Aug. 29, 1944. F. BRECKENRIDGE ET AL 2,356,816

LAUNDRY APPARATUS

Filed Dec. 31, 1940 3 Sheets-Sheet 1

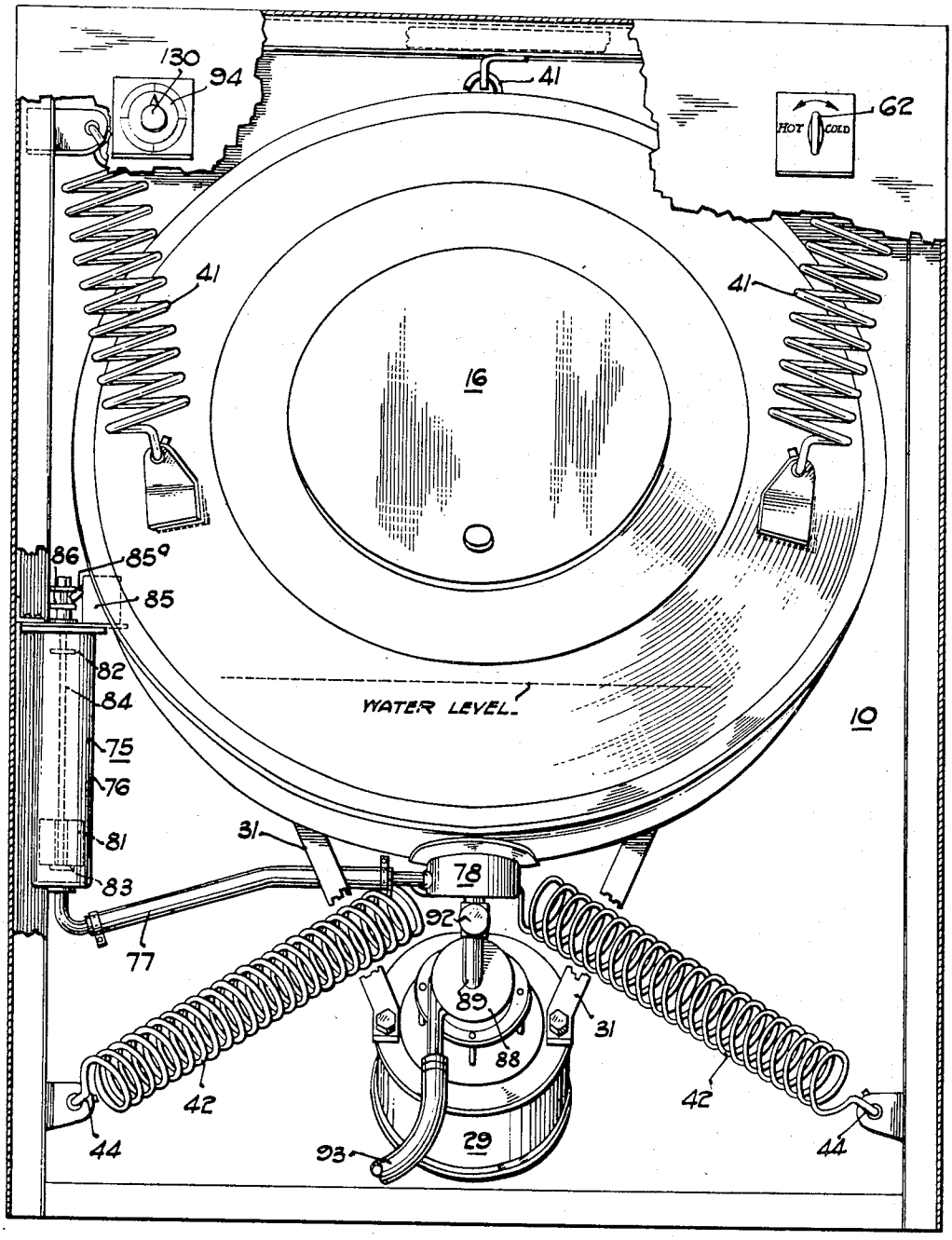


FIG. 1.

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LAUNDRY APPARATUS

Filed Dec. 31, 1940 3 Sheets-Sheet 2

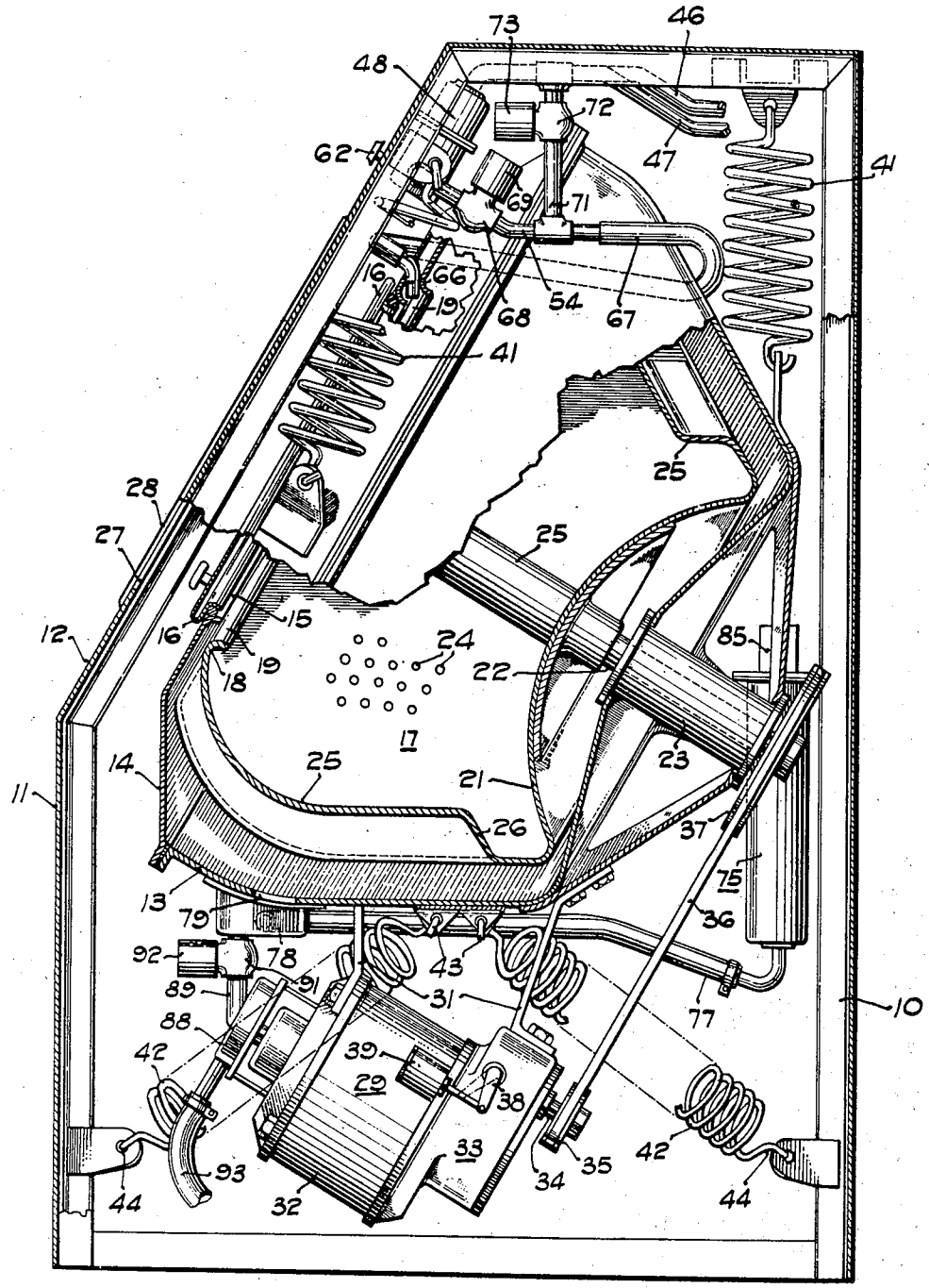


FIG. 2.

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LAUNDRY APPARATUS

Filed Dec. 31, 1940 3 Sheets-Sheet 3

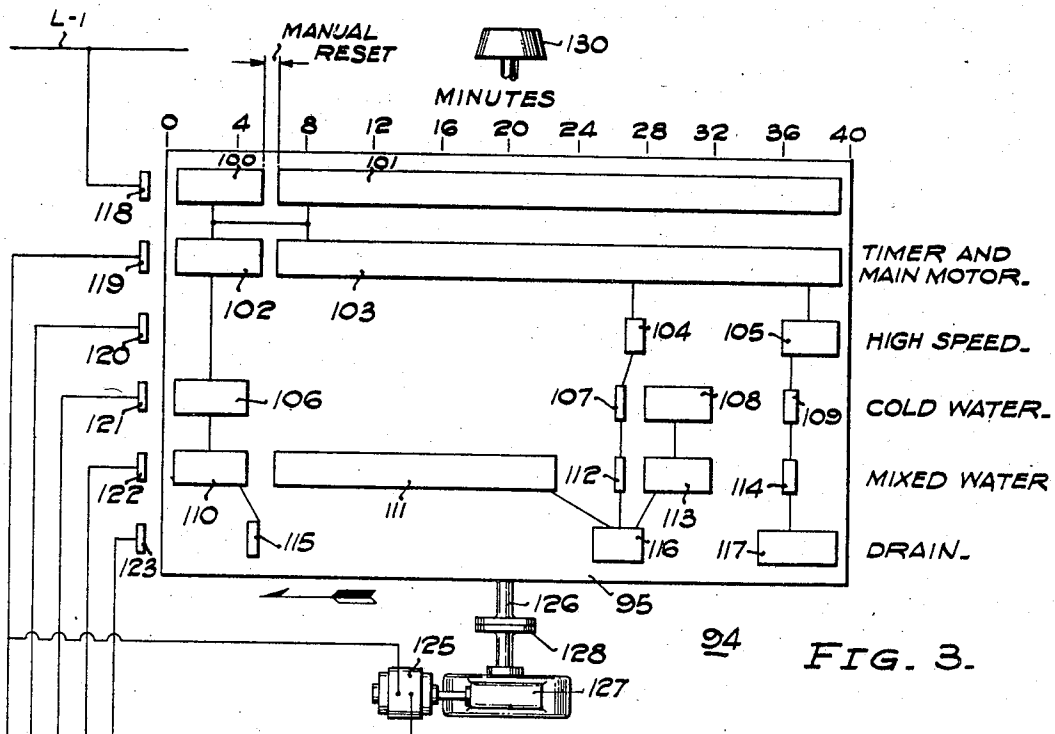


FIG. 3.

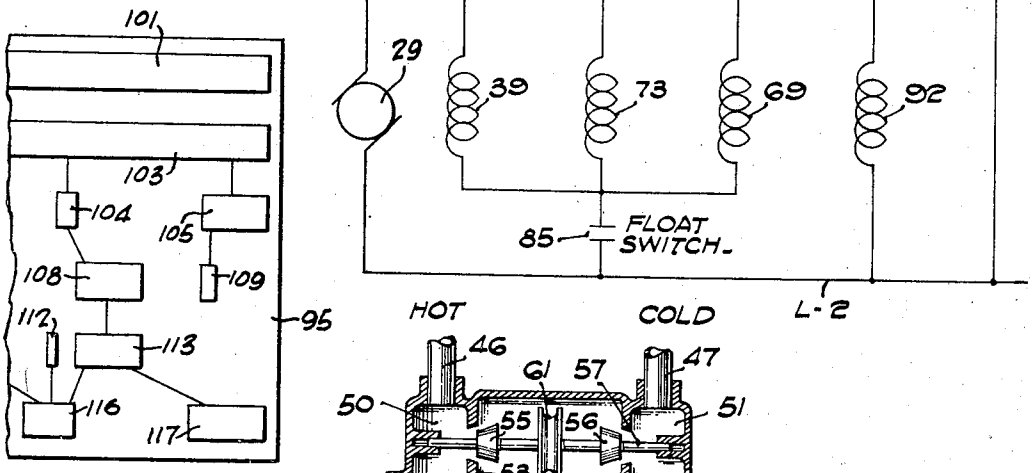


FIG. 5.

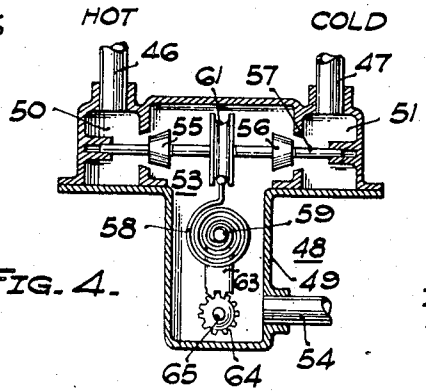


FIG. 4.

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UNITED STATES PATENT OFFICE

2,356,816

LAUNDRY APPARATUS

Frank Breckenridge and Earl K. Clark, Mansfield, Ohio, assignors to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application December 31, 1940, Serial No. 372,616

2 Claims. (Cl. 68—12)

This application is a continuation-in-part of our application, Serial No. 251,699, filed January 19, 1939. Our invention relates to laundry apparatus and has for an object to provide improved apparatus of this kind.

A further object of the invention is to provide improved laundry apparatus wherein the washing, rinsing and water-extracting steps in the washing program are automatically effected.

A further object of the invention is to provide an improved laundry machine of the character set forth in which the amount of hot water used during a washing cycle is small and wherein a relatively large number of temperature settings for the water admitted to the machine are provided.

A further object of our invention is to provide improved cleaning apparatus in which the fabrics being treated are subjected to a plurality of rinsing operations including a final spray rinse which cools the fabrics and the air within the apparatus so that removal of the fabrics from the apparatus may be effected by the operator in comfort.

A further object of the invention is to provide improved flexibly mounted washing apparatus having control devices for regulating the operation of the apparatus and supported so that they are not subjected to vibratory motion of the apparatus.

It is a still further object of the invention to provide an improved program of steps in the washing, rinsing and drying of fabrics.

These and other objects are effected by our invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a front view of a laundry machine constructed and controlled in accordance with the invention; portions of the outer casing of the machine being broken away;

Fig. 2 is a side view of the machine having portions thereof broken away for the sake of clearness;

Fig. 3 is a diagram of the electrical connections of the automatic control;

Fig. 4 is a sectional view of a detail shown in Fig. 2; and,

Fig. 5 is a partial view of a modified timer mechanism of the type shown in Fig. 3 and defining an element of a second embodiment of our invention.

Reference will now be had to Figs. 1 and 2 wherein we have shown a laundry machine of the type generally shown and claimed in the copending application of Frank Breckenridge, Serial No. 203,804, filed April 23, 1938, and assigned to the assignee of the present application.

The laundry machine shown in Figs. 1 and 2 includes a casing structure generally indicated at 10 and having a front wall 11, a portion of which is inclined as shown at 12. A water-containing structure or tub 13 of frusto-conical configuration is disposed within the casing structure 10 so that its axis is inclined, said tub being provided with an end wall 14 at the large end thereof. The end wall 14 is provided with an opening 15 that is closed by a suitable door 16.

Rotatably disposed within the tub 13 is a perforate basket 17 of frusto-conical configuration and having an end wall 18 at the large end thereof within which an opening 19 is formed. The basket 17 includes an end wall 21 at the small end thereof which is curved inwardly of the basket 17 and defines a dome within the basket 17. The basket 17 is coaxially arranged within the tub and rotatably carried by a shaft 22 journaled in a bearing 23, the latter being carried by the tub structure 13 as shown. The basket 17 is provided with a plurality of perforations 24 which are spaced apart throughout substantially the entire extent of the side walls of the basket. The basket 17 includes a plurality of inwardly-extending and circumferentially-spaced vanes 25 which extend from adjacent the end wall 18 toward the dome 21 and terminate in spaced relation with the latter as shown at 26. The specific form of basket structure shown herein is more fully disclosed and claimed in the copending application of Stuart R. Baird, Serial No. 268,103, filed April 15, 1939, and assigned to the assignee of the present application.

The respective access openings 15 and 19 of the tub 13 and basket 17 are aligned substantially with an access opening 27 formed in the inclined portion 12 of the casing front wall 11. The opening 27 is closed by a suitable cover 28 during inactive periods of the laundry machine, which cover is removed during operation. When the cover 28 is removed, the door 16 may be swung to its open position through the opening 27 of the casing. The admission of the fabrics to be washed to the basket 17 is effected through the openings 15 and 19.

Rotation of the basket 17 is effected by a driving mechanism, generally indicated at 29 and preferably carried by the tub structure 13. As shown, a pair of brackets 31 are secured to

the tub structure 17 and carry the driving mechanism 29. The driving mechanism 29 includes a motor 32 and a speed-reducing mechanism 33 driven thereby, said speed-reducing mechanism 33 having a driven shaft 34 upon which a pulley 35 is carried. The pulley 35 is belted, as shown at 36, to a relatively large pulley 37 carried by the shaft 22 of the basket 17.

The speed-reducing mechanism 33 is adjustable to provide high and low speeds of the driven shaft 34. Adjustment of the mechanism 33 is effected by an arm 38 that is actuated by a magnet 39. When the magnet is deenergized, the arm 38 is in the position shown in full lines and slow-speed operation is effected. When energized, the magnet 39 moves the arm 38 to the position shown in broken lines for effecting high-speed operation of the shaft 34.

As two-speed mechanisms of the type shown at 33 are well understood in the art, further description of the same is deemed unnecessary. Any suitable mechanism may be employed for effecting low and high-speed operation of the shaft 34 and consequently the basket 17. The specific form of mechanism employed forms no part of the present invention and has not been shown in detail for the sake of brevity.

The tub structure 13 may be carried within the casing 10 in any well-known manner and, as shown, is flexibly supported. A plurality of springs 41 are suspended from the casing 10 and resiliently support the tub 13 within the casing 10. Centering of the tub 13 within the casing 10 is effected by a plurality of tension springs 42 which are secured to the bottom of the tub 13 at their inner ends, as shown at 43, and to the casing 10 at the outer ends thereof, as shown at 44. A suitable flexible support, generally of the type disclosed, is described and claimed in the co-pending application of Frank Breckenridge et al., Serial No. 303,202, filed November 7, 1939, and assigned to the assignee of the present application.

In accordance with our invention, water at a predetermined temperature is supplied to the container or tub 13 from suitable sources of hot and cold water (not shown). Hot and cold water conduits 46 and 47, respectively, are secured within the casing 10 (Fig. 2) and convey the water from said sources to a thermostatically-controlled mixing valve structure, generally indicated at 48 and secured to the inclined portion 12 of the casing front wall 11. The mixing valve structure 48 is shown in detail in Fig. 4 and includes a housing 49 having hot and cold water inlet chambers 50 and 51 communicating with the conduits 46 and 47, respectively. The housing 49 also encloses a water-mixing chamber 53 that communicates with a discharge conduit 54. Passage of water from the inlet chambers 50 and 51 to the mixing chamber 53 is controlled by respective valves 55 and 56 which are carried by a common stem 57 and so arranged that one valve moves in an opening direction as the other valve is moved in a closing direction.

Movement of the valves 55 and 56 is effected by a suitable thermal responsive element 58, shown by way of example as a bimetal spiral, the inner end of which is secured to a rotatable stud 59 and the outer end of the spiral being operatively connected to a collar 61 carried by the valve stem 57. As the temperature of the water in the mixing chamber 53 increases, the spiral 58 unrolls and moves the collar 61 to the left so that the valve 55 is actuated in a closing direction and the valve 56 in its opening direction. A reduction in temperature of the water in the chamber 53 effects opposite operation of the valves 55 and 56. Accordingly, the temperature of the water in the chamber 53 is maintained at a substantially constant value which may be varied by rotation of the stud 59 and consequent winding or unwinding of the spiral 58. Rotary movement may be imparted to the stud 59 by a knob or handle 62 fixed thereto and disposed externally of the casing 10 as shown in Figs. 1 and 2. Preferably, the stud 59 is secured to a movable plate 63 having teeth formed thereon which mesh with a pinion 64 carried by a shaft 65. The shaft 65 extends exteriorly of the casing 10 and carries the knob 62.

The water discharged from the water-mixing device 48 is conveyed to a nozzle 66 secured to the tub 13 and so disposed that it directs the water into the basket 17 through the opening 19. As the resiliently-supported tub 13 is movable relative the casing 10, we employ a flexible conduit 67 for conveying the water from the discharge conduit 54 of the mixing device 48 to the nozzle 66. An electrically-operated valve 68 is disposed in the conduit 54 for controlling the flow of mixed water discharged by the device 48 and may be of any suitable construction. As shown, a solenoid 69 is employed for actuating the valve 68 and is so arranged that the valve 68 is opened during energized periods of the solenoid 69 and is closed when the solenoid 69 is deenergized. As the construction and operation of the solenoid-operated valves are well understood, no further description of the same is deemed necessary.

As set forth in the cycle of operation appearing hereinafter, cold water is admitted to the tub directly from the cold water supply conduit 47 at times, and, in order to effect this operation, a conduit 71 is connected between the cold water supply conduit 47 and the conduit 54 on the downstream side of the valve 68. A valve 72 is connected in the conduit 71 and provided with a solenoid 73. The solenoid-operated valve 72 is constructed similarly to the valve 68 so that further reference to its operation is not necessary. The arrangement of the valves 68 and 72 in the water supply system is such that mixed water at a predetermined temperature, cold water or a mixture of the mixed water and cold water may be supplied to the tub 13.

The level of the water in the tub 13 is controlled by a float switch structure generally indicated at 75 (Fig. 1) and fixedly secured in any suitable manner to the casing 10. The float switch structure 75 may be of any well-understood construction and, as best shown in Fig. 1, includes a reservoir 76 that communicates with the interior of the tub by means of a flexible conduit 77 secured to the bottom of the reservoir 76 at one of its ends and at its other end to a pan 78. An opening 79 is provided in the bottom of the tub structure 13 and provides communication between the interior of the tub 13 and the pan 78. A removable strainer (not shown) of suitable construction is preferably disposed in the pan 78 between the outlet 79 and the conduits 89 and 77 for preventing passage of solid objects from the tub to the latter conduits 89 and 77.

The float switch structure 75 includes a float 81 that is movable between upper and lower shoulders 82 and 83 formed on a rod 84. A switch 85 of the tumbler type is carried by the struc-

ture 75 and is actuated by projections 86 formed on the rod 84. The switch 85 includes an actuating arm 85a which is engageable with the projections 86. As shown in Fig. 1, the reservoir 76 is empty so that the float 81 is in its lowermost position and, due to the weight thereof, has moved the switch 85 to its open position. When the water in the tub 13 attains a level indicated by the dotted line, the float 81 will have moved upwardly sufficiently to engage the collar 82 whereupon the rod 84 and the projections 86 are moved upwardly and engage the actuating member 85a so that the switch 85 is moved to its closed position. As described more fully hereinafter, the switch 85 is connected in the electrical circuits of the valve solenoids 69 and 73 and effects deenergization of the same when the level of the water in the tub is at the level indicated by dotted lines. Closure of the switch 85 is effected when substantially all of the water has been removed from the tub 13.

The discharge of vitiated water from the tub structure 13 is effected by a pump 88 (Fig. 1) having an inlet connection 89 connected to the pan 78. Delivery of water from the pan 78 through the conduit 89 is controlled by an electrically operated valve 91, the construction of which is similar to the construction of the valves 68 and 72. The valve 91 is actuated by a solenoid 92 which, when energized, effects opening of the valve 91, and, conversely, when the solenoid 92 is deenergized, the valve 91 is moved to its closed position. The water translated by the pump 88 is discharged through a suitable conduit 93, shown by way of example as a length of rubber hose, to a point of discharge.

Control of the various electrical instrumentalities including the motor 29, the valve solenoids 69, 73 and 92 and the clutch magnet winding 39, is automatically effected by a timing device generally indicated by the numeral 94 in Fig. 1 and carried by the inclined panel 12 of the casing 10. The timing device 94 is preferably of the motor-driven drum switch type and is diagrammatically shown in Fig. 3. The timer 94 includes a drum 95 which is shown in development in Fig. 3 and which carries electrically-connected contact segments 100 to 117 inclusive. The timing device 94 also includes stationary contact fingers 118 to 123 inclusive which cooperate with said segments in establishing electrical circuits of the motor 29, the valve solenoids 39, 73 and 69, and the clutch magnet winding 92.

Rotation of the drum 95 is effected by a motor 125 of the type commonly employed for driving clocks. The drum 95 is rotatable about a shaft 126 which is driven by the motor 125 through a speed-reducing mechanism generally indicated at 127. Movement of the drum 95 is at all times in the direction of the arrow Fig. 3. The drum 95 may be manually rotated by a knob or handle 130 when initiating a washing cycle. In order that manual rotation of the shaft 126 and drum 95 may be effected, a clutch 128 is disposed between the shaft 126 and the speed-reducing mechanism 127, it being understood that the high reduction speed-reducing mechanism 127 could not be manually rotated by the handle 130. The operation of the clutch is such that when the motor 125 is operated, rotation of the drum 95 is effected through the clutch 128. When rotary movement is manually imparted to the drum 95, through the handle 130, the clutch 128 is adapted to slip.

The source of power for the various electrical instruments is indicated by line conductors L_1 and L_2, the former of which is connected to the contact finger 118. The line conductor L_2 is directly connected to one terminal of each of the motors 29 and 125 and to a terminal of the discharge valve solenoid 92. The opposite terminals of the motor 29 and 125 are joined and connected to the contact finger 119. The opposite terminal of the solenoid 92 is connected to the contact finger 123. One side of each of the solenoids 39, 73 and 69 is respectively connected to contact fingers 120, 121 and 122. The opposite terminals of the solenoids 39, 73 and 69 are joined and connected to the line conductor L_2 through the switch 85 of the float switch structure 75.

Operation

The cycle of operation of the apparatus will now be described. The fabrics to be washed are deposited in the basket 17 through the openings 15 and 19 at which time a suitable break may be deposited for increasing the alkaline content of the water. The door 16 is then closed and the drum 95 of the switch is rotated manually for initiating operation of the apparatus. Engagement of the contact fingers 118 and 119 with the segments 100 and 102 energizes the timer motor 125 and the main motor 29. The drum 95 is slowly advanced by the timer motor 125 and, as the clutch magnet 92 is deenergized at this time, the motor 29 rotates the basket at a relatively slow or washing speed, for example, 55 R. P. M. Engagement of the contact fingers 121 and 122 with the segments 106 and 110 effects energization of both water valve solenoids 73 and 69, it being understood that the float switch 85 is closed. Mixed water at a temperature determined by the setting of the thermostat knob 62 is admitted to the tub through the nozzle 66 and cold water from the conduit 47 is passed through the solenoid valve 72 to the nozzle 66. Accordingly, the temperature of the wash water for the first washing period is relatively low. When the level of the water in the tub has risen to the level indicated by the broken line, the float switch 85 is opened and the flow of water to the tub 13 is terminated. The relatively slow rotation of the basket effects agitation of the clothes in the wash water for dissolving the soils therein. Agitation of the fabrics is effected by the vanes 25 elevating the fabrics to an upper portion of the basket and then dropping the same on the dome 21. As the fabrics slide downwardly of the dome 21, they engage the upper surface of the body of water and are deflected forwardly of the basket. This operation is then repeated.

When the soil conditions are severe, the first washing period is effected for the full period of time, or six minutes, at the end of which time, the segments 100 and 102 are disengaged from the fingers 118 and 119 and operation of both the timer motor 125 and the main motor 29 is terminated. Prior to terminating operation of the motors, the segment 115 engages the contact finger 133 for opening the drain valve 91 for discharging the water from the tub.

Manual attention is now necessary and the operator deposits a detergent in the basket after which the drum 95 is again manually adjusted to initiate operation of the apparatus. This operation is effected by the engagement of the contact segments 101 and 103 with the fingers 118 and 119. At this time, the segment 111 en-

gages the finger 122 whereupon the mixed water solenoid valve 68 is opened and relatively warm water at a temperature determined by the setting of the thermostatically-controlled devices 48 and 62 is admitted to the tub. In this connection, no change in the setting of the water-mixing device 48 is necessary. During the initial admission of water to the tub for the first wash period, both mixed and cold water is admitted to the tub so that the wash water temperature is relatively low. Only mixed water from the device 48 is admitted for the second wash so that the water temperature is relatively high.

The flow of warm water into the tub is terminated when the float switch 85 is opened and the second washing period is now effected for a period of time determined by the setting of the drum 95 when manually initiating operation of the apparatus for the second time. It will be understood that if the soil conditions are light, the drum 95 may be manually advanced whereupon the duration of the washing period is shortened.

The washing cycle is completed when the drum 95 has been advanced to the position indicated approximately by the twenty-five minute point as shown in Fig. 3, at which time the drain valve 91 is opened by the engagement of the contact segment 116 and the finger 133. When substantially all of the water is drained from the tub, the segments 107 and 112 engage the fingers 121 and 122 and, as the float switch 85 is closed, cold water and mixed water are directed into the basket through the nozzle 66 for flushing out soap scum and soils remaining on the fabrics. This operation is effected for a relatively short period of time after which the contact segment 104 engages the finger 120 and, as the float switch 85 is closed at this time, the clutch magnet 39 is energized and high-speed operation of the basket is initiated. The wash water remaining in the fabrics is centrifuged therefrom for a period of time of approximately two minutes, after which the magnet 39 is deenergized and slow-speed operation of the basket is initiated. At this time, the drain valve is also closed as the segment 116 is disengaged from the finger 123.

Filling of the tub with rinse water is then effected. Rinse water composed of cold water and mixed water is admitted to the tub with the energization of the solenoids 73 and 69, which operation is effected by the engagement of the segments 108 and 113 and their respective fingers 121 and 122. When sufficient water is admitted to the tub, the float switch 85 again opens and terminates flow of rinse water to the tub. Agitation of the fabrics in the rinse water is effected for approximately seven minutes or until the timer has been moved to the thirty-five minute position on the scale, at which time, the drain valve is opened by the engagement of the segment 117 and the finger 123. At this time the soap is thoroughly diffused in the rinse water and is discharged therewith.

High-speed operation of the basket is again effected when the segment 105 engages the finger 120 and the rinse water is spun from the fabrics and discharged from the tub. It is understood that the float switch 85 is closed during high-speed operation of the basket. A spray rinse is effected for a relatively short period of time during the early portion of the spinning of the fabrics or when the segments 109 and 114 engage the fingers 121 and 122, which operation effects energization of both the water valve solenoids 69 and 73 so that water at a relatively low temperature is sprayed on the fabrics during the high-speed rotation of the same. The fabrics are spun at high speed for approximately four minutes at a speed of approximately 500 R. P. M., or until the contact segment 105 has been disengaged from the finger 120. A complete cycle of operation has now been described and the damp fabrics may be removed from the basket.

From the foregoing, it will be apparent that the first washing period may be eliminated if the soil conditions are light, as the drum 95 may be immediately adjusted in initiating operation of the apparatus to its advanced position or the position wherein the segment 101 is engaged with the contact finger 118. Furthermore, the duration of the washing period may be varied depending upon how far the drum is advanced in initiating operation. The thermostatically-controlled water valve which we employ is gradually operated and effects close regulation of the temperature of the wash water admitted to the tub. The thermal responsive element or spiral 58 is on the downstream side of the regulating valves 55 and 56 in the mixing chamber 53 so that it is subjected at all times to the temperature of the water mixture which is admitted to the tub. The thermal responsive element 58 rapidly effects the necesary change in ratio of hot and cold water admitted to the chamber, and precludes the possibility of admitting water to the tub at a temperature above a safe temperature for the articles to be washed. In other words, alternate surges of hot and cold water into the tub are prevented. Accordingly, woolen articles which may be damaged when subjected to water at a temperature above approximately 105° F., may be safely washed.

Furthermore, the rinse water admitted to the tub is a mixture of mixed water discharged from the thermostatically-controlled valve 48 and cold water, whereby a substantial saving in the amount of hot water used is effected. We consider this an important feature of our invention. The thermostatically-controlled valve which we employ for mixing the cold and hot water is gradually operated so that noise due to water hammer is prevented.

In the embodiment of our invention described heretofore, the rinse water employed during the first flushing rinse, the agitating rinse and the final spray rinse is composed of a mixture of cold water and water discharged from the mixing chamber. Accordingly, the temperature of the water for all rinses is lower than the temperature of the water employed for washing. In Fig. 5 we have shown a portion of a timer mechanism employed in a second embodiment of our invention wherein the temperatures of the water admitted to the tub for the different rinses vary. The timer mechanism shown in Fig. 5 is identical with the timer shown in Fig. 3 except that the contacts 107 and 114 are omitted. Accordingly, the solenoid 73 is deenergized and the valve 72 is closed during the first flush rinse and, therefore, only relatively warm water at the washing temperature is employed for the first flush rinse. Furthermore, the solenoid 69 is deenergized and the valve 68 is closed during the final spray rinse so that only cold water is admitted to the fabrics at this time. Otherwise, the structure and operation of our second embodiment are identical with the structure and operation of the first embodiment.

The admission of relatively warm water dur-

ing the first flushing rinse is advantageous as it more readily dissolves the soap residue deposited within the basket by the receding water as it is drained from the basket. The warm water, furthermore, expands the fibres of the fabrics which facilitates the centrifuging of wash water therefrom. The agitating or deep rinse which follows is carried out in the same manner as described in connection with the first embodiment. The final spray rinse which accompanies the initial portion of the centrifuging or final extraction period, employs only cold water in the present embodiment. This operation is effected, not only for the saving of hot water, but for the purpose of cooling the fabrics for subsequent handling and for contracting the fibres thereof. We have found that the fabrics are very effectively cleared of soap residue when rinsed in accordance with the program of the present embodiment and that the removal of the fabrics from the basket may be more comfortably carried out where the fabrics and the air in the tub are first cooled. It will be understood in this connection that a substantial portion of the moisture in the heated air within the tub is condensed and precipitated therefrom by the cold spray.

While we have shown our invention in several forms, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various other changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What we claim is:

1. In apparatus for washing fabrics and for subsequently centrifuging washing water therefrom, the combination of a container for a body of washing water and the fabrics to be treated, means for agitating the fabrics within the container at relatively low speed for effecting washing and rinsing actions, means for rotating the fabrics at relatively high speed for extracting fluid from the fabrics, sources of hot and cold water, a timer for energizing said agitating means at different times for providing washing and rinsing periods, said timer being effective to energize said high speed rotating means at different times for the extraction of washing and rinsing water from the fabrics, means controlled by the timer for admitting water from said hot water source to the container prior to the washing and rinsing periods and means controlled by the timer for spraying a predetermined quantity of cold water only within the container during the final high speed rotation of the fabrics, said quantity of cold water being effective to cool the fabrics and to reduce, substantially, the moisture content of the atmosphere within the container.

2. In apparatus for washing fabrics and for subsequently centrifuging washing water therefrom, the combination of a container for a body of washing water and the fabrics to be treated, means for agitating the fabrics within the container at relatively low speed for effecting washing and rinsing actions, means for rotating the fabrics at relatively high speed for extracting fluid from the fabrics, sources of hot and cold water, a thermostatically-controlled water-mixing device connected to said hot and cold water sources and adjustable for providing a water mixture of predetermined temperature, a first valve controlling the flow of mixed water from said mixing device to the container, means including a second valve for delivering cold water to the container, and time-controlled means for controlling the agitating and rotating means and determining the duration of the periods of operation thereof, said time-controlled means including means for opening said first valve at the beginning of the washing period, means for opening the first and second valves at the beginning of the rinsing period and means for opening the second valve only for a predetermined period of time during the period of high speed rotation of the fabrics.

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