Nov. 25, 1952 L. H. MADDOCK-CLEGG ET AL 2,619,284

THERMOSTATIC MIXER FOR WASHING MACHINES

Filed Sept. 13, 1950 3 Sheets-Sheet 1

FIG. 1.

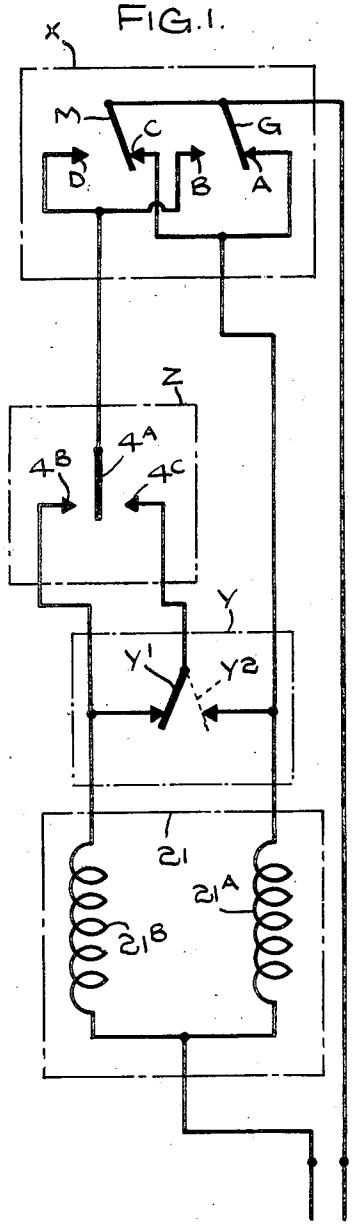


FIG. 2.

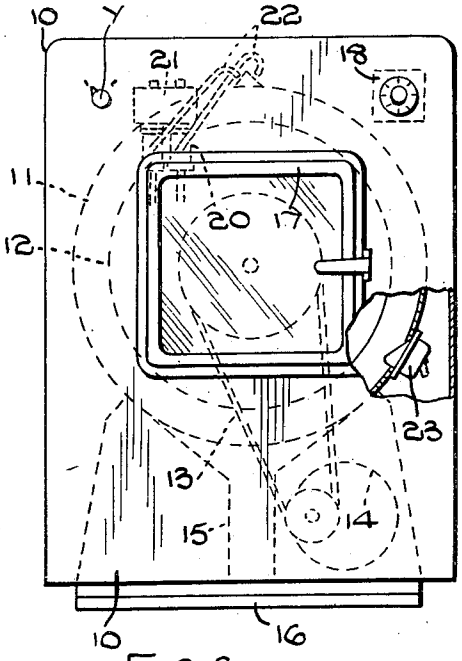
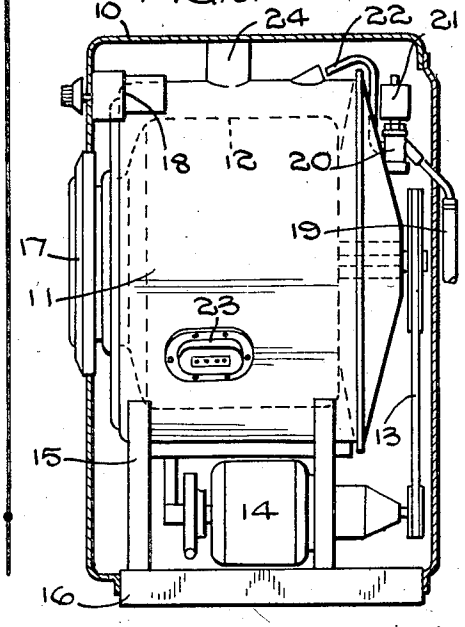


FIG. 3.



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THERMOSTATIC MIXER FOR WASHING MACHINES

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FIG.4.

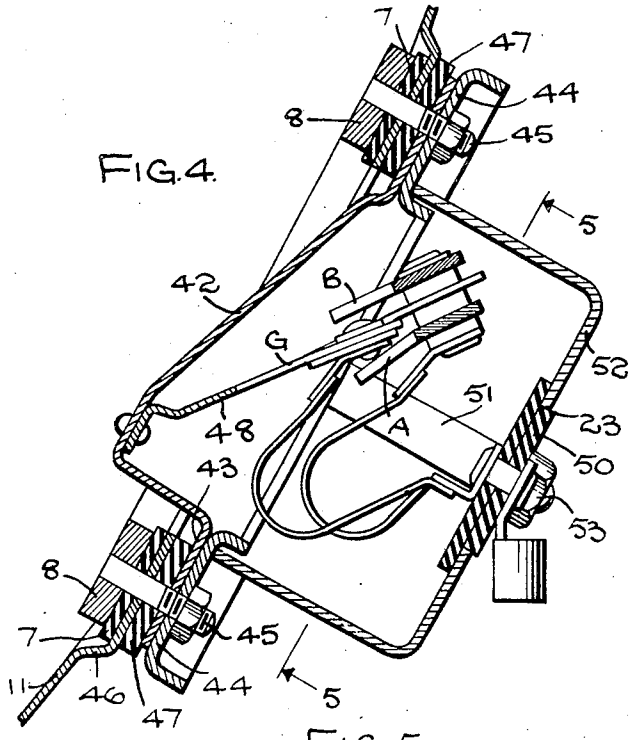
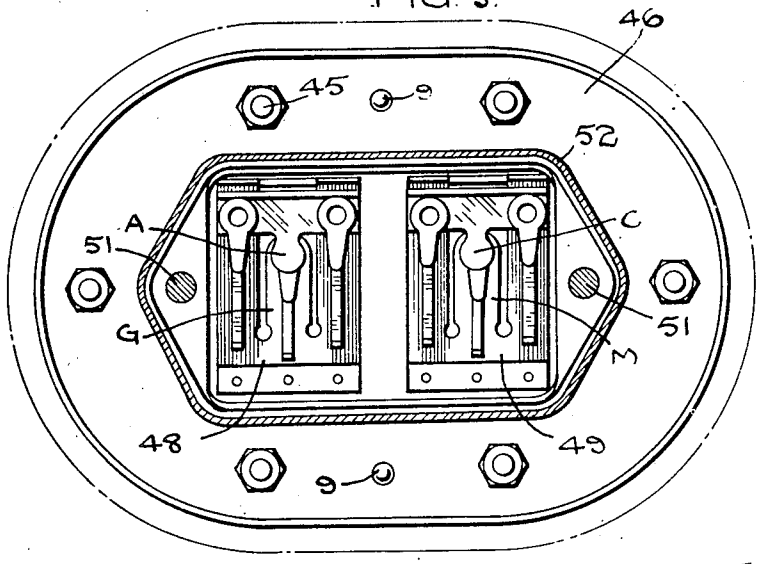


FIG.5.



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THERMOSTATIC MIXER FOR WASHING MACHINES

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FIG.6.

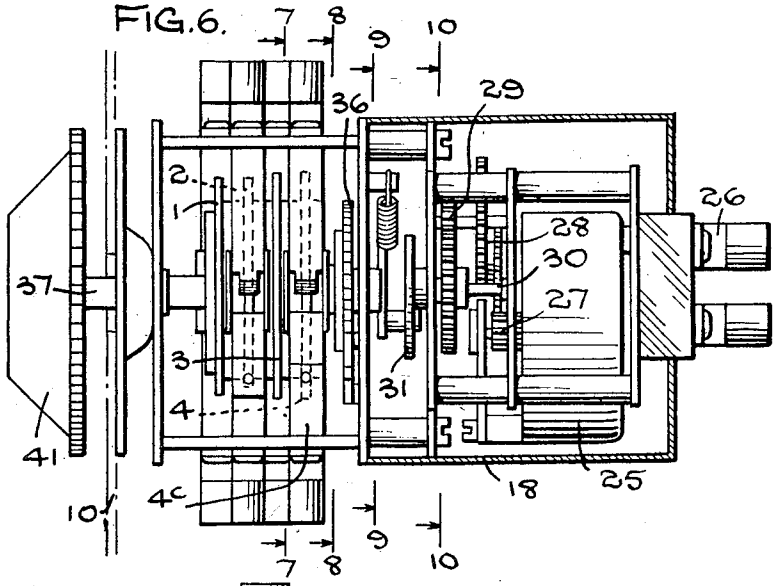


FIG.7.

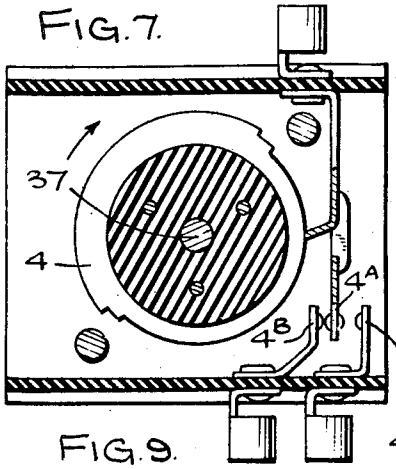


FIG.8.

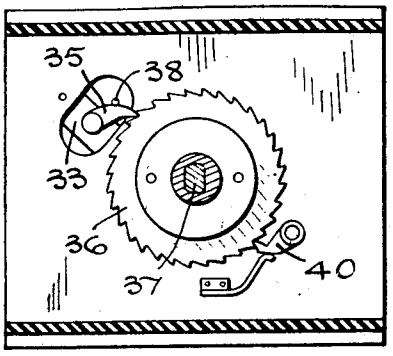


FIG.9.

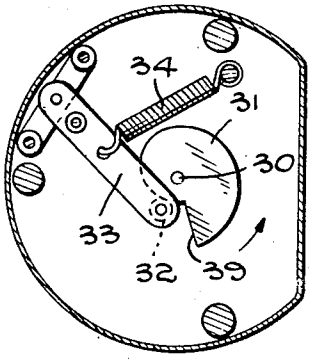
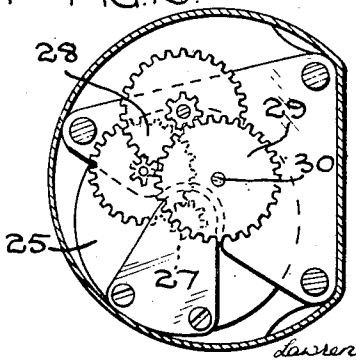


FIG.10.



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2,619,284

UNITED STATES PATENT OFFICE

2,619,284

THERMOSTATIC MIXER FOR WASHING MACHINES

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In Great Britain September 24, 1949

3 Claims. (Cl. 236—12)

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This invention relates to washing machines of the kind wherein water is admitted through the medium of one or more mechanically operated valves to a washing tub such tub comprising either a single tub which is adapted to contain both the clothes and the water or a pair of tubs the outer of which contains the water and the inner of which is perforated and contains the clothes the inner tub and the clothes therein being wholly or partially immersed in the water in the outer tub.

The invention is primarily concerned with washing machines whose operation is controlled by an automatic timer mechanism.

One of the difficulties in connection with domestic washing machines is to obtain a close control over the temperature of the water in the clothes tub during soaking, warm washing and rinsing operations. For maximum washing efficiency this temperature should be maintained, as nearly as possible at 97° F. For hot washing the temperature of the washing water is, of course, as high as can be obtained from the normal domestic supply.

In order to comply with the regulations of the majority of British water boards the hot and cold water supplies cannot be mixed; in other words they must be fed through separate pipes and separate discharge orifices into the clothes tub. In order to achieve some measure of control over the proportions of hot and cold water admitted to the clothes tub it has been proposed to provide in the hot water line a valve which can be manually set so that more or less hot water can be admitted to the clothes tub depending upon the temperature of the hot water supply.

The object of the present invention is to provide an improved construction for controlling the temperature of the water in the clothes tub.

According to the present invention the hot and/or cold water inlet valves are operated by a thermally responsive switch which is actuated by the temperature of the water in the washing tub.

The thermally responsive switch is secured to a side wall of the water tub and comprises a base portion, a pair of thermally responsive blade members secured at one end to said base portion and each carrying at its free end a moving contact member, a pair of stationary contacts one of each pair of which is engaged by its associated moving contact prior to the blade members reaching their operating temperature and the other of each pair of which is engaged

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after the blade members have reached their operating temperature and a cover secured to said base and surrounding said contacts.

Preferably one of the thermally responsive blade members is adapted to operate at a slightly lower temperature than the other.

The invention is illustrated in the accompanying drawings wherein:

Figure 1 is a schematic circuit diagram showing a portion of the circuit for operating the hot and cold water inlet valves.

Figure 2 is a front elevation of a washing machine.

Figure 3 is a side elevation thereof.

Figure 4 is a section in side elevation of the thermally responsive switch.

Figure 5 is a section on line 5—5 of Figure 4.

Figure 6 is a side elevation showing the timer mechanism.

Figure 7 is a section on line 7—7 of Figure 6.

Figure 8 is a section on line 8—8 of Figure 6.

Figure 9 is a section on line 9—9 of Figure 6, and

Figure 10 is a section on line 10—10 of Figure 6.

In the construction illustrated the invention is applied to an electrically operated washing machine of the kind comprising an outer casing 10, a cylindrical water tub 11 within which is a cylindrical perforated clothes tub 12 which is mounted for rotation about a horizontal axis and which can be driven by means of belt drive 13 from a motor 14. The water tub 11 is mounted on a suitable cradle 15 which is secured to the base 16 of the machine. Access may be obtained to the clothes tub 12 through a door 17 mounted in the front of the casing 10.

The various operations such as soak, wash and rinse in the washing cycle are controlled by a timer mechanism which is indicated generally at 18 and in detail in Figures 6 to 10, the operation of this timer mechanism being described more fully hereinafter.

The connection to the domestic water supply is shown at 19, the water inlet valves at 20, the solenoids which control these valves at 21 and the water delivery pipes at 22, the arrangement being that the two jets of water are directed on to a splitter (not shown in the drawings) which comprises a V shaped projection the apex of which is directed towards the jets of water. Each jet is split into approximately two halves by this splitter so that a proportion of both hot and cold water passes along both sides of the splitter thereby effecting a certain

mixing of the water supply after they have left their respective inlet pipes. The two streams of water are now guided by deflectors to a point where they converge and thence flow down one side of the water tub 11 passing over the base of a thermally operated switch 23 which is secured to the wall of the water tub. An opening 24 is provided in the top of the water tub 11 through which soap can be admitted.

The operation of the timer mechanism will now be more fully described. The timer 16 which is shown in detail in Figures 6 to 10 is of a known type and provides the following sequence in the washing cycle; off, soak, drain, off, wash, drain, rinse, drain, rinse, drain, spin and off.

The timer consists briefly of an electric motor 25 which obtains its supply from suitable terminals 26 the motor driving a shaft on which is mounted a gear wheel 27. This gear wheel 27 drives through a suitable chain of reduction gears indicated generally at 28 a final gear wheel 29 which is mounted on a shaft 30. Also mounted on this shaft 30 is a cam 31 against which bears a roller 32 which is mounted on one end of a lever arm 33 this arm 33 being biased by a spring 34 so that the roller 32 is always engaging the face of the cam 31. Mounted on this lever arm 33 is a pawl 35 which engages with a ratchet wheel 36 mounted on a further shaft 37. The pawl 35 is also biased by a spring 38 so that it is in engagement with the ratchet wheel 36 and the arrangement is that as the cam 31 is rotated by the motor in an anti-clockwise direction as seen in Figure 9 the lever arm 33 is moved to the left thus moving the pawl 35 to the left so that it disengages from one tooth of the ratchet wheel 36 and engages the next tooth in an anti-clockwise direction as viewed in Figure 8. The pawl 35 and lever arm 33 are furthest to the left when the roller 32 is engaging that portion of the cam just before the step 39. As soon as the roller moves down the step 39 and the lever arm 33 is moved quickly to the right under the influence of the spring 34 the pawl 35 is also moved to the right and moves the ratchet wheel 36 round by one step in a clockwise direction. A further spring loaded pawl 40 engages the ratchet wheel 36 and prevents this from rotating in an anti-clockwise direction when the pawl 35 is disengaged from the ratchet wheel during its movement to the left.

The shaft 37 has also mounted thereon a series of cams one of which, cam 4, is shown in Figure 7. Four cams in all are provided and an operating handle 41 is mounted on the end of the shaft 37.

Each cam engages a moving contact carrying member and these contacts actuate various electric circuits for effecting the operation of the machine throughout the washing cycle. For example cam 2 and its associated moving and fixed contact controls the operation of the motor 14 which drives the clothes tub 12 and cam 3 operates the drain valve.

The control knob 41 is marked with the various phases of the washing cycle such as soak, wash, rinse and at the commencement of the washing this knob is manually set to the position marked "off" just prior to the soak portion of dial. The operator then having placed the clothes in position turns the dial in a clock-wise direction to the beginning of the soak period, water is admitted to the machine, the operator adds a small quantity of soap and the clothes tumble as the clothes tub rotates the shaft 37 being rotated by the motor 25 until such time as the end of the soak period is reached. The drain valve is operated and the motor will then be cut off as cam 2 causes the motor contacts to open. At the same time as the motor 14 is de-energised the motor 25 which drives the cams is also de-energised and the user now moves the dial 41 to the beginning of the wash period whereupon the motors are re-energised and the tub is filled with water, the operator now adds the required amount of soap and the washing cycle continues until the end of the final spin is reached.

The construction of the thermally operated switch 23 is shown in detail in Figures 4 and 5 and comprises a base plate 42 which is provided with a peripheral flange 43 which flange is secured by rivets 9 to a fixing plate 44 whose central portion is cut away as shown in Figure 4. The fixing plate 44 and base plate 42 are secured by means of bolts 45 mounted on a ring 8 to the wall 46 of the water tub 11 the wall being suitably shaped to receive this fixing plate. A rubber washer 47 is secured between the wall 46 and the fixing plate 44 and further washers 7 are secured between the ring 8 and the wall 46 such washers each surrounding a bolt 45. The base 42 is inclined as shown in Figure 4 the base sloping away from the top of the water tub 11 so that the flow of water over the base 42 is not broken.

Secured to the inner side of the base 42 are thermally responsive elements 48 and 49 each element consisting of a plate which is provided with a central tongue G and M respectively these tongues forming the moving contacts of the switch. The plates 48 and 49 are stressed so that they are highly sensitive to temperature and the arrangement is such that on plate 48 attaining a temperature of 92° F. the tongue G will move from one fixed contact A to the fixed contact B. The other plate 49 is stressed so that the tongue M would move when a temperature of 103° F. is obtained. The construction of such a stressed switch plate is fully described and claimed in British specification No. 600,055.

The fixed contacts A and B associated with the plates 48 and the fixed contacts C and D (not shown) associated with the plate 49 are connected by flexible strips to a terminal block 50 made of insulating material and mounted on a pair of pillars 51 which are connected to the fixing plate 44 of the switch. The contacts A and C are connected together as are the contacts B and D. A suitable cover 52 is secured to the pillars 51 as by nuts 53.

The function of the thermally operated switch 23 will now be fully described and this switch 23 is, in the electrical sense, used in conjunction with cam 4 which operates a moving contact 4A which may engage either of the fixed contacts 4B and 4C or which may engage neither of them.

For the sake of simplicity in the circuit diagram shown in Figure 1 the contacts operated by cam 4 have been shown as a three position switch which will be hereinafter referred to as switch Z. The thermally operated switch will be hereinafter referred to as switch X and the plate which operates at the lower temperature is referred to as contact G and the plate which operates at the higher temperature as contact M. The fixed contacts between which the moving contact or plate G operates are referred to as contacts A and B and the fixed contacts between which the plate or moving contact M operates are referred to as C and D respectively. The plate G is set to operate at approximately 92° F. and the plate M at approximately 103° F.

Both the moving contacts G and M are electrically live during the soak, wash or rinse cycles of the machines, with the exception, of course, of the drain period at the end of these cycles. Contacts A and C, which are connected together, are engaged respectively by contacts G and M when the thermally responsive members associated with the latter have not reached their respective operating temperatures. The contacts B and D are also connected together and are engaged respectively by contacts G and M when the thermally responsive elements associated therewith have reached their respective operating temperatures.

Considering now the electrical circuit for the solenoids 21A and 21B which control the inlet valves for the hot and cold water supply respectively one side of each solenoid is connected directly to one side of the mains supply. The other side of the mains supply is connected, through cam 1 of the timer, to the contacts G and M so that these contacts are electrically live when the timer is in the soak, rinse or wash position.

The other side of the hot water solenoid 21A is connected directly to the contacts A and C so that when either or both of these contacts are engaged by either of both of the contacts G or M respectively the hot water solenoid 21A will be energised and hot water will be admitted to the water tub.

The other side of the cold water solenoid 21B is connected to the fixed contact 4B of the switch Z which is engaged by the moving contact 4A thereof when the timer is in the soak or rinse position. The moving contact 4A of the switch Z is connected to contacts B and D of the thermally operated switch so that if either or both of the contacts B and D are engaged by either or both of the contacts G or M respectively then the cold water solenoid 21B will be energized and cold water will be admitted to the water tub.

The operation of the water inlet solenoids 21A and 21B and the thermally operated switch 23 with the timer in the soak position will now be described. When clothes are being soaked it is necessary, in order to obtain a loosening of the dirt in the clothes, that the temperature of the water should be as nearly as possible 97° F. Similarly, when rinsing clothes, it is necessary, in order to dissolve out the soap in the clothes, that the water temperature should be as nearly as possible 97° F. When water is initially admitted to the clothes tub for soaking the clothes prior to washing, the water coming from the hot water storage tank will initially be cold or nearly so due to the fact that this water has been in the pipe leading from the storage tank and has consequently become cooled. Also the water tub will be cold so that the thermally responsive members associated with contacts G and M will be in their initial non-operated state so that contact G engages contact A and contact M engages contact C thereby energising the hot water solenoid 21A and admitting the water from the hot water storage tank. The cold water solenoid 21B will not be energised so that the cold water inlet valve is shut. The temperature of the hot water being admitted to the tub will rapidly rise and when the temperature of the water in the tub reaches 92° F. contact G will operate to engage contact B thus energising the cold water solenoid 21B and admitting cold water to the tub.

The circuit to the cold water solenoid 21B is, of course, completed through contacts 4A, 4B of the timer which are closed in the soak position. The hot water solenoid 21A will still be energised as contact M is still engaging contact C but if the temperature of the water in the tub rises to 103° F. contact M will operate to engage contact D thereby de-energising the hot water solenoid 21A so that the cold water only is admitted to the tub. The quantity of water admitted to the tub is controlled by a suitable float switch and if the water temperature in the tub falls below 103° F. before the full amount of water has been admitted to the tub the hot water solenoid 21A will again be energised, as contact M will re-engage contact C, so that both hot and cold water are admitted. Similarly if the temperature should fall below 92° F. the cold water solenoid 21B will be de-energised and hot water only will be admitted to the tub. It will be seen therefore that the temperature of the water in the clothes tub will be controlled at approximately 97° F. during the soak portion of the washing cycle. As contacts 4A, 4B of the timer are also closed in the rinse position it will be seen that the temperature of the water will also be controlled at approximately 97° F. during the rinse portions of the cycle.

The circuit arrangements and the operation of the control device during the wash period of the washing cycle will now be described. The second fixed contact 4C of the switch Z is engaged by the moving contact 4A thereof when the timer is in the wash position. This second contact 4C is connected, in the known manner, to a control switch Y which provides for a warm or hot wash. This switch is mounted on the front of the machine as shown in Figure 2. As is well known certain articles of clothing, such as woollens, must not be washed in very hot water so that a manual control is provided whereby the water used during the washing period is either maintained at approximately 97° F. or else is as hot as can be obtained from the storage tank. When the manual hot or warm control switch Y is moved to the warm position Y1 the second, or wash, fixed contact 4C of the switch Z is connected to the lead connecting the first, or soak or rinse, fixed contact 4B to the cold water solenoid 21B so that contacts B and D of the thermally operated switch are connected to the cold water solenoid 21B and the operating conditions are exactly the same as described above in relation to the soak and rinse periods of the washing cycle. If however the hot/warm control switch Y is moved to the hot position Y2 the second fixed contact 4C of the switch Z is connected to the lead connecting contacts A and C of the thermally operated switch to the hot water solenoid 21A. The hot water solenoid 21A is thus permanently energised during the wash period of the cycle and the cold water solenoid 21B permanently deenergised as, if the temperature of the water in the tub is below 97° F. the hot water solenoid 21A will be energised either through contacts M and C or through contacts G and A or through both, or, if the temperature of the water is above 97° F., it will be energised either through contacts M and D, or contacts G and B or through both and through the moving contacts 4A and second fixed contact 4C of switch Z.

Thus during the wash period of the washing cycle it will be seen that with a warm wash the temperature of the washing water is controlled

at approximately 97° F. whilst during a hot wash the temperature will reach the maximum obtainable from the storage tank regardless of the position of the thermally operated switch.

It will thus be seen that we have provided a washing machine in which the temperature of the water in the clothes and water tubs is closely controlled during the soak, warm wash and rinse portions of the washing cycle and in which the temperature of the water during the hot wash is as high as can be obtained from the domestic water supply.

What we claim is:

1. In a washing machine having a water tub, hot and cold water inlet pipes for delivering water to said tub and a solenoid operated valve for controlling the supply of water to each of said inlet pipes, a thermally responsive switch mounted on said water tube and having a base portion projecting into the said tub, a pair of thermally responsive blades anchored to said base portion, a moving contact secured to the free end of each blade and a pair of fixed contacts associated with each moving contact, one contact of each pair of fixed contacts being connected electrically to one side of said hot water solenoid, the other contact of each pair of fixed contacts being connected electrically to one side of said cold water solenoid, one line of an electrical power supply being connected to the other side of said solenoids and the other line of said power supply being connected to said moving contacts whereby when said moving contacts are operated, consequent upon a change in temperature of the water in said tub, the hot or cold water inlet valve is operated so as to provide the desired water temperature in said tub.

2. In a washing machine having a water tub, hot and cold water inlet pipes for delivering water to said tub and a solenoid operated valve for controlling the supply of water to each of said inlet pipes, a thermally responsive switch mounted on said water tub and having a base portion projecting into said tub, a pair of thermally responsive blades anchored to said base portion, a moving contact secured to the free end of each blade and a pair of fixed contacts associated with each moving contact, each blade being stressed to operate with a snap-action and one of said blades operating at a lower temperature than the other, one contact of each pair of fixed contacts being connected electrically to one side of said hot water solenoid, the other contact of each pair of fixed contacts being connected electrically to one side of said cold water solenoid, one line of an electrical power supply being connected to the other side of said solenoids and the other line of said power supply being connected to said moving contacts whereby when said moving contacts are operated, consequent upon a change in temperature of the water in said tub, the hot and/or cold water inlet valves are operated so as to provide the desired water temperature in said tub.

3. In a washing machine having a water tub, hot and cold water inlet pipes for delivering water to said tub and a solenoid operated valve for controlling the supply of water to each of said inlet pipes, a thermally responsive switch mounted on said water tub and having a base portion projecting into said tub, a pair of thermally responsive blades anchored to said base portion, a moving contact secured to the free end of each blade and a pair of fixed contacts associated with each moving contact, one of said blades operating at a lower temperature than the other, each moving contact engaging one fixed contact of each pair prior to its associated blade reaching its operating temperature and each moving contact engaging the other fixed contact after its associated blade has reached its operated temperature, said fixed contacts which are engaged by the moving contacts prior to the blades reaching their operating temperature being connected electrically together and to one side of said hot water solenoid, the fixed contacts which are engaged by the moving contacts after the blades have reached their operating temperature being connected electrically together and to one side of said cold water solenoid, one line of an electrical power supply being connected to the other side of said solenoids and the other line of said supply being connected to said moving contacts whereby when said moving contacts are operated, consequent upon a change in temperature of the water in said tub, the hot and/or cold water inlet valves are operated so as to provide the desired water temperature in said tub.

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