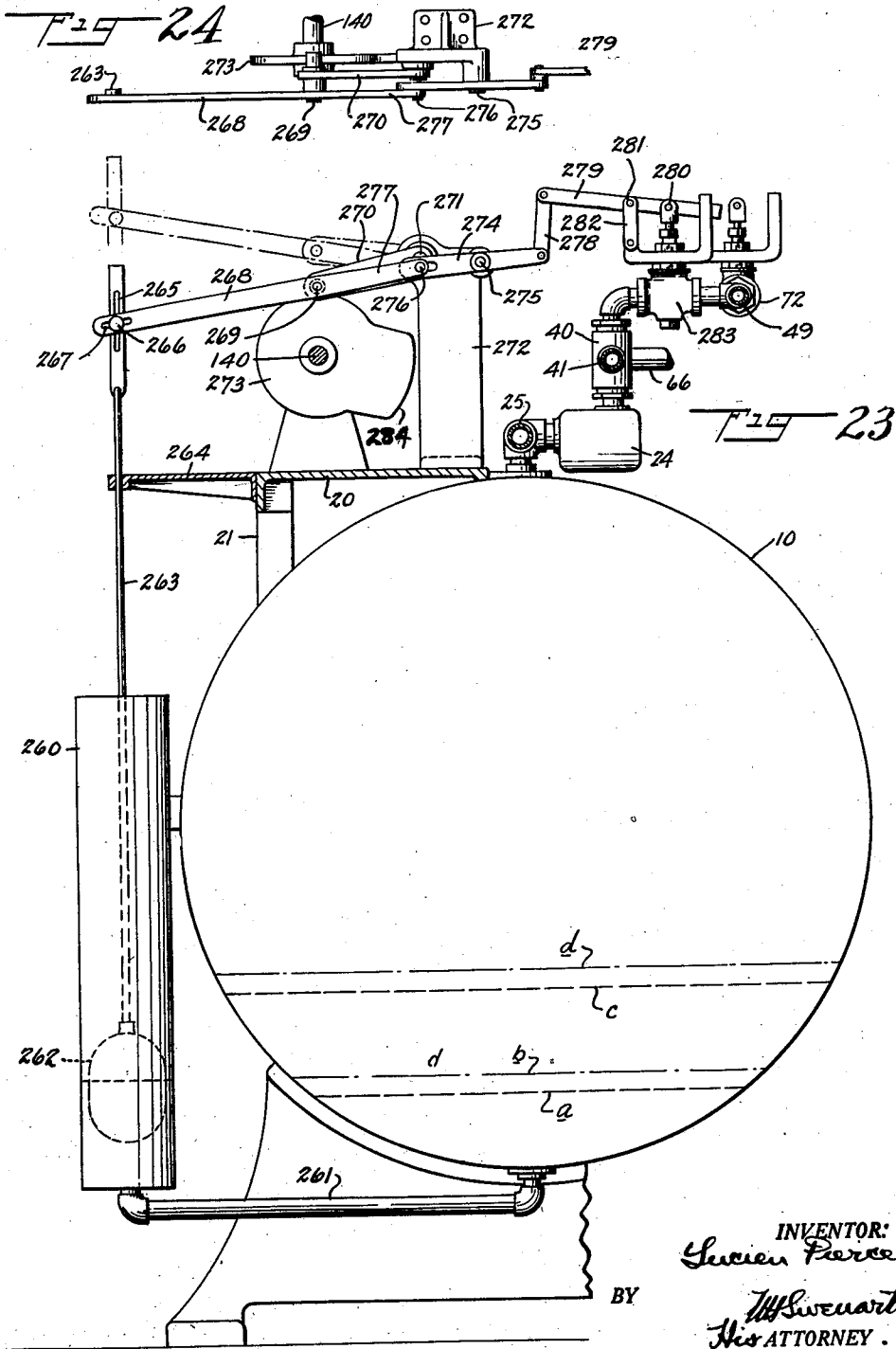
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METHOD OF AND APPARATUS FOR WASHING FABRICS

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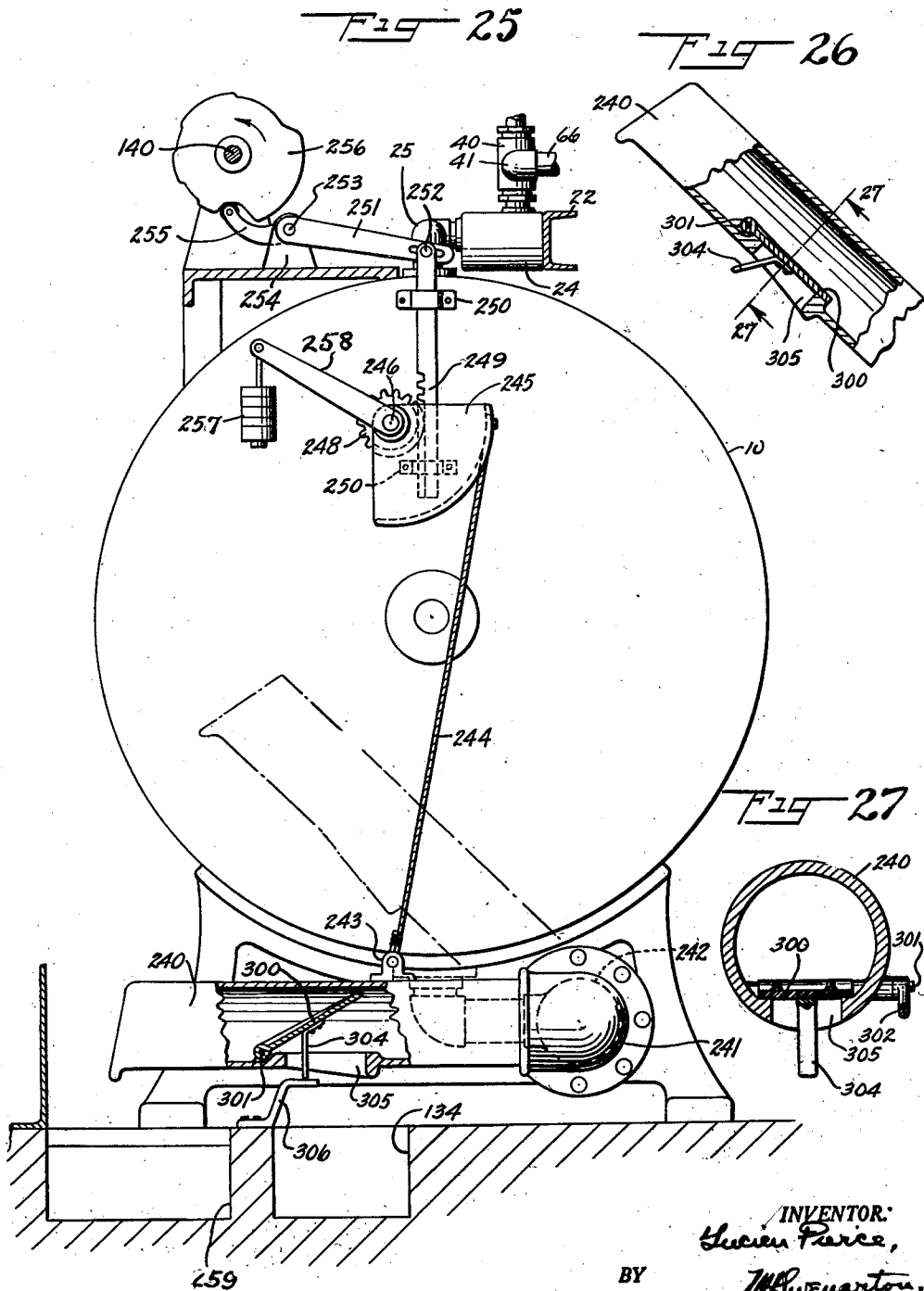
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METHOD OF AND APPARATUS FOR WASHING FABRICS

Filed Jan. 4, 1930

10 Sheets-Sheet 8



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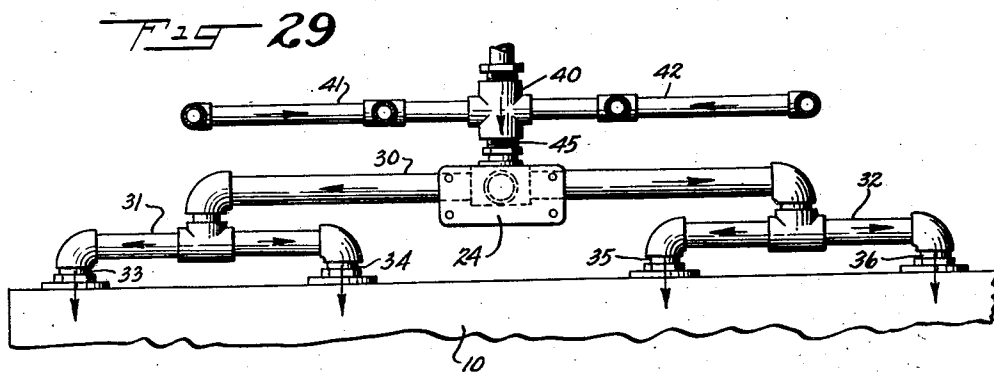
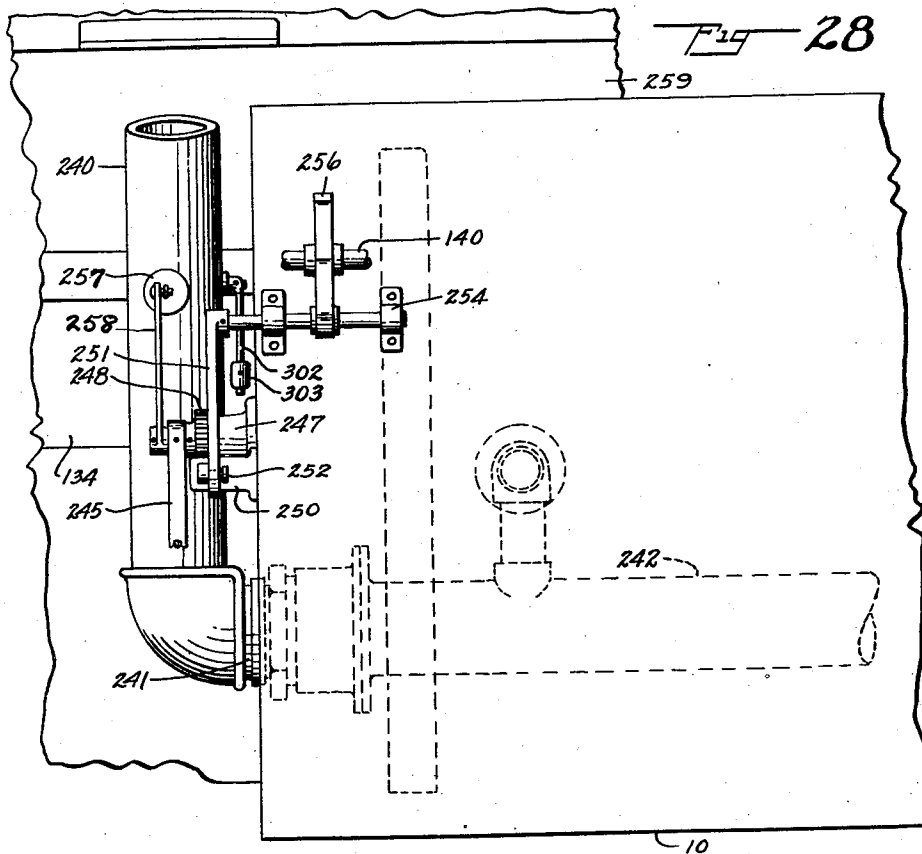
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METHOD OF AND APPARATUS FOR WASHING FABRICS

Filed Jan. 4, 1930

10 Sheets-Sheet 9



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METHOD OF AND APPARATUS FOR WASHING FABRICS

Filed Jan. 4, 1930

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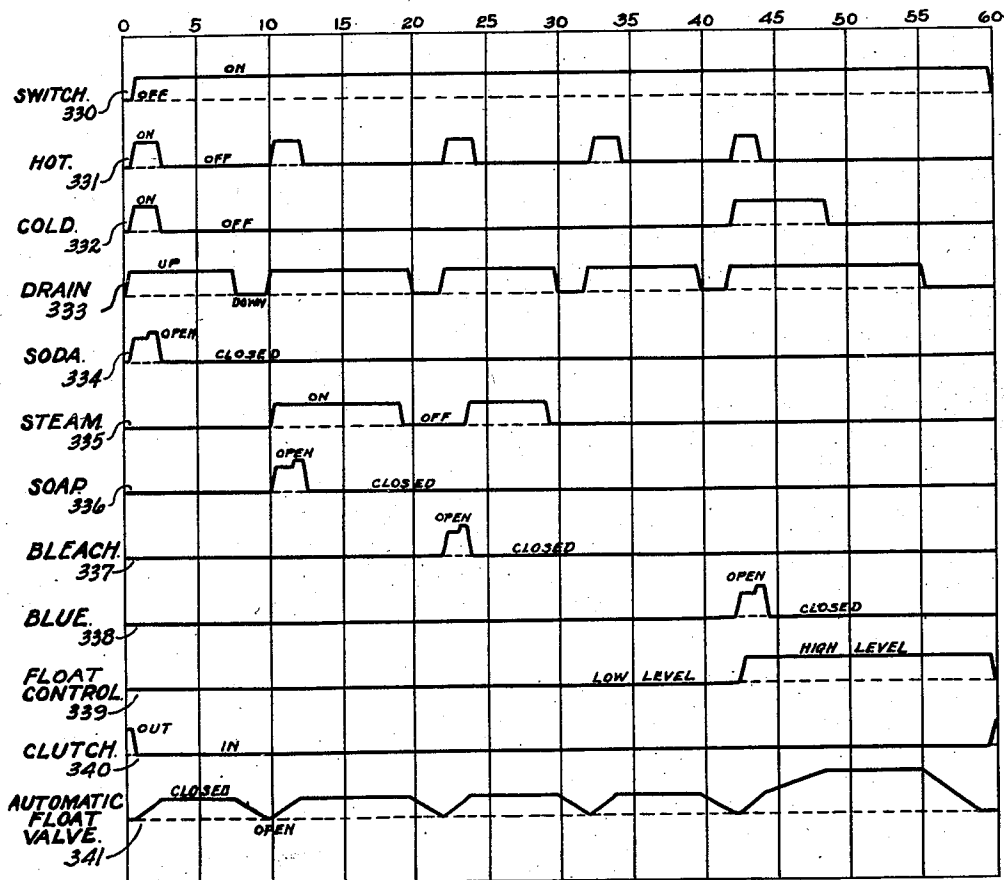
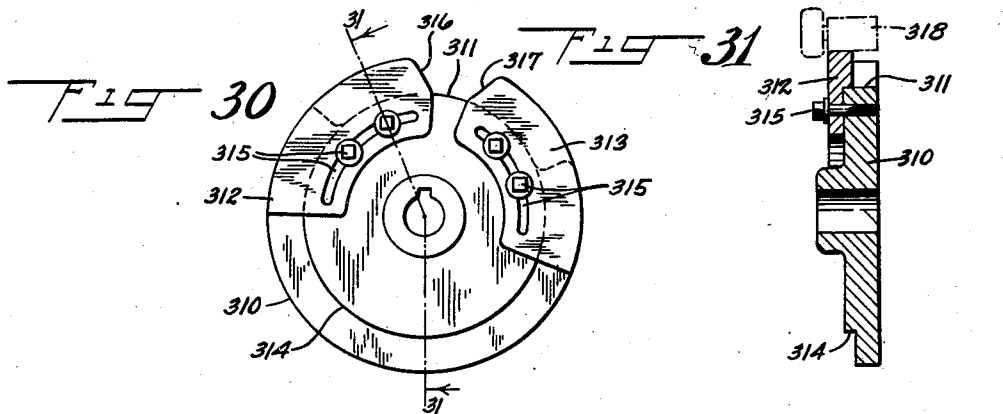


Fig. 32

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UNITED STATES PATENT OFFICE

2,030,394

METHOD OF AND APPARATUS FOR
WASHING FABRICS

Lucien Pierce, Malden, Mass., assignor of one-half to Family Laundry Co., Malden, Mass., a corporation of Massachusetts, and one-half to George W. Hooper, Salem, Mass.

Application January 4, 1930, Serial No. 418,518

9 Claims. (Cl. 68—18)

This invention relates to the washing of fabrics and has for its particular objects the expeditious and efficient washing of such fabrics, as well as the provision of a simple, inexpensive and sturdy mechanism that is adapted to be attached to the standard washer such for example of the type employed in so-called domestic or power laundries.

Heretofore, as I am well aware, it has been proposed to equip the washers in large laundries with means for automatically controlling the supply of water and the admission to the wash wheel of the washing compounds during fixed intervals of time, which latter are predetermined in accordance with a definite schedule of operation, and also to automatically dump or discharge the various solutions from the wash wheel at the expiration of each stage of the washing operation. My investigations have led to the discovery that the washing operation can be effected in a remarkably efficient, expeditious and economical manner through the employment of the herein-after described continuous flow method of operation and the automatic mechanism for effecting the control of the various stages in the washing operations, such method and mechanism being set forth and described in detail in the following description and drawings forming a part thereof in which

Figure 1 is a plan view of a commercial washing machine equipped with my improved automatic mechanism for automatically controlling the washing operation at every stage thereof;

Fig. 2 is an end elevation, partly in section, of the mechanism shown in Fig. 1;

Fig. 3 is a fragmentary section, on the line 3—3 of Fig. 2, showing the piping arrangement;

Fig. 4 is a vertical cross section of an injector mechanism such as is preferably employed;

Fig. 5 is a fragmentary section on the line 5—5 of Fig. 1;

Fig. 6 is a partial section on the line 6—6 of Fig. 2;

Fig. 7 is a fragmentary rear elevation of the bottom portion of the mechanism shown in Fig. 1;

Fig. 8 is a section on the line 8—8 of Fig. 1;

Fig. 9 is a side elevation of a clutch member associated with the cam shaft;

Fig. 10 is a fragmentary side elevation, partly diagrammatic, of the starting mechanism;

Fig. 11 is a diagrammatic development of the controlling cams showing their relation to each other, wherein the vertical lines indicate specified time intervals in minutes; and Fig. 12 is a

view similar to Fig. 11 but illustrating the cams used in a modified form of mechanism;

Fig. 13 to Fig. 20 are side elevations of the various controlling cams, as indicated by the reference numerals;

Fig. 21 is a fragmentary end elevation of a modified form of dispensing receptacle for a washing compound;

Fig. 22 is an enlarged vertical section through the upper portion of Fig. 21;

Fig. 23 is an end elevation and Fig. 24 a plan view of a washing machine showing a modified arrangement of cam controlled float valve;

Fig. 25 is an end elevation of a washing machine with a modified form of drain pipe;

Fig. 26 is a fragmentary view, partly in section, of the drain pipe in its raised position;

Fig. 27 is a section on the line 27—27 of Fig. 26;

Fig. 28 is a plan view of the mechanism shown in Fig. 25;

Fig. 29 is a front elevation showing a modified form of intake manifold;

Fig. 30 is a front elevation of an adjustable form of cam which may be used;

Fig. 31 is a section on the line 31—31 of Fig. 25 30; and

Fig. 32 is a diagrammatic development showing the controlling cams and their relation to each other when employing a modified method of washing.

Referring to the drawings and the construction shown therein, the numeral 10 represents the cylindrical outer casing of a commercial washing machine of the horizontal cylinder type such as is commonly used in domestic laundries, which machine is conventionally shown in the drawings since the construction thereof is well known. The wash-wheel or inner perforated cylinder 11 which is within the casing and which contains the fabrics to be washed may be rotated by any desired means such as the motor 12 and appropriate gearing (not shown). While the washing machine as above stated does not of itself constitute any part of my invention, nevertheless, both the washing machine and my improved controlling mechanism are intimately associated mechanically and functionally.

The mechanism constituting the subject matter of my invention is supported upon suitable framework and as illustrated, it comprises a platform 20, one edge of which is secured by welding or otherwise to the said outer casing 10. The platform 20 serves to support the various rocker shafts, cam shaft and associated mechanism, as hereinafter set forth, the same being secured at

its ends by uprights 21 which are secured to the casing 10. A second framework serves for supporting the piping and the containers for the washing compounds, the same comprising a horizontally disposed channel beam 22 which extends the entire length of the washing machine and is secured to the cylindrical casing 10 by means of two uprights 23—23.

A rectangular mixing chamber 24, through which all water and washing compounds must pass before entering the washing machine proper, is attached to the said channel beam 22 adjacent the center thereof. Extending from the rear wall (left in Fig. 2) of the chamber 24, is a system of piping which constitutes an intake manifold. As embodied, this comprises a horizontal reach of piping 25 from which depend four drop-pipes 26, 27, 28 and 29 respectively, these latter delivering directly into the interior of the washing machine at properly spaced points. It is preferable that the manifold 25 be disposed laterally symmetrical with respect to the chamber 24 so that a proper distribution of the various ingredients will occur prior to the entrance thereof into the washing machine. To this end also there is a slight reduction in the diameter of the end sections of the manifold 25.

In Fig. 29, a modified form of intake or distributing manifold is illustrated, the same comprising a horizontal reach of pipe 30 that communicates centrally thereof with the mixing chamber 24 while each end leads respectively into the center of branch distributing pipes 31 and 32. The ends of the pipes 31 and 32 lead through drop-pipes 33, 34, 35, 36, respectively, and deliver into the interior washing machine. The pipes 31 and 32 are preferably slightly less in diameter than pipe 30 in order to better secure proper distribution of materials therethrough.

Into the top wall of the mixing chamber 24 is tapped the lower end of an injector which latter consists of a cross 40, having screwed therein two suction pipes 41 and 42, and injector pipe 43 whose lower end 44 extends below the entrance of the two suction pipes, and an exit pipe 45. As shown, the pipe 45 is larger in diameter than the pipe 43 and consequently, as water under pressure enters the injector through the latter and passes on through pipe 45 into the chamber 24, a partial vacuum is created in pipes 41 and 42, so that if there is any residual material of any sort in these pipes it will be drawn into the injector wherein it will be commingled with a stream of water and pass with the latter into the chamber 24 where it is thoroughly mixed before it passes on into the intake manifold 25 and thence into the washing machine.

Water of a proper temperature is delivered to the machine by controlling the mixing of a supply of both hot and cold water. The hot water supply, as illustrated, enters through a pipe 46, passes through a hand valve 47, thence through an automatically controlled valve 48 to a T 49, at which point it meets the supply of cold water that enters the system through a pipe 50, passes through a hand operated valve 51, thence through an automatically controlled valve 52 to the said T 49, where together with the hot water it passes downwardly through a valve 53, which is controlled by a float positioned in the outlet drain hereinafter described, into the injector 40 and thence, as previously described, into the machine.

Conveniently located within reach of an operator, are a plurality of containers for temporarily

storing the various washing compounds employed in the washing operation, such as soda, soap, bleach and bluing. I preferably provide four containers, rather than one or two, so that the particular compound to be used may be placed in each at the beginning of a run, whereas if a lesser number were used, it would be necessary to empty each container during the course of a run before the next compound in order could be placed therein. This use of four or more (depending upon the number of compounds used) enables an operator to give his attention only once to the filling of the containers at the beginning of a run.

The washing compound containers 60, 61, 62, 63 each comprise a tank with a capacity of about 10 quarts having a sight glass 64 for observation of contents. At the bottom of each tank is a hand operated needle valve 65, which may be set to allow a predetermined amount of material to pass therethrough in a given time. Leading from valves 65 are pipes 66, 67, 68, 69 respectively having centrally located automatically controlled valves 70, 71, 72, 73 and connecting at their ends with the suction pipes 41, 42. It will thus be seen that, with the valves 65 set for a predetermined flow, then as each of the valves 70 to 73 are successively opened, the particular compound contained in the respective tank will pass into either pipe 41 or 42 and thence into the injector and on into the machine along with the water which is also entering, the water and compound having been first thoroughly mixed in the chamber 24. Both gravity and the influence of the partial vacuum contained in pipes 41, 42 serve to insure the movement of the compound along its course. Inasmuch as some of the compounds used are corrosive and might damage the apparatus if left standing therein or tend to become viscid and hence clog the pipes, it is advantageous to provide some means for immediately cleansing each of the containers 60 to 63 after its use. For this purpose there is provided for each container a spray pipe 74, which projects just inside the rim of the container. The end of the pipe 74 is slit obliquely so as to produce a strong fan-shaped spray which will reach practically the entire inner surface of the container and flush same free of any washing compound. In order that the spray only be applied at predetermined intervals, each of the pipes 74 is provided with an automatically controlled valve 75 which is interconnected with each of the valves 70 to 73. The spray pipes 74 are connected through a header 76 with the T 49 where the hot and cold water supplies meet. As is evident, the header 76 will have a pressure of water therein corresponding to the head of water which is flowing through the T 49, and will supply each of the spray pipes 74 with water at whatever temperature it may be supplied to the T 49 at that particular moment.

As is well known, it often becomes necessary at certain stages during the washing of a batch of clothes, to raise the temperature of the water which is in the machine over that at which it entered and for this purpose steam is the medium usually employed. In my apparatus I have provided header 80 (Fig. 7) located in back of the machine from which a plurality of take-off pipes 81 communicate with the interior thereof at a point well below the water level. From the header 80 a steam pipe 82 leads up to the top of the machine, first through a thermostatically controlled steam valve 83, thence along the

top of the machine to an automatically controlled valve 84 and thence to any source of supply through a pipe 85. The thermostatically controlled valve 83 may be any of the well known forms and as illustrated, consists of an actuating mechanism 86 and flexible tubing 87 which latter leads downwardly to a thermostat bulb 88 contained in a well 89 secured on the under side of the outer cylinder. This well opens inwardly so that water contained in the machine is always in contact with the thermostat bulb 88 and consequently its temperature will control the amount of steam flowing through pipe 82 and when enough steam has passed through the take-off pipes 81 to raise the water in the machine to a predetermined temperature the valve 83 automatically closes, reopening again when the temperature drops below this point.

In the preferred method of operating my invention there is a continuous stream of liquid flowing through the machine with the various washing compounds injected at predetermined intervals and the dump valve is only utilized to empty the washer at the finish of the washing operation on a batch of clothes. Since, however, it is advantageous to have the washing done in a substantially constant level of water, means have been provided whereby this level can be maintained at any desired predetermined level selected by the operator. Due to the fact that city water pressures vary at different times and as varying demands are made upon it, it is necessary to so design the various piping and overflows that the incoming supply is, even at its minimum flow, more than sufficient to maintain the selected level and for this purpose I utilize a float valve arrangement. As embodied this consists of a drain chamber 95 having a telescoping top portion 96 that may be secured in any selected position by a set screw 97. The top 96 has at one side a pitcher-shaped spillage edge 98 which carries the overflow into a gutter 99 running along the floor in back of the machine. A float 100 is slidably secured in the cylindrical portion of the top 96 by having its upper and lower stems 101 supported in a strap 102 and spider ribbing 103 respectively. Connected to the upper stem 101 is a slide rod 104 slidably supported at its upper end in a bracket 105 and pivotally connected at 106 to a lever 107 which is fixed on a rock shaft 108. The rock shaft 108 extends along the top of the machine being supported in suitable brackets, and has fixed on its inner end a lever 109 whose connecting rod 110 is pivotally attached to the end of a valve lever 111. The lever 111 is fixed upon the end of the valve stem in the float-controlled valve 53 previously described and is so arranged that a rotation of its valve-stem will allow more or less water to flow through as the case may be. As a consequence, if too much water is flowing into the machine the level within the same rises and at the same time the level in the drain chamber 95 rises over the spillage edge 98 and causes the float 100 to move upwardly whereby through its slide rod 104 and levers 107 and 109 the stem of the valve 53 is rotated to retard the flow of water into the machine.

Provision is made for varying the desired level of water to be used and as embodied comprises the telescoping top 96 of the drain chamber and an adjustable pivotal connection 106 between slide rod 104 and lever 107, which connection (see Fig. 5) consists of a stud 112 that is rotatably secured by means of a nut 113 and washer 114

in a hole in lever 107. The other end of stud 112 passes through a slot 115 in slide rod 104 and is adapted to be clamped in any desired position therein by means of thumb screw 116 and washer 117.

The drain chamber 95 is secured to the end of an outlet manifold 120 located beneath the machine (see Fig. 7) and communicates with the interior thereof through a plurality of drain pipes 121 located at the proper points to obtain a uniform withdrawal of water. The outlet manifold is provided with a removable closure plate 122 to allow access thereto for cleaning should lint or other material collect in and clog up the drain pipes.

The drain chamber 95 is provided with a hand operated dump valve in the bottom thereof and as embodied it consists of a valve 123 having guiding fins 124 on the bottom and a stem 125 on the top which has fixed therein a pin 126. A forked lever 127 spans the stem 125 and serves by means of its slotted connection therewith to unseat the valve 123 when rocked upwardly. The lever 127 is fixed on one end of a rocker shaft 128, the other end of which carries a lever 129. The shaft 128 is supported in a bearing formed in the wall of the drain chamber in such fashion that the one end of the shaft is within the chamber and the other is external thereto. A rod 103 connects the upper end of the lever 129 to the lower end of a hand lever 131 which is pivotally attached by pivot 132 to the end wall of the outer cylinder of the machine. A stop pin 133 is provided to limit the forward throw of the hand lever 131 so that as the operator pulls the latter forward (right in Fig. 2) the valve 123 cannot rise high enough to allow the guide fins 124 to leave the hole in the drain chamber in which they are positioned, although it must, of course, rise sufficiently high to allow a quick escape of the liquid contents of the machine.

The bottom of the drain chamber with its dump valve 123 is directly over a gutter 134 formed in the floor beneath the machine. This gutter 134 and the aforesaid gutter 99 deliver into the sewer and preheater respectively, the latter being adapted to carry a continuous run of substantially hot water and the former dumping the relatively cold water from the end of the run.

Referring now to the means for automatically operating the various valves, comprising motor-starting-and-stopping switch for the machine and the cam-shaft stopping-clutch, a horizontally disposed cam shaft 140 is provided, the same being rotatably supported in bearing brackets 141 attached to platform 20. The driving means for the cam shaft 140 comprises a three step cone pulley 142 rotatably mounted thereon midway of its length and a belt 143 which encircles the pulley and is driven from any convenient source such as a counter shaft (not shown). In the form of apparatus illustrated, one revolution of the cam shaft 140 carries out the steps necessary to completely wash one batch of clothes. By providing the cone pulley 142 with three steps and driving same from a constant speed counter-shaft, the operator is enabled to select one of three speeds for the cam shaft, which will give either a quick wash for moderately clean fabrics such as hotel and hospital linens, an average length wash for so called family trade, or a slow wash for particularly dirty fabrics such as rugs or mechanics' clothing.

Fixed at various points along cam shaft 140, are peripheral cams which (reading from left to 75

right Fig. 1) are designated as soda cam 144, hot water cam 145, soap cam 146, steam cam 147, bleach cam 148, cold water cam 149, motor cam 150, blue cam 151.

Attached to the left end of the cam shaft (see Fig. 1), is a sprocket 152 which is connected by means of a chain 153 to another sprocket 154 fixed to a hand wheel 155. The hand wheel rotates freely on a stub shaft 156 carried in a bracket 157 which is attached to the end wall of the outer cylinder of the machine and is within easy reach of an operator.

The cone pulley 142 is operatively connected to the cam shaft by means of a semi-automatic clutch, the hub 158 of the pulley being provided with teeth to form one member of the clutch. The other member of the clutch comprises a toothed collar 159 slidably mounted on the cam shaft but secured against rotation thereon by a key 160 (see Fig. 8). One of the brackets 141 forms a stop against movement of the collar 159 in one direction and the clutch member 158 stops its movement in the other. The said clutch collar 159 is adapted to be moved in either direction by a hand lever and in one direction (i. e. from engaged to disengaged) by a cam action of the following mechanism viz: a collar 159, having a relatively wide groove 161 formed midway of its length, one side of which is parallel to the end face of the collar and the other side of which groove is provided with a projection 162 which acts as a cam to disengage the clutch as herein-after explained. Co-operatively engaged within the groove 161 is a roller 163 which is preferably of a diameter slightly less than one-half of the width of the groove 161 and is carried upon one arm of a bell crank lever 164 that is pivotally mounted in a bracket 165 secured to the platform 20. The other arm 166 of the bell-crank lever is connected by a rod 167 to a hand bell-crank lever 168 pivotally attached at 169 to the channel beam 22 within reach of the operator. Carried within the bracket 165, is a heavy spring 170 which co-acts with a projection on the bell crank lever 164 to maintain the latter either to one or the other side of a center thus serving to hold the collar 159 either in or out of engagement.

The operation of the clutch when the machine is run in its preferred manner is as follows:— the operator first rotates the cam shaft slightly by means of the hand wheel 155 so that the projection 162 in collar 159 is not opposite the roller 163 (it being opposite same when machine stops from previous run). He then throws the handle 168 to the left (Fig. 1), the first part of this movement being lost motion due to the width of the groove 161 but the final part of the movement causing the collar 159 to move to the right and to engage with the hub 158 of the rotating cone pulley 142 which, of course, then drives the cam shaft. As the shaft approaches the end of its one revolution the projection 162 in the collar 159 contacts with the roller in the lever 164 and slowly forces the latter to the left (Fig. 1) until, as the high point of the projection reaches the roller, such lever slightly passes the center point of its full movement. At this point the teeth of the clutch are still fully engaged, but as the center is passed the heavy spring forces the lever 164 to complete the rest of its movement to the left, which movement fully disengages the clutch and brings the cam-shaft to a stop.

If at any time during the operation of the machine the operator should find it necessary to stop the cam mechanism, it is only necessary to

throw the hand lever 168 to disengaged position which causes the machine to continue operating at whatever step it then happens to be until the operator returns the handle to the engaged position at which time the operation will continue to the end of its automatically timed run, the same as if never interrupted.

The various automatically controlled valves previously referred to including valve 48 in the hot water line, valve 52 in the cold water line, valves 70, 71, 72, 73 in the lines from the compound containers, valves 75 in the spray lines, and valve 84 in the steam line are all mechanically similar to each other and may be of any well known form wherein the valve stem reciprocates to open and close the valve, the valve being maintained in a closed position by a self-contained spring.

Since the operation and construction of the connections between cams 144, 146, 148, 151 and the washing compound valves 70, 71, 72, 73 are substantially alike, it is deemed that the following description of but one system of levers will be sufficient, viz:

There is provided a fulcrum rod 175, supported in brackets 176 attached on platform 20, rotatably mounted upon this rod is the cam actuated lever 177, one end of which carries a cam roller in contact with the periphery of its respective cam while the other end (see Fig. 2) connects by means of a short link 178 to the end of a valve operating lever 179. This latter lever is fulcrumed by means of a link 180 to a member carried by the valve in the compound container line and is pivotally secured to the valve stem at 181. A spring 182 is attached to the end of the lever 179 and to the washing compound pipe 66 and serves to maintain the cam roller in contact with the cam.

Operatively associated with each of the valves 70, 71, 72 and 73 is the spray valve 75 which is directly above each of these valves and operated from the same lever 179 which operates them. To this purpose an actuating yoke member 183 termed herein an actuator, is provided, the lower forked end of which is pivotally attached at 184 to the lever 179 at a point near the point of attachment of the valve stem. The upper portion of the actuator 183 passes along each side of the spray valve 75 and is joined together at the top by means of a spacer bolt 185 (Fig. 6). The stem of the valve 75 has attached transversely thereto a long pin 186 which is in operative engagement with slots 187 in the actuator 183. When both valves 70 and 75 are in their closed positions, the pin 186 is in the upper part of the slot 187. The valve-actuating cams 144, 146, 148 and 151 are provided with double rises or cam faces, the first face 188 serving to open the washing compound valve but not the spray valve 75 due to the lost motion provided in the slot in the actuator 183, while the second face 189 opens the compound valve further and also opens the spray valve for a selected length of time sufficient to thoroughly flush the compound container and piping.

The two automatically controlled valves 48 and 52 in the hot and cold water lines respectively are operated in a manner substantially like that just described for the washing compound valves. The cams 145 and 149 have cam levers 190 and 191 associated with them which are supported on fulcrum rod 175 and are connected by means of links 192 and 193 to the valve-actuating levers 194 and 195. These levers are fulcrumed at 196

on members carried on the valve bodies and are pivotally secured to the valve stems as at 197.

The steam valve 84, though smaller in size, is similar in all respects to the other automatically controlled valves just described. The cam 147 co-operates with a lever 199 carried on fulcrum rod 175. A link 200 connects the lever 199 to the valve-actuating lever 201 which latter is mounted similar to and operates substantially like those previously described.

The starting and stopping of the machine motor 12 is effected by a cam 150 which actuates a switch 205 through a bell crank lever 206 carried on the fulcrum rod 175. (Fig. 10.) A spring 207 serves to hold the cam roller in contact with the cam 150 and a spring contained within the switch 205 tends to keep it in the "off" position unless held in the "on" position by the bell crank lever 206. A hand-operated rheostat-magnetic switch 208, which is interposed in the machine motor circuit, serves to start the machine at the beginning of the run.

The operation of the above described apparatus may be accomplished in several different ways, for example, when the cylinder is empty all the valves are closed except the float valve 53, while the dump valve 123 is open and also the switches 205 and 208 are open and the clutch 159 is disengaged. The needle valves 65 are opened by the operator to an amount sufficient to allow the wash compound to slowly flow through at a speed that will empty a container of its respective charge in about the time necessary to complete the particular step taking place. Thus, if a soaping of ten minutes is desired and for this treatment about 8 quarts of liquid soap is to be used, the needle valve 65 is so set as to allow the 8 quarts to flow through in about ten minutes. The two hand operated valves 47 and 51 in the hot and cold water lines respectively are set so that the union of the two streams produces the desired washing temperature. The adjustable spout 96 of the drain chamber is set at the desired level to insure the proper depth of water in the machine. These various settings are ones which it is only necessary to make at infrequent intervals, being changed only when the temperature of the main water supply varies or when a greater quantity of washing compound is employed or a different washing level is needed.

After an operator has introduced the requisite charge of the respective washing compounds into the particular washing compound containers 60, 61, 62 and 63, such charge being sufficient for one wash, charging door of the machine is opened to receive the batch of clothes it is desired to wash. Just previous to loading the clothes into the machine, the operator throws the hand lever 131 back so as to close the dump valve 123 and at the same time gives a slight turn or partial rotation to the hand wheel 155 which movement in turn imparts rotary motion through the chain 153 to the cam shaft 140, whereby all the cams aforesaid are rotated a corresponding amount. In the timing diagram (see Fig. 11), the vertical line 3 designates the point to which the cams are moved by the aforesaid partial rotation of the hand wheel 155. It will be noted that by this initial movement, the said control clutch 159 and the three of the cams, i. e., the switch-cam 150, the hot water-cam 145, the cold water-cam 149 will operate the respective mechanisms which are controlled by these cams. As a consequence, the automatic switch 205 is closed, the hot and cold water valves are opened, thus allowing water

to enter the machine and the tooth or projection 162 in the clutch 159 is moved out of the path of the hand lever actuated roller 163.

During the period that the water is thus entering the machine, the operator proceeds to load the clothes into the inner cylinder 11 after which the doors are closed and the machine is ready to be started on its automatic operation. To accomplish this it is only necessary for the operator to close the hand switch 208, thus starting the machine motor 12 and to then throw the handle 169 to the left (Fig. 1) which will cause engagement of the clutch members 158, 159 and thereby effect rotation of the cam-shaft 140. From this point until the washing has been completed, the entire operation is automatic and in the particular example selected for illustration (see Fig. 11) takes place as follows:

At a point between the three minute line 3 and five minute line 5, the proper level of water will have been reached and the float 100 will have operated to adjust the inflow to the outflow of liquid as it will then continue to do until the end of the run.

At the line 5, the soda ash cam 144 effects the opening of the valve 70 and allows the soda to flow into the machine along with the water. At the end of about five minutes, the second rise on the cam 144 effects the opening of the spray valve 75 on the soda container and flushes the same for about one or two minutes after which the cam drops to its original position, closing the two valves and thus completing its part of the operation. At the line 10, or as the soda cam ends its operation, the cold water is shut off by cam 149 and the steam cam 147 opens the valve 84 to allow steam to enter the machine and raise the temperature of the water for the next step. Also at the line 10, the soap cam 146 begins to act and opens the valve 71, allowing liquid soap to flow from the container 62 into the machine to perform the main cleansing operation. This continues for about 10 minutes (or to the line 20), when the spray valve is opened by the second rise on the cam 146 and cleans out the soap container. As the soap operation is completed (at line 20), the bleach cam 148 opens the valve 72 and permits the bleach compound to enter and act for about 10 minutes (at the line 30).

From the line 30, when the bleach valve 72 closes, to the line 50, or about twenty minutes, a thorough rinsing takes place, while the temperature of the water is gradually reduced, first by the steam being shut off at line 35, then by the cold water being turned on (at line 40) and finally by the hot water being turned off (at line 45). At the end of this twenty minute period, or at line 50, the bluing cam 151 opens the valve 73 and allows the blue to enter and then opens the spray valve 75 for the cleaning operation, this being accomplished in about 4 minutes (near line 55).

After the bluing has been injected, the process is substantially completed and at line 55 the following actions take place:

The switch 205 opens, breaking the machine motor circuit, allowing the hand switch 208 to open and stopping the machine. The cold water valve then closes, thus completely shutting off all the water. The control clutch projection 162 actuates the bell crank 164 and disengages the clutch members 158, 159, thus bringing the cam shaft 140 to a stop and thereupon the entire machine is at rest with about four or five inches of bluing water contained therein.

Whenever the operator desires to remove the clothes, which are now clean, it is merely necessary to open the dump valve 123, which entirely empties the machine, open the doors in the outer and inner cylinders and lift the batch of wash out, after which the machine is ready for the next batch.

In Figs. 21 and 22 I have shown a modified form of washing compound container wherein the container is connected to a large storage tank of a particular supply and means are provided to limit the amount of material flowing from the storage tank into the container. As embodied, a feed line 220 leads from the storage tank 221 into the compound container 222. A shut-off valve 223 is provided so that the line can be sealed when not in use.

The container 222 carries in its upper portion an adjustable plunger 224 which is vertically slidable therein by means of a threaded rod 225 rotatably attached to the plunger by a plate 226. A cover plate 227 on the container has a threaded boss in the center thereof that carries the rod 225 to which a hand wheel 228 is secured, the rotation of which handwheel effects the vertical movement of plunger 224 within the container 222 and thereby serves to vary the amount of space available therein for washing compounds. The plunger 224 carries a self-closing check valve which consists of a ball-valve 229 and vent hole 230, as well as a spray nozzle 231 which has contained therein a second self-closing check-valve 232. The plunger is made air and liquid tight in the usual manner by means of packing and packing ring 233. Threaded into the upper portion of the plunger is the spray pipe 74 which communicates with the nozzle 231 through a hole 234. The upper end of the pipe 74 has attached thereto a flexible hose connection 235 which leads to the automatically controlled valve 75 (not shown in Figs. 21 and 22) which arrangement allows the reciprocation of the plunger 224 without disturbing the rest of the mechanism. An automatically controlled valve 236 is located in the feed line 220 just outside of the container 222, the same being operatively connected to the valve 70 through its actuating lever 237 being connected by the link at 238 to the lever 179 which operates the valve 70. These two valves 70 and 236, are connected in such a way that when one is opened the other closes and vice versa.

The operation of this automatically measuring container is as follows:—the operator first sets the plunger 224 at a point which will give the desired quantity of compound by turning the hand wheel 228. The valve 223 is then opened and the liquid material flows into the container through the valve 236, which is open, the air meanwhile being vented through ball valve 229. When the liquid reaches the plunger 224 the ball valves 229 and 232 close and prevent the escape of the liquid through the air passage 230 or spray pipe 74. At this point the liquid ceases to flow into the container since the space is entirely filled.

When the time comes for the material in the container to be used the valve 70 is automatically opened as previously described, while the valve 236 is closed, thus preventing any more material from flowing into the container while it is being emptied through the valve 70. Immediately, however, that the valve 70 closes the valve 236 opens and allows the container to refill ready for the next cycle.

In certain methods or systems of washing, it

is customary to employ a different depth or level of water for some of the various steps. For instance the application of the soda, soap and bleach may be done in a depth of four inches of water and with the water at a "dead level" that is neither flowing in or out, while the bluing and subsequent rinsing may be carried on with a 15 inch dead level and 14 inch "flow level" respectively. To accomplish this system of washing automatically, I have shown in Figs. 23 to 28 a modified form of drain chamber and float control valve for the incoming liquid.

A drain pipe 240 of relatively large diameter is attached by means of a swivel joint 241 to the end of the outlet manifold 242. Midway of the length of the pipe 240 is a bracket 243 to which is secured one end of a cable 244, the other end of which is fastened to a segment 245. The segment is fixed on a stub-shaft 246 rotatably secured in a bracket 247 bolted to the end wall of the outer cylinder of the machine. Also fixed on the stub shaft 246 is a pinion 248 which meshes with a rack 249 carried in two brackets 250 on the machine end wall. Rack 249 is actuated by a lever 251 to which it is pivotally attached at 252. The lever 251 is mounted upon the end of a rock shaft 253 supported in brackets 254 bolted to the platform 20. A cam lever 255 mounted on the other end of the rocker shaft contacts by means of its roller with a cam 256 fixed upon the cam shaft 140. A counter weight 257 carried on the end of a lever 258, which is fixed on the stub shaft 246, serves to balance the weight of the drain pipe 240 and relieve the strain upon the cam and levers which serve to raise it. Thus it will be seen that as the cam is rotated the system of levers and the rack and pinion serve to rotate the segment 245 and raise the drain pipe 240 to any predetermined height compatible with the level of water desired for washing.

To the end that the final dump of the cool water from a wash will not go into the gutter 259 which leads to a preheater (not shown) I have provided the drain pipe 240 with a dump gate 300 which automatically opens when the drain pipe is lowered to its final position and allows the water to flow into the gutter 134 which is connected to the sewer. As embodied the flapper gate 300 is hinged on a rod 301 which rotates in projections cast upon the pipe 240. The rod 301 projects through the wall of the pipe 240 and has a lever arm 302 fastened to its exterior end upon which a weight 303 is movably secured for the purpose of urging or maintaining the gate 300 in a closed position. An arm 304 secured to the under side of the gate 300 and projecting through the large exit orifice 305 serves to open the gate when it is lowered into co-operative engagement with a bracket 306 mounted upon the floor of the wash room.

In Figs. 24 and 25 I have shown a float and associated mechanism to control the inflowing liquid in the system of washing where different "dead levels" and "flow levels" of water are used. As embodied, this comprises a float chamber 260 located in back of the machine and connected with the interior thereof by a pipe 261. A float 262 contained within the chamber 260 carries a rod 263, the upper end of which is supported in a bracket 264 extending outwardly from the platform 20. Adjustably fixed in a slot 265 in the upper end of rod 263 is a stud 266 which forms a pivot to operate within a slot 267 in one arm of a float lever 268. The fulcrum 269 for the float lever 268 is carried in the end of a cam 75

lever 270 which is pivoted at 271 on a bracket 272 secured on the platform 20. A roller on lever 270, carried on the same stud which forms the pivot 271, contacts with a cam 273 on cam shaft 140. An intermediate lever 274, pivotally mounted at 275 on the bracket 272, has one end slotted and in engagement with a stud 276 fixed in the end of the arm 277 of the float lever 268. The other end of the lever 274 is connected by a link 278 to the valve lever 279 which is pivoted to the valve stem at 280 and fulcrumed at 281 on a link 282 carried on a member secured to the valve body 283.

The operations of these modified forms of drain chamber and float mechanism is as follows:—

The cam 256 (Fig. 25) first raises drain pipe 240 to a point which will give a level of water in the machine suitable for the first step in the process, for instance 5 inches, the float valve 283 is, of course, open due to the float 262 being in its lowermost position. At the time the drain pipe was raised, the water was turned on and flowed into the machine until a level of 5 inches was reached, indicated by line *b* in the drawings, when the float acts through its lever system to shut the valve 283. This leaves a dead level of about 5 inches of water in the machine which remains until the cam 256 lowers the drain pipe a short distance and allows the water to drain off to about a 4 inch level *a*. The float 262 then drops and opens the valve 283, allowing water to flow in. The drain pipe being too low to retain enough water to raise the float and close the valve 283 a "flow level" i. e. enough water flowing into balance that flowing out, is maintained. When, however, it is necessary to raise the drain pipe to a high point for a 15 inch depth of water, it is also necessary to raise the float a corresponding distance so as to shut off the water at the 15 inch level and not at the 5 inch level as in the previous steps. This is accomplished automatically by means of the peculiar lever system illustrated in Figs. 23 and 24. Thus it will be seen that as the high point 284 on the cam 273 advances it will raise the lever 270 as is indicated in dot and dash lines in the drawings, and carry with it the fulcrum stud 269 of the float lever 268. Due to the weight of the float 262 and the rod 263, the lever 268 will tend to rotate anti-clockwise (Fig. 23) which will open valve 283. This rotation then being stopped by the seating of the valve, the pivot 276 becomes a fulcrum about which the whole lever 268, 277 rotates in a clockwise direction, due to the action of the cam lever 270, and raises the rod 263 and float 262 to the proper height for operation. The valve then being open allows water to flow in until a height of 15 inches as at *d* is reached at which time it is shut by the action of the float as in the previous case. This constitutes a 15 inch dead level whereas a slight lowering of the drain pipe will act to produce a 14 inch flow level, as at *c* and the final drop of the drain pipe to its lowermost position will entirely empty the machine.

It is sometimes desirable to change the timing of some of the various steps in the washing process without changing all of them. This can be done either by changing the individual cams or by having some or all of the cams adjustable. I have shown one form of adjustable cam which may be used for this purpose. As embodied (Figs. 30 and 31) the cam disc 310 has a cut-away portion 311 extending a distance greater than would ever be desired for actuating purposes. The central portion of this cut-away part forms the low

run of the cam while the large diameter of the cam disc forms, partially, the high run. The adjustable feature consists of two segments 312 and 313 circularly slidable on the cam disc 310 and held in alignment by a shoulder 314 and bolt and slot connection 315. The front faces 316 and 317 of the segments form the risers for lifting the cam roller 318 from the low to the high portion of the cam. The cam roller 318 in that it first rides on the segments and then on the cam disc must be as wide as the thickness of the segment plus that of the cam disc. Thus it will be seen that if a longer dwell is desired on the low part of the cam, all that is necessary to obtain this is to loosen the bolt and slot connection 315 and slide the segments around the disc to the proper place and re-tighten the bolts 315.

While I have described my invention as applying to a continuous and semi-continuous system of washing it may at times be necessary or expedient to wash in the manner it is done at present, i. e. entering the water and washing compound in a short period of time, holding same within the machine for five or ten minutes while the clothes are agitated therein and then entirely dumping the water after each of the various steps of the process. By merely changing the cams if fixed ones are used, or re-locating the high and low points if adjustable ones are used, the mechanism already described and illustrated (especially Figs. 23 to 28) is entirely capable of automatically performing the necessary steps in this form of washing. In Fig. 32 I have shown diagrammatically the form of cams to be used and their relation to each other in radial alignment for completing a wash as it is at present carried out in most laundries. It will be seen that as the machine is started the drain pipe 240 is first drawn up to a predetermined height by cam 333 and then the hot and cold water and soda valves are opened by cams 331, 332, 334. The spray valve associated with each of the compound valves is operated as already described. The machine motor is, of course, started by cam 330. At the end of perhaps two minutes the water has reached the proper level and the float valve 341 closes after which hot and cold water and soda valves close. The next five minutes, called the break, the clothes are properly agitated in the soda water after which the drain pipe is fully lowered and empties the machine, causing the float valve to reopen. As the drain pipe is again raised to its previous position, the hot and cold water, steam and soap valves are operated and quickly fill the cylinder with hot soapy water which, after the valves are closed, is held for a 10 minute soaping operation. At the end of this period the drain pipe is again fully lowered and entirely empties the machine. The following operations are similar to the ones just described except that each time a different compound valve is operated or perhaps none at all if a rinsing operation is desired. A list of the operations or steps as illustrated in Fig. 32 with the time taken is as follows: The break (hot and cold water and soda) 8 minutes; dump 2 minutes; soap 10 minutes; dump 2 minutes; bleach 8 minutes; dump 2 minutes; rinse 8 minutes; dump 2 minutes; blue 13 to 18 minutes; dump 2 minutes, a total of 60 minutes.

While I preferably employ the herein described apparatus for performing a continuous washing operation without intermediate dumping of the washwheel, I may, if desired, conduct a semi-continuous operation in which case the washwheel is

dumped after certain of the stages or may conduct an intermittent washing operation as now commonly employed in which the water is periodically supplied to and periodically dumped from the wash wheel at each stage of the operation.

When washing fabrics in accordance with my improved method, not only is considerable undue friction and excessive tumbling avoided due to the fact that the periodic dumping and refilling of the wash wheel at each stage of the washing operation is rendered unnecessary since in my process the machine is not dumped until the end of the washing operation, but also due to the fact that the fabrics are supported by the water during the entire process and therefore unnecessary wear and lint is avoided with the consequence that the fabrics are not only conserved, but the much smaller amount of lint produced is more readily removed in the rinsing operation. Furthermore, when washing in accordance with my improved method the tendency of the fabric to snarl and knot is lessened with the result that the tendency for the fabric to tear in the washing and in the removal operation and in the unsnarling of the same is also reduced.

Another advantage of my improved continuous washing method is that the continuous supply of fresh water facilitates the removal of the soil from the fabrics as there is less tendency for the soap to become neutralized by the foreign matter or soil in the goods due to the constant removal of such foreign matter and soil by the continuous flow of water through the goods whereby the washing operation itself is more effective and the fabrics are more expeditiously cleaned. In other words, the fabrics are continuously submerged in water which is constantly becoming cleaner and more effective because there is less foreign matter in the soil contained therein to impair or neutralize the cleansing action of the soap or other washing materials.

My improved process, even when operated manually, is considerably simpler than the ordinary washing operation as at present conducted, since approximately six openings and six closings of the dump valve are eliminated and even the dump valve itself, which is a constant source of annoyance due to the leakage and expense for maintenance, is eliminated. Furthermore, the water inlet valves are not required to be operated at such frequent intervals.

Among the additional advantages flowing from my invention are the simplification of the equipment due to the elimination of gate valves, water level dial and the smaller sizes of the pipes and fittings and water manifold thereof required in my improved apparatus, the more effective preheating of the supply water, the reduction in the machine hours required for a washing operation due to the greater efficiency of the washing operation, as well as the elimination of many of the manipulations now required in other automatic washing machines, the effective distribution of the supply water through the manifold attachment whereby preferably the water is admitted through four different openings in the top of the machine and also the extreme simplicity of the control devices employed.

Various other modifications within the scope of the appended claims may be made without departing from the spirit of my invention herein set forth.

Having thus described my invention, what I claim and desire to obtain by United States Letters Patent is:—

1. In a machine for laundering fabrics, the sub-combination comprising a wash wheel, a main water supply valve, draining means providing a continuous overflow of waste wash water from the wash wheel during the washing operation while maintaining a predetermined level of water therein, means for maintaining the water supply valve in a predetermined position to continuously admit a predetermined quantity of water into the machine during the washing operation, receptacles for respectively containing different laundering agents, a cam shaft and a plurality of cams carried thereby and a plurality of valves respectively associated with the outlets of said laundering receptacles, means operated by the cams and associated with such latter valves to admit predetermined quantities of the respective laundering agents successively into the machine during the washing operation and means for admitting a fixed charge of a laundering agent into the respective receptacles therefor.

2. The method of washing fabrics, which comprises providing a main body of water of predetermined quantity and subjecting a batch of fabrics to be washed therein to a washing action while continuously during the period of such washing action, introducing water into and continuously during the period of such washing action withdrawing waste wash water from the main body of water and at intervals during washing sequentially introducing measured quantities of different laundering agents without interrupting the continuous inflow of water to and outflow of water from said main body of water; and then finally draining the water from the batch of fabrics.

3. In a machine for laundering fabrics, the sub-combination comprising a washwheel having an inlet and a drain outlet, the latter comprising a movable drain pipe adapted to optionally maintain water at a predetermined level in said washwheel while permitting of the constant overflow of water thereinto, a cam shaft operatively associated with said washwheel, a cam mounted on said shaft, said cam having a cam face of predetermined contour, an arm operatively associated with said cam face, the free end of said arm being adapted to ride on said cam face and means connecting said latter arm with said movable drain pipe whereby the position thereof can be changed at predetermined intervals.

4. In a machine for laundering fabrics, the combination of a washwheel, a manifold adjacent the top thereof, means for affording communication between said washwheel and said manifold at a plurality of different locations longitudinally of said washwheel, a main delivery conduit for supplying water to said manifold, a valve for controlling such main conduit, means intermediate said valve and said manifold for introducing into said supply conduit a plurality of different washing materials, means for supplying hot water, cold water or steam to said water supply conduit, a plurality of washing compound receptacles mounted adjacent the top of said machine and being located successively at intervals longitudinally thereof, means affording communication between the respective receptacles and the aforesaid water supply conduit in advance of the aforesaid main manifold, valve controlled conduits affording communication between the upper portions of said receptacles and the main water supply conduit adapted to supply controlled amounts of water at predetermined temperatures to such receptacles, valves for controlling the amount of

the charge introduced into such receptacles and cam controlled means for effecting in orderly sequence the starting and stopping of the machine, the amount of hot water and the amount of cold

5 water introduced in the main delivery pipe, the intervals at which washing compounds are introduced into the respective receptacles and discharged therefrom into the washwheel, the amount of steam introduced into the water supply and the control of the drainage from the machine.

10 5. In an automatic washing machine, a washwheel having an inlet and an outlet for fluids and a movable overflow conduit controlling the amount of drainage from said machine and serving to maintain the level of the wash water therein at different predetermined intervals during the washing operation, means to effect through said conduit a quick dumping of the water in such washwheel and cam-controlled means for automatically controlling the position of such conduit.

25 6. In an automatic washing machine, a washwheel having an inlet and an outlet for fluids and a swinging overflow conduit controlling the amount of drainage from said machine and serving to maintain the level of the wash water therein at different predetermined intervals during the washing operation, means to effect through said conduit a quick dumping of the water in such washwheel and cam-controlled means for automatically controlling the position of such conduit.

30 7. In an automatic washing machine, a washwheel having an inlet and an outlet and a movable drainage conduit in communication with such outlet and located externally of such washwheel, said conduit having a valve intermediate the ends thereof, there being a discharge opening provided in said conduit and controlled by said valve and

means for opening said valve when the said conduit approaches its lowermost position whereby water can be discharged through said latter opening.

8. The method of washing fabrics which comprises providing a main body of water of predetermined amount, continuously introducing a supply of additional water to said main body, periodically introducing different washing compounds into said additional water in advance of its entrance into said main body of water into which such additional water is so introduced, subjecting a batch of fabrics to be washed to the washing action of said main body of water, effecting the continuous withdrawal of water from the main body of water and then following the completion of the washing operation with such washing compounds, rinsing the fabrics and draining the water therefrom.

9. The method of washing fabrics, which comprises continually introducing a supply of aqueous washing fluid into a main body of water during the rotary agitation thereof and subjecting a batch of fabrics to be washed to the washing action of said main body of water while introducing at intervals into said wash water during the washing operation measured quantities of different laundering agents, maintaining the main body of water throughout certain of the various stages of soaping, bleaching and bluing at a predetermined but different level from that maintained in a preceding stage while continually withdrawing water from the main body of water throughout certain of said stages and at least once prior to the removal of the fabrics from the main body of water, draining the washing water from the batch of fabrics.

LUCIEN PIERCE.