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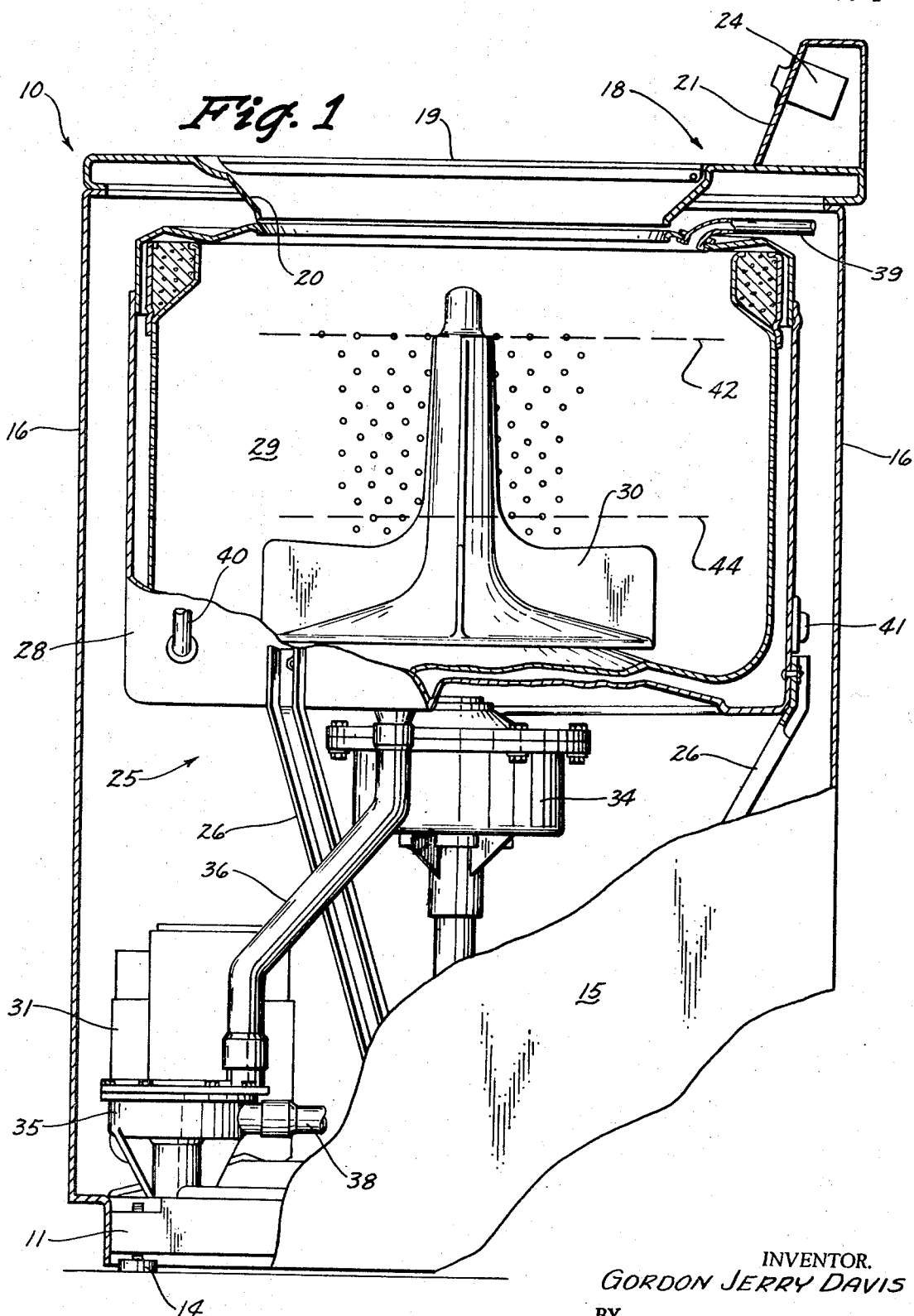
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METHOD AND APPARATUS FOR FABRIC COOL DOWN

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2 Sheets-Sheet 1



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1

2

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METHOD AND APPARATUS FOR FABRIC COOL DOWN

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9 Claims

ABSTRACT OF THE DISCLOSURE

Operation of a fabric washing apparatus through a liquid cool-down sequence initiated at a predetermined low liquid level under control of a pressure sensing switch and terminated at a predetermined low liquid temperature under control of temperature sensing means is disclosed.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to automatic fabric washing machines and more particularly to operation through a liquid cool-down sequence prior to the centrifuging operation for achieving an improved sequence of operations for washing "permanent press" or "wash and wear" articles.

Description of the prior art

It is common in the operation of automatic fabric washing machines to provide for a washing operation using warm or hot liquids to effect the cleansing of the fabrics. This high temperature wash operation is followed by a centrifugal liquid extraction operation and then by a rinse operation to remove the washing liquid from the fabrics and then in turn followed by a final liquid extraction operation. It has been found that the high temperature washing operation is most effective in achieving optimum cleansing of the fabrics and that the high temperature is effective for releasing wrinkles that have formed during prior wearing of the newer synthetic fabrics commonly called "permanent press" or "wash and wear."

If, however, the synthetic fabrics are subjected to a high speed liquid extraction operation following the high temperature washing operation, the compacting of the fabrics against the inner periphery of the rotating fabric basket causes wrinkling of the synthetic fabrics that become relatively fixed and difficult to remove. Previous work in the washing of synthetic fabrics has shown that it is desirable to reduce the temperature of the washing liquid for reducing the temperature of the fabrics being washed. A cool-down operation prior to the centrifugal extraction of liquids from the fabrics effectively achieves this end.

Prior art patents indicate a continuing search for improved methods and means for achieving a cool-down operation in an automatic washing machine. For example, Hughes, U.S. Pat. 3,055,202 proposes a system for alternately effecting partial emptying of the liquid container and refilling with cold water through a timed period after which the washing machine is operable for continuing the spinning operation to effect removal of the liquid from the fabrics. Billings et al, U.S. Pat. 3,078,700 on the other hand provides an overflow operation at the end of the wash operation to reduce the temperature of the water prior to the high speed fluid extraction. Billings et al. is directed to a system for preventing a spinning operation while the liquid is above a predetermined temperature.

SUMMARY OF THE INVENTION

It is an object of the instant invention to provide operation of a fabric washing apparatus through an improved cool-down sequence during the initial centrifugal extraction of the washing fluid.

It is a further object of the instant invention to provide for improved operation of a fabric washing apparatus including a cool-down operation initiated by liquid level sensing means and terminated by liquid temperature sensing means.

It is a still further object of the instant invention to provide for operation of a fabric washing machine including a fabric cool-down sequence initiated by liquid level sensing means wherein termination is initiated by liquid temperature sensing means and wherein sequential programming means are maintained de-energized during the cool-down sequence.

The instant invention achieves these objects in a fabric washing machine having a control system including selectively energizable programming means, liquid level sensing means, and liquid temperature sensing means. These control elements are cooperable in a control circuit and upon initiation by the programming means the liquid level means is operable for initiating the cool-down sequence during an initial portion of the extraction operation following a high temperature washing operation. Following the cool-down sequence, in which cold water is introduced into the liquid container, temperature sensing means is operable for conditioning the programming means for completing the sequence of operations of the washing apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a fabric washing machine with portions broken away and partially sectioned to illustrate elements of the washing machine and the instant invention;

FIG. 2 is a schematic diagram of an electrical control circuit incorporating the instant invention and useful with the washing machine shown in FIG. 1;

FIG. 3 is a diagrammatic view showing the sequential switching of the programming means shown schematically in FIG. 2 and operable through the improved sequence of operations of the instant invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is shown an automatic washing machine 10 including a base frame 11 supported on a plurality of adjustable leg members 14 and mounting a cabinet enclosure 15 comprising sidewall portions 16 and a top cover portion 18. The top cover portion 18 includes a hinged door panel 19 normally covering a recessed loading opening 20 and further includes an upwardly extending housing 21 for accommodating various control members, such as programming means 24.

Mounted within the cabinet 15 is a tub assembly 25 rotationally supported on the base frame 11 by a tripod arrangement including tub braces 26 which are connected to a generally imperforate outer liquid container or tub at their upper ends. Revolvably mounted within the imperforate outer tub 28 is a perforate clothes basket 29 in which is positioned an oscillatable agitator 30 for effecting movement of fabrics and water within the tub assembly 25. The outer imperforate tube 28 and the perforate clothes basket 29 are substantially aligned with the loading opening 20 in the top cover 18 for permitting the operator to place fabrics within the basket 29 and to remove them upon completion of the cycle.

The base frame 11 also supports a reversible drive motor 31 operable for selectively effecting oscillation of

3

the agitator 30 or centrifugal rotation of the inner basket 29 through the transmission assembly 34. The motor 31 is operable through a belt drive arrangement (not shown) and through the transmission 34 to effect in one direction of operation the oscillation of the agitator 30 and operable in the other direction to effect centrifugal rotation of the fabric basket 29. The transmission 34 and the belt drive arrangement effectively provide a slipping clutch or torque limiting means between the motor 31 and the basket 29.

The construction and mounting of the tub assembly 25 and the operation of the inner basket 29 and agitator 30 are more clearly and specifically shown in the following patents, each of which is assigned to the assignee of the instant invention: Scott et al., U.S. Pat. 2,854,297; Smith et al., U.S. Pat. 2,926,136; Burkland, U.S. Re. 25,157; and Goodlaxson, U.S. Pat. 3,013,645.

The base frame 11 also supports a pumping means 35 that is driven by the motor 31 and which communicates through a flexible conduit 36 with the outer tub 28. This pump 35 is operable for carrying fluids from the outer tube 28 and pumping them toward an external drain through a drain hose 38 when the motor 31 is operated in the direction for effecting centrifugal rotation of the basket 29. More detailed description of the operation of the fluid pumping system is shown in Smith U.S. Re. 25,125, also assigned to the assignee of the instant invention.

Various liquid control elements are provided on the tub assembly 25 and include a water inlet conduit 39 through which water may be selectively introduced into the washing basket 29 and outer tub 28. Water level sensing means is provided and includes a tube 40 in connection with the outer tub 28 at the sidewall toward the lower portion of the tub as in FIG. 1. A thermostat or thermosensing device 41 is also attached to the tub 28 and is operable for sensing the liquid temperature within the outer tub 28. Operation of the liquid level and liquid temperature sensing means will be shown and described hereinafter as relating to the improved cycle of operations for a fabric washing apparatus.

Referring to the schematic electric circuit of FIG. 2, the motor 31 corresponds to the portion of the circuit enclosed within the broken line and includes a low speed winding 50, a high speed winding 51, a start winding 54, and a pair of centrifugally operable switches 55 and 56. At a predetermined speed, switch 55 opens to remove start winding 54 from the circuit and switch 56 operates between high speed winding 51 and low speed winding 50. The programming means or mechanism 24 is shown schematically in FIG. 2 as a plurality of contacts 60 through 78 operable in pairs under control of cam means (not shown). Each cooperating pair of contacts function as a sequentially operable switch. The switch 79 is in the power line 80 and serves as a line switch or an "on-off" switch. The liquid level sensing means is in the form of a pressure switch communicating with the tube 40 in FIG. 1 and having a switch member 81 operable between a first contact 84 with a predetermined high liquid level which will be considered as a normal full tub of liquid as indicated by broken line 42 in FIG. 1 and a second contact 85 corresponding to a predetermined lower liquid level representing a switch reset position and indicated generally, at a static condition, by broken line 44 in FIG. 1. The temperature sensing means is in the form of the thermostat 41 that is normally closed but operates to the open position at temperatures above 80° F., for example.

The circuit further includes valve means 87 for controlling the incoming water and comprises a pair of coils 88 and 89 selectively energizable to provide either cold or hot water to the fluid inlet conduit 39 shown in FIG. 1. In addition to being sequentially controlled by contact pairs 73-74, 74-75, 76-77, and 77-78, the water valve solenoids 88 and 89 are controlled by a pair of manually

4

operable switches 90 and 91 to selectively control the wash and rinse temperatures entering the washing container 28. A first switch 90 is operable between one of two contacts and is coupled with a second switch 91. The second switch 91 is effectively operable between open and closed positions.

Also included in FIG. 2 is a motor speed control switch 94 operable between a first contact 95 for effecting slow speed operation of the motor and a second contact 96 operable for effecting high speed rotation of the motor 31. It is assumed that for this discussion that high speed operation has been selected as shown by the position of switch 94 made to contact 96.

Direction of motor rotation is controlled by contact pairs 65-66, 66-67, 68-69 and 69-70. When contact pairs 66-67 and 69-70 are closed the start winding 54 is so energized as to effect operation of the motor 31 in a direction for rotating basket 29 and operating the pump 35 for draining liquid from tub 28. When contact pairs 65-66 and 68-69 are closed the motor is energized for rotation in a direction for operating the agitator 30.

The circuit of FIG. 2 still further shows a pair of switches 98 and 99 for selectively providing the cool-down sequence of operations. These two switches 98, 99 are normally closed for the regular cycles of operations but are manually operated to an open position upon selection by the operator of a specialized cycle including the cool-down operation for synthetic fabrics.

Referring to FIG. 3 there is shown a diagrammatic representation of the sequencing control of the programming means. A detailed analysis of FIG. 3 taken with the circuit of FIG. 2 will show a person skilled in the art that the washing apparatus of FIG. 1 will be operable through a sequence of operations comprising the following:

Increments:	Operation of the machine
1-7 -----	Off.
8-35 -----	Washing operation with hot liquid and agitator operating.
36 -----	Pause for reversing direction of motor rotation.
37 -----	Initial spin operation and cool-down sequence.
38-40 ----	Extraction of wash liquid.
41 -----	Spray rinse with fabric basket centrifugally rotating.
42-44 ----	Final portion of wash liquid extraction.
45 -----	Pause for reversing direction of motor rotation.
46-49 ----	Deep rinse with motor operating to oscillate the agitator.
50 -----	Pause for reversing direction of motor rotation.
51-55 ----	Final centrifugal extraction for cycles in which a cool-down period has been selected.
56-60 ----	Continued fluid extraction operation for regular fabrics.

The instant invention is directed to the cool-down operation provided in increment 37. Upon advancement of the programming means 24 by a timing motor 100, for example, into increment 37, the position of the cam operated programming switches of FIG. 2 will be as follows: Contact pairs 60-61, 65-66, 68-69, 71-72, 73-74, 76-77, and 77-78 will be open whereas contact pairs 61-62, 63-64, 66-67, 69-70, and 74-75 will be closed. It is also understood that by the prior selection of the "permanent press" or the "wash and wear" cycle that the pair of switches 98 and 99 will be operated to the open position. Since a high temperature washing operation has just been completed the thermostat 41 will be operated to the open position and the water level switch 81 will be operated to the contact 84 indicating a full water condition. It is therefore possible to determine that the water valve

5

87 is de-energized, the timer motor 100 is de-energized, and the main drive motor 31 is energized.

Energization of the drive motor 31 effects rotation of the fabric basket 29 and operation of the pump 35 to remove liquid from the outer tub 28. Because of the full tub of water and since only a portion of the liquid is removed, rotation of the inner basket 29 in the liquid will be limited to a relatively slow speed. Upon the emptying of a portion of the liquid, the level sensing switch 81 will operate to the low level contact 85 for de-energizing the motor 31 and energizing the water valve 87. Since timer contact pair 74-75 is made, the cold water solenoid 88 is energized for effecting a refilling of the liquid container 28 with cold water. This cold water will reduce the temperature of the liquid within the outer tub 28 and of the fabrics in the basket 29.

When the liquid within the tub 28 reaches the predetermined full level, the level sensing switch 81 will operate from the low level contact 85 to the full contact 84 to again re-energize the motor 31 for effecting a spin operation of the fabric basket 29. If the temperature of the liquid has been reduced below the selected 80° F. temperature, the thermostat 41 will operate to the closed position for re-energizing the timer motor 100 to advance the programming means 24 out of the 37th increment and place the control of the washing apparatus 10 under the programming means 24 for continuation of the cycle of operations.

If, however, the temperature remains above the selected level, operation of the pressure switch 81 to the full contact 84 will re-energize the motor 31 without energizing the timer motor 100 and the motor 31 will effect the partial emptying of the liquid from the tub 28 until the level switch 81 resets to the low level contact 85 and the refilling operation with cold water will be repeated.

More specifically, the circuit operation is as follows: At the beginning of the 37th increment, a circuit is completed for energizing the motor 31 from power line 80 through switch 79 and a conductor 101 to the liquid level sensing switch 81 and through the full contact 84 and a second conductor 104 to a junction 105. From the junction 105, the circuit continues through a conductor 106, timer contact pair 63-64, the speed switch 94, and contact pairs 66-67 and 69-70 to the motor 31. The other side of the motor 31 is connected to the neutral line 107. The motor will thus operate the pump and rotate the basket.

Upon operation of the level switch 81 from the full contact 84 to the empty contact 85, the circuit to the motor 31 is broken and a circuit is completed to the water valve 87 through the level switch 81 made to the low level contact 85 and through the conductor 108 to a timer contact 74 made to contact 75. The circuit continues through conductor 109 to the coil 88 for opening the cold water inlet. The opposite side of the cold solenoid is connected to the neutral line 107. Upon the temperature reaching a predetermined lower level, the thermostat 41 closes to complete a circuit, upon operation of the level switch 81 to the full contact 84, from the junction 105 through the thermostat 41 to the timer motor 100 that is in turn connected to the neutral line 107. At the same time, a circuit will be completed to the drive motor 31 from the junction 105, as previously indicated. In the 38th increment the motor 31 will be energized for continuous high speed spin.

It is therefore seen that after the temperaturing sensing means indicates a sufficiently lowered temperature within the fabric container 29, the timer motor 100 will be energized for placing control of the washing apparatus 10 under the programming means 24.

While the liquid level sensing means is in the form of a pressure operated switch 81, it is recognized that other liquid level sensing devices may be provided within the liquid container 28 and operable in the instant invention.

6

Likewise, the temperature sensing means 41 is shown as mounted on the outer periphery of the outer tub 28 but it is recognized that other temperature sensing means can be shown attached to, within or juxtaposed the liquid container 28 for sensing the temperature of fluid within the tub or associated conduit as an indication of the fabric temperature of the articles being washed therein.

In the drawings and specification, there has been set forth a preferred embodiment of the invention and although specific terms are employed, these are used in a generic and descriptive sense only and not for purpose of limitation. Changes in form and the proportion of parts as well as the substitution of equivalents are contemplated, as circumstances may suggest or render expedient, without departing from the spirit or scope of this invention as further defined in the following claims.

I claim:

1. A method of treating fabrics following washing of said fabrics in a container of relatively high temperature liquid comprising: removing a predetermined portion of liquid from said container; introducing cold liquid into said container after removal of said predetermined portion to reduce the temperature of the washing liquid therein; preventing significant extraction of liquid from said fabrics during said liquid removal and cold liquid introduction operations; sensing the temperature of liquid in said container; and initiating extraction of liquid from said fabrics after the temperature of the washing liquid has cooled to at least said lower temperature.

2. A method of treating fabrics as defined in claim 1 wherein the liquid removal operation is preceded by the sensing of the temperature of said washing liquid to determine that the temperature of said washing liquid is above said lower predetermined temperature and that a cool-down operation is required.

3. A method of treating fabrics as defined in claim 1 wherein the liquid removal and cold liquid introduction operations are repeated for reducing the temperature of the washing liquid to said lower predetermined temperature before proceeding with the extraction of the liquid from said fabrics.

4. A washing apparatus comprising: container means for receiving washing liquid and fabrics to be washed; means for washing fabrics in said container means; means for removing liquid from said fabrics and said container means; liquid supply means energizable to selectively introduce hot and cold liquid into said container means; selectively energizable programming means operable for controlling said washing apparatus through a sequence of operations including a washing operation with relatively high temperature liquid; liquid level sensing means responsive to the level of liquid in said container means; temperature sensing means responsive to the temperature of the liquid in said container means; and circuit means interconnecting said programming means, said level sensing means, and said temperature sensing means, said programming means being cooperable with said level sensing means and said temperature sensing means for initiating said liquid removing means following said washing operation to effect partial emptying of the liquid from said container means, said liquid level sensing means being responsive at a lower liquid level in said container means for de-energizing said liquid removing means and energizing said liquid supply means for supplying cold liquid to said container means, said temperature sensing means being operable at a predetermined lower temperature of liquid in said container means for initiating completion of said sequence of operation.

5. A washing apparatus as defined in claim 4 and further including means for driving said washing means and said liquid removing means and wherein said level sensing means includes a switch member operable in a first condition for energizing said drive means and operable in a second condition corresponding to said lower

7

liquid level for de-energizing said drive means and energizing said liquid supply means.

6. A washing apparatus comprising: container means for receiving washing liquid and fabrics to be washed; means for washing fabrics in said container means; means for removing liquid from said fabrics and said container means; liquid supply means energizable to selectively introduce hot and cold liquid into said container means; control circuit means including selectively energizable sequential programming means operable for controlling said washing apparatus through a sequence of operations, said control circuit means further including first switch means operable to a first condition at a first level of liquid in said container means and second switch means for sensing the temperature of liquid in said container means and operable to a first condition at a first temperature of liquid in said container means, said control circuit means being operable through said programming means for initiating said liquid removing means at a predetermined position in said sequence of operations to effect partial emptying of the liquid from said container means, said first switch means being operable to a second condition at a predetermined lower liquid level in said container for effecting de-energization of said liquid removing means and energization of said liquid supply means for supplying cold liquid to said container means, said second switch means being operable to a second condition at a second lower temperature in said container for initiating completion of said sequence of operations.

7. A washing apparatus as defined in claim 6 wherein said programming means includes selectively energizable timing means for driving said programming means and wherein said timing means is maintained de-energized during the partial emptying of hot liquid and addition of cold liquid and is conditioned for re-energization to effect completion of said sequence of operations upon said temperature sensing means indicating a predetermined lower temperature level in said container means.

8. A washing apparatus as defined in claim 6 and further including selectively operable switch means for initiating a sequence of operations excluding said cool-down operation, said selectively operable switch means being operable for bypassing said level sensing means and said

8

temperature sensing means to effect continued operation of said timing means and control of said washing apparatus by said sequential programming means.

9. A washing apparatus comprising: liquid container means for receiving washing liquid; fabric basket means within said liquid container means for receiving fabrics to be washed in said washing liquid; means for washing fabrics in said basket means; pumping means for removing liquid from said container means; drive means operable in a first condition for driving said washing means and in second condition for rotating said basket means and operating said pumping means; liquid supply means energizable to selectively introduce hot and cold water into said container means; programming means for controlling said washing apparatus through a sequence of operations including a washing operation with relatively high temperature liquid in said container means and operable for energizing said drive means following said washing operation to effect rotation of said basket means and operation of said pumping means, said pumping means being operable for effecting removal of liquid from said container means while the speed of said basket means is retarded by the drag of the liquid remaining in said container means; means operable after a portion of said liquid has been removed for effecting de-energization of said drive means and effecting energization of said liquid supply means for supplying cold liquid to said container means; and temperature sensing means mounted on said container means and operable at a predetermined lower temperature of liquid in said container means for initiating completion of said sequence of operations.

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WILLIAM I. PRICE, Primary Examiner

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