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S. HORECKY
CLOTHES DRYING MACHINES

2,820,304

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2 Sheets-Sheet 1

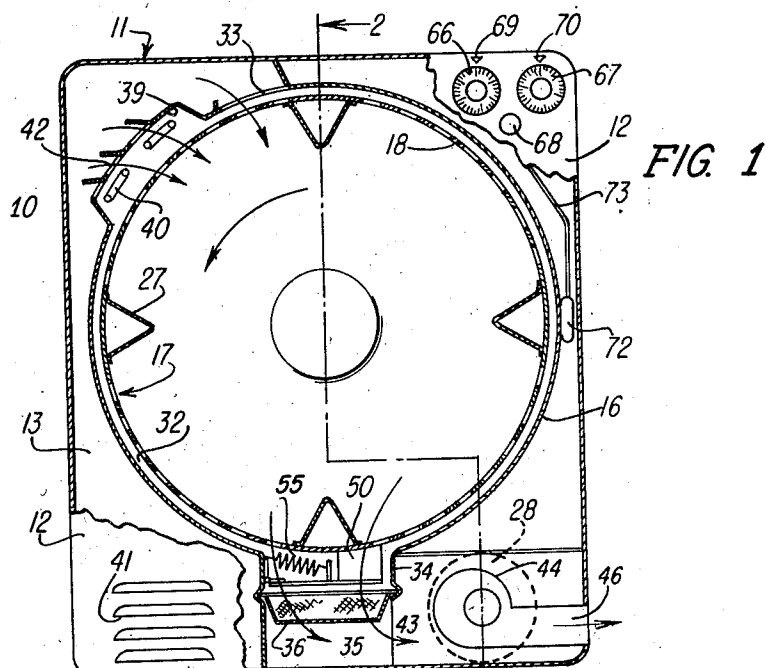


FIG. 1

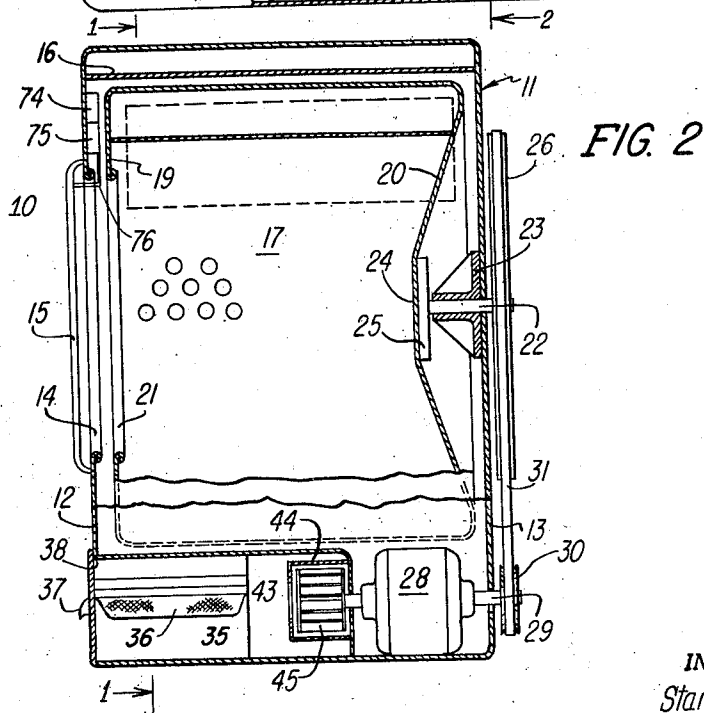


FIG. 2

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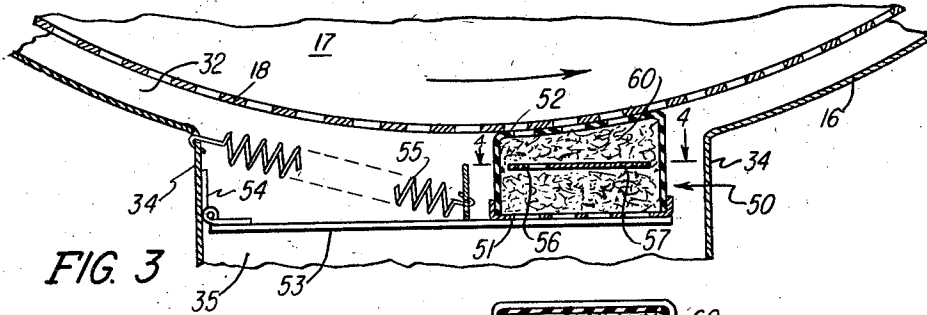


FIG. 3

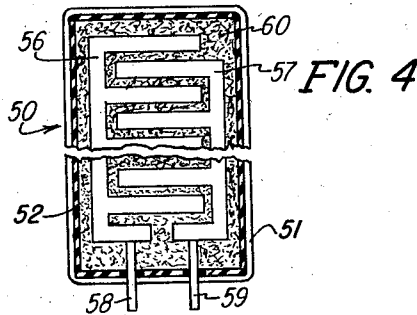
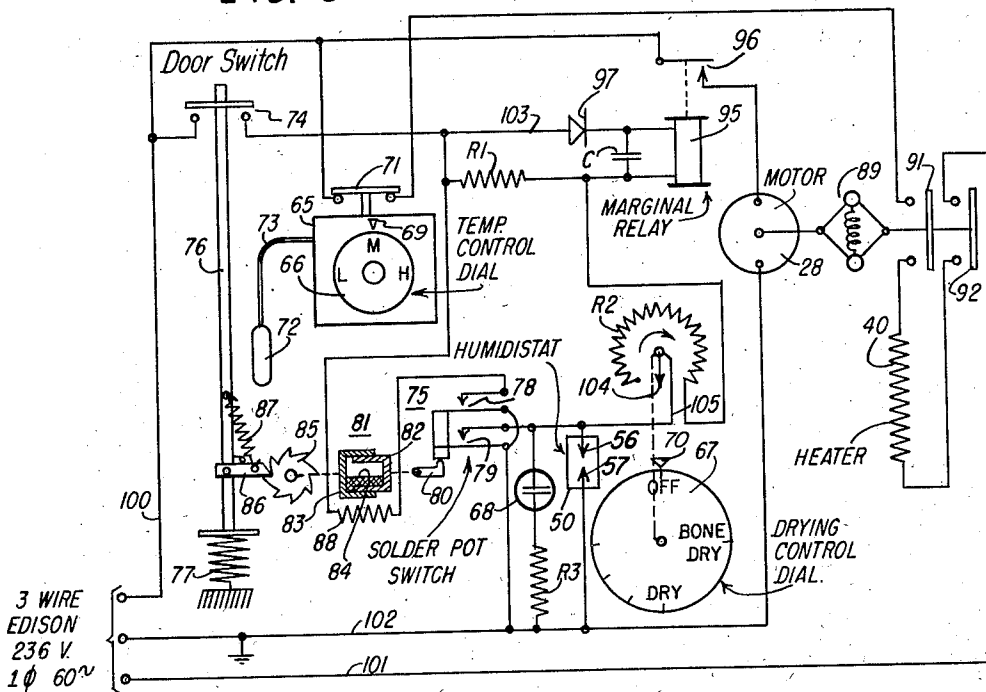


FIG. 4

FIG. 5



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CLOTHES DRYING MACHINES

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The present invention relates to clothes drying machines of the home laundry type.

A conventional clothes drying machine of the home laundry type comprises a timer that may be selectively set manually in order to establish the time interval of the drying cycle so as to accommodate the drying of different loads of clothes to different states of dryness as required.

While this arrangement is reasonably satisfactory, the control is dependent entirely upon the judgment of the operator with reference to her estimate of the time interval that will be required to dry the load of clothes to the desired state of dryness. In order better to establish this estimate, it has been suggested that the clothes should be weighed after they have been removed from the associated clothes washing machine and before they are placed into the dryer; however, this suggestion is useful only in reducing the limits of the error involved in the estimate, as different types of fabrics carry, when wet, different amounts of moisture. Furthermore, the weight of water carried by a given garment, when wet, is dependent upon the character of the extraction operation that has been carried out in the associated clothes washing machine, which extraction operation is also subject to many variables.

Accordingly, it is the general object of the present invention to provide in a clothes drying machine of the home laundry type, a control arrangement that is governed by a humidistat, whereby the state of dryness of the clothes undergoing the drying operation is measured directly by the humidistat, and this measurement is employed directly as the control for arresting the drying operation after it has been manually initiated.

Another object of the invention is to provide in a clothes drying machine, including a drum mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried and provided with a substantially tubular perforated side wall, an improved control arrangement comprising a humidistat provided with a control shoe in contact with the side wall mentioned and selectively governed in accordance with the amount of moisture carried by the clothes in the drum.

A further object of the invention is to provide in a clothes drying machine, an improved and simplified electric control circuit incorporating a humidistat responsive to the amount of moisture carried by the clothes undergoing the drying operation.

Further features of the invention pertain to the particular arrangement of the elements of the clothes drying machine, whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and principle of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which:

Figure 1 is a lateral vertical sectional view of a clothes drying machine of the home laundry type, taken in the

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direction of the arrows along the line 1—1 in Fig. 2, and embodying the present invention;

Fig. 2 is a longitudinally substantially vertical sectional view of the machine taken in the direction of the arrows along the offset line 2—2 in Fig. 1;

Fig. 3 is a greatly enlarged fragmentary lateral vertical sectional view of the lower portion of the clothes drying machine, as shown in Fig. 1;

Fig. 4 is a greatly enlarged fragmentary substantially horizontal sectional view taken along the line 4—4 in Fig. 3, illustrating the details of the humidistat incorporated in the machine; and

Fig. 5 is an electrical diagram of the control circuit incorporated in the machine.

Referring now to Figs. 1 and 2 of the drawings, the clothes drying machine 10 there illustrated, and embodying the features of the present invention, is of the home laundry type, comprising an outer substantially box-like casing 11, including front and rear walls 12 and 13, the front wall 12 being provided with a substantially centrally disposed front access opening 14 therein that is provided with a cooperating front door 15, the front door 15 being movable into open and closed positions with respect to the front opening 14 by hinge mechanism, not shown. Arranged within the casing 11 is a substantially tubular baffle 16; and arranged within the baffle 16 is a drum or basket 17, including a substantially tubular perforated side wall 18 and front and rear imperforate walls 19 and 20. The front wall 19 has a substantially centrally disposed front access opening 21 provided therein and disposed in registry with the front access opening 14 provided in the front wall 12. The drum 17 is adapted to receive the clothes to be dried and is mounted for rotation about a substantially horizontal axis by an arrangement including a shaft 22 fixed to the rear wall 20 and journaled in a bearing carried by a bearing bracket 23 supported by the rear wall 13 of the casing 11. More particularly, the central portion of the rear wall 20 is provided with a substantially conical and forwardly directed offset portion 24, that receives and is secured to a plate 25 carried on the extreme front end of the shaft 22, the intermediate portion of the shaft 22 being journaled in the bearing carried by the bearing bracket 23, and the extreme rear end of the shaft 22 carrying a pulley 26. Also a plurality of vanes or baffles 27 extend radially inwardly from the side wall 18 of the drum 17 so as to effect tumbling of the clothes upon rotation of the drum 17. The drum 17 is rotated at a relatively low speed; for example, about 50 R. P. M., by an electric motor 28 disposed in the lower right-hand portion of the casing 11 below the baffle 16, the motor 28 being provided with a rearwardly projecting operating shaft 29 carrying a pulley 30. In the arrangement, the pulleys 26 and 30 are disposed exteriorly of the rear wall 13 of the casing 11 and interconnected by a flexible drive belt 31.

The substantially drum-like baffle 16 encompassing the drum 17 defines a drying chamber 32 that is provided with an air inlet opening 33 disposed adjacent to the top thereof, the bottom of the baffle 16 opening into a downwardly extending throat 34 that communicates with an associated passage 35. A lint trap 36 is arranged in the passage 35 and may be in the form of a tray made of wire screen, or the like, so as to effect the accumulation of lint therein from the stream of air discharged from the drying chamber 32 through the passage 35. The lint trap 36 is provided with a handle 37 and is removable through a suitable opening 38 formed in the lower central portion of the front wall 12 of the casing 11. The tubular baffle 16 is also formed to provide a cove 39 in the upper left-hand portion thereof in which an electric heater 40 is arranged. The electric heater 40 may be of any suitable type, but is preferably of

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the sheathed resistance conductor type, so as to effect radiant heating to the side wall 18 of the drum 17, as well as the clothes contained therein, and also the air that is circulated through the perforations formed in the side wall 18 of the drum 17.

In the operation of the machine 10, air from the laundry room is admitted into the casing 11 through louver openings 41 formed in the lower left-hand portion of the front wall 12 thereof, which air passes upwardly within the casing 11 and enters the inlet opening 33 into the drying chamber 32. Also the air passing upwardly within the casing 11 enters through a number of slots 42 provided in the wall of the baffle 16 into the cove 39 and across the heating element 40 and thence into the drying chamber 32. The air then passes through the perforated side wall 18 of the drum 17 into contact with the clothes undergoing the tumbling action, whereby moisture contained in the clothes is evaporated therefrom and carried in the air stream through the passage 35 into a communicating compartment 43 which communicates directly with the eye of a blower 44, the rotor 45 of which is secured to the front end of the operating shaft 29 of the motor 28. Finally, the blower 44 discharges the damp air back into the laundry room through a discharge conduit 46 extending through the lower right-hand side wall of the casing 11. The lint contained in the air that is discharged from the drying chamber 32 through the passage 35 into the compartment 43 is caught in the lint trap 36 so that it is not blown through the discharge conduit 46 into the laundry room.

Thus the operating motor 28 effects rotation of the drum 17 in the counterclockwise direction as viewed in Fig. 1 and operation of the blower 44, whereby the wet clothes are tumbled in the drum 17 and dried both by the radiant heat from the heating element 40 and by the hot current of air passing through the drum 17.

Further, the machine 10 comprises a control arrangement including a humidistat 50 that is best shown in Figs. 3 and 4, the humidistat 50 being arranged in the throat 34 provided in the lowermost portion of the tubular baffle 16 and positioned adjacent to the bottom of the side wall 18 of the drum 17. More particularly, the humidistat 50 may comprise a longitudinally extending casing including a lower perforated casing section 51 and an upper perforated casing section 52 detachably secured together. The lower casing section 51 may be formed of metal, or the like, and the upper casing 52 is preferably formed of a wear-resistant material so that it comprises a control shoe in direct contact with the tubular side wall 18 of the drum 17. For example, the control shoe 52 may be formed of a suitable plastic material, such, for example, as the synthetic polyamide resin known as "nylon." Alternately the control shoe 52 may be formed of a porous sheet of textile fabric, a perforated sheet of leather, or other material having a suitable wear-resistant characteristic. The humidistat 50 is carried on the outer end of a lever 53, the inner end of the lever 53 being secured to the adjacent wall of the throat 34 by a hinge mechanism 54, and the lever 53 being biased about the hinge mechanism 54 toward the tubular side wall 18 by an arrangement including a coil spring 55 extending between the lever 53 and the wall of the throat 34; whereby the humidistat 50 is urged toward the drum 17 causing the control shoe 52 to bear and ride upon the tubular side wall 18 as the drum 17 is rotated. Suitably supported within the casing of the humidistat 50 are a pair of electrodes 56 and 57 disposed in spaced-apart relation and provided with respective terminals 58 and 59. Finally, the interior of the casing of the humidistat 50 contains a porous filling of fibrous material 60, such, for example, as glass fibers, whereby the electrodes 56 and 57 are variably insulated from each other by the fibrous material 60

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and dependent upon the moisture that is carried by the fibrous material 60. The fibrous material 60 is loosely packed within the casing of the humidistat 50 and in embedding relation with the respective electrodes 56 and 57 so that the current of air passing from the interior of the drum 17 through the throat 34 into the passage 35 may pass therethrough and through the perforated casing of the humidistat 50.

From the foregoing, it will be understood that the resistance of the electrical path through the fibrous material 60 between the electrodes 56 and 57 is dependent upon the amount of moisture adsorbed by the fibrous material 60, and if desired this electrical characteristic may be further controlled by impregnating the fibrous material 60 with a water-soluble salt so as to provide an electrolyte in the moisture adsorbed by the fibrous material 60. This salt may be either highly soluble (NaCl, etc.) or only slightly soluble (CaCO₃, etc.) in water. As a practical matter, the impregnation of the fibrous material 60 with a salt is unnecessary, since the water normally encountered in wash water carries not only the native salts of the water used in the washing step, but also the salts derived from the detergents employed in the washing step.

Further, as best shown in Figs. 1 and 5, the control arrangement comprises a temperature control switch 65 provided with a manually rotatable control dial 66, and a combined switch and rheostat R2 provided with a manually rotatable control dial 67, as well as a signal lamp 68, the elements 65, R2 and 68 being housed in the upper right-hand front portion of the casing 11, whereby the control dials 66 and 67 are carried by rotatable shafts extending through respective openings provided in the front wall 12 of the casing 11, the dials 66 and 67 being disposed adjacent to the front wall 12 and respectively cooperating with index markers 69 and 70 carried by the front wall 12. Further, the signal lamp 68 comprises a gas discharge tube visible through an appropriate opening provided in the overlying front wall 12, which gas discharge tube may comprise a neon tube of type NE48. The temperature control switch 65 also comprises a contact bridging element 71 and thermal control mechanism, not shown, that is governed by a temperature sensing bulb 72 connected thereto by an associated capillary tube 73, the temperature sensing bulb 72 being arranged in heat exchange relation with the tubular baffle 16 adjacent to the intermediate right-hand portion thereof, as shown in Fig. 1.

Also arranged within the casing 11 between the front wall 12 thereof and the front wall 19 of the drum 17 is a door switch 74 and a control switch 75 that are selectively actuated by an associated plunger 76 as the door 15 is moved between its open and closed positions. The arrangement of the door switch 74 and control switch 75 is best shown in Fig. 5, wherein it is indicated that the plunger 76 is biased by a spring 77 to move the door switch 74 into an open position when the door 15 occupies its open position, the plunger 76 being moved against the bias of the spring 77 when the door 15 is moved into its closed position so as to operate the door switch 74 into its closed position.

The control switch 75 is of the solder-pot type and comprises two sets of switch springs 78 and 79 that are selectively operated by an arm 80, as well as a solder pot 81 including complementary casing sections 82 and 83 containing a body of fusible solder 84. The casing section 82 is, in turn, connected to a rotatable shaft to which the arm 80 is connected; while the casing section 83 is, in turn, connected to a rotatable shaft to which a ratchet wheel 85 is connected. In turn, the ratchet wheel 85 cooperates with a pawl 86 carried by the plunger 76 and normally biased by a spring 87 into an operating position. Finally, the solder pot 81 is provided with an electric heating element 88.

In the operation of the solder pot switch 75, when the door 15 is moved into its open position, the plunger 76 is moved upwardly, as viewed in Fig. 5, by the spring 77, so that the pawl 86 rides over a tooth on the ratchet wheel 85 preparing the ratchet wheel 85 to be rotated one step. At this time, the quantity of solder 84 is in a solid condition securing together the casing sections 82 and 83; and also at this time, the sets of switch springs 78 and 79 are urged into open positions due to their inherent resiliency. Subsequently when the door 15 is moved into its closed position, the plunger 76 is moved downwardly, as viewed in Fig. 5, against the bias of the spring 77 whereby the ratchet wheel 85 is rotated one step by the cooperating pawl 86, so that the solder pot 81 is rotated through an angle corresponding to one step of the ratchet wheel 85 in order that the arm 80 urges the sets of switch springs 78 and 79 into a closed position. At this time, a circuit traced hereinafter, is completed, for energizing the electric heating element 88, whereby, after a predetermined time interval, the solder pot 81 is heated to a sufficiently high temperature to effect melting of the quantity of solder 84 so that the casing sections 82 and 83 are no longer secured together, but are free to rotate with respect to each other. Accordingly, the resiliency of the sets of switch springs 78 and 79 acting upon the arm 80 effects rotation of the casing section 82 with respect to the casing section 83, this relative rotation being accommodated by the liquid condition of the quantity of solder 84 at this time. Thus the sets of switch springs 78 and 79 are operated back into their open positions, whereupon the electric heating element 88 is deenergized so that the solder pot 81 may cool in order to bring about resetting of the quantity of solder 84 with the result that again the casing sections 82 and 83 are secured together. Thus at this time, the switch 75 is reconditioned to be reoperated, first into a closed position and then subsequently back into an open position, the next time the door 15 is opened and again closed.

Continuing with the composition of the control circuit, the motor 28 governs speed responsive mechanism 89 that may be of the "flyball" type that, in turn, controls a pair of contact bridging members 91 and 92. Further, the control arrangement comprises two resistors R1 and R2, a relay 95 provided with a pair of contacts 96 constituting a power switch, a capacitor C and a crystal diode 97 that may be of selenium rectifier type. Finally, the control circuit comprises a three-wire Edison source of power of 236 volts single-phase 60 cycle and including a pair of outside lines 100 and 101 and a grounded neutral line 102.

In the circuit arrangement, the capacitor C is connected in parallel relation with the winding of the relay 95; and the diode 97 and the parallel connected winding of the relay 95 and the capacitor C are connected in series relation across the resistor R1. The outside line 100 is connected via the door switch 74 to a conductor 103; one terminal of the resistor R1 is connected to the conductor 103 and the other terminal thereof is connected to one terminal of the combination switch and resistor R2; the combined device R2 including a wiper 104 that is connected to a conductor 105. The signal tube 63 is connected in series relation with the resistor R3 between the conductor 105 and the neutral line 102; and the electrodes 56 and 57 of the humidistat 50 are respectively connected to the conductor 105 and to the neutral line 102. Further, the conductor 105 is connected to one of the switch springs of the set 79, while the other spring of this set is connected to the neutral line 102. One of the springs of the set 78 is connected to the neutral line 102 and the other spring of this set is connected to one terminal of the heating element 88, the other terminal of the heating element 88 being connected to the conductor 103.

Considering now the overall operation of the clothes drying machine 10, the operator places the wet clothes through the front access openings 14 and 21 into the

drum 17 with the door 15 in its open position, and then closes the door 15. When the door 15 is thus closed, the plunger 76 is actuated operating the door switch 74 into its closed position and operating the solder pot switch 75 into its closed position by virtue of the relationship between the pawl and ratchet 86—85 and the solder pot 81, as previously explained. The operator then sets the control dial 66 in accordance with the desired temperature of the drier and specifically into its high, medium or low position, thereby setting the temperature at which the thermal system, including the thermal bulb 72, will effect operation of the bridging member 71 into its open position. Then the operator sets the control dial 67 into the position corresponding to the state-of-dryness desired of the wet clothes; and at this time, it may be assumed that the operator wishes to dry the wet clothes to a bone-dry condition or state-of-dryness. When the control dial 67 is rotated in the clockwise direction, as viewed in Fig. 5, out of its off position toward its bone-dry position, the wiper 104 engages and adjusts the effective resistance of the resistor R2, and completes a bridge circuit that is employed to effect energization of the winding of the relay 95. This bridge circuit extends from the outside line 100 via the door switch 74, the conductor 103, the resistor R1, the resistor R2, the wiper 104, the conductor 105, and the set of switch springs 79 to the neutral line 102. When this bridge circuit is closed, the outside line to neutral voltage is impressed across the resistors R1 and R2 in series relation, whereby the voltage drop across the resistor R1 is rectified by the diode 97 and impressed across the capacitor C and the winding of the relay 95 in parallel relation so that the winding of the relay 95 is energized causing it to operate, it being of the marginal type. Upon operating, the relay 95 closes its contacts 96 connecting the motor 28 across the outside line 100 and the neutral line 102, whereby operation of the motor 28 is initiated effecting rotation of the drum 17 and operation of the blower 44 in the manner previously explained. As the rotor of the motor 28 is accelerated substantially to its normal operating speed, the speed-responsive mechanism 89 is governed to effect closure of the bridging members 91 and 92 so that the electric heater 40 is connected via the contact bridging member 71 across the outside lines 100 and 101 effecting heating thereof and the consequent heating of the clothes tumbling in the rotating drum 17, as well as the current of air circulated through the drum 17.

Also, at this time, the electric heating element 88 is connected between the conductors 103 and the neutral line 102, whereby it is energized, the door switch 74 and the set of switch springs 78 occupying their closed positions. The electric heating element 88 is energized effecting heating of the solder pot 81, whereby the quantity of solder 84 contained therein is heated so that it is ultimately fused; the time interval required to bring about the fusion of the quantity of solder 84 being governed primarily by the rating of the electric heating element 88. For the present purpose of description, it may be assumed that this time interval required to effect fusion of the quantity of solder 84 is three minutes, but, of course, it will be understood that any appropriate time interval may be selected depending upon the design of the elements of the solder pot switch 75 and particularly upon the rating of the electric heating element 88.

As the wet clothes are tumbled in the drum 17, water therefrom passes through the perforations provided in the side wall 18 thereof and thence into the humidistat 50 so that the resistance of the circuit path between the electrodes 56 and 57 is substantially reduced as a consequence of the adsorption of moisture by the fibrous material 60. This circumstance is of no moment at this time by virtue of the closed position of the set of switch springs 79 short-circuiting the humidistat 50, but this control is employed subsequently, as explained hereinafter.

At the expiration of the three minutes, the quantity of

solder 84 contained in the solder pot 81 becomes fused, as previously explained, bringing about the release of the casing section 82 with respect to the casing section 83, whereby the sets of switch springs 78 and 79 are operated back into their open positions. Opening of the set of switch springs 78 effects deenergization of the electric heating element 88 so that the solder pot 81 subsequently cools with the consequent resetting of the quantity of solder 84 with the result that the casing sections 82 and 83 are again secured together, whereby the solder pot switch 75 is reset back into its normal condition. Opening of the set of switch springs 79 removes the short-circuit from around the humidistat 50, whereby an alternative bridge circuit is completed between the outside line 101 and the neutral line 102 via the door switch 74, the resistors R1 and R2, the wiper 104, the conductor 105, the electrode 56, the circuit path through the fibrous material 60 and the electrode 57. At this time considerable moisture is adsorbed by the fibrous material 60 so that the resistance path therethrough is relatively low, whereby the voltage drop across the resistor R1 is considerably high in the series bridge circuit in order that the rectified voltage applied to the capacitor C and to the winding of the relay 95 is quite high so that the relay 95 is retained in its operated position. Moreover, the voltage drop through the humidistat 50 is not adequate to ignite the signal tube 68, whereby the extinguished signal tube 68 is indicative of the circumstance that the machine 10 is operating in its drying cycle at this time.

As time proceeds, the moisture contained in the clothes tumbling in the drum 17 is evaporated therefrom and removed by the current of hot air circulated therethrough, as previously explained, whereby the current of hot air passing through the passage 33 and through the humidistat 50 becomes progressively drier so that this relatively dry hot air also effects the removal of moisture from the fibrous material 60 in the humidistat 50 with the result that the amount of moisture adsorbed by the fibrous material 60 is reduced bringing about a corresponding increase in the resistance of the circuit path between the electrodes 56 and 57. As the resistance of this circuit path is thus increased, the voltage drop thereacross is correspondingly increased with the result that there is a reduction in the voltage drop across the resistor R1, whereby ultimately the resistance of the circuit path between the electrodes 56 and 57 becomes controlling. At this time, the voltage drop across the resistor R1 becomes inadequate to provide a rectified voltage impressed across the capacitor C and the winding of the relay 95 in parallel relation to maintain the relay 95 in its operated position so that the relay 95 restores opening its contacts 96 to arrest operation of the motor 28. When operation of the motor 28 is thus arrested, the speed-responsive mechanism 89 effects opening of the bridging members 91 and 92 and the consequent deenergization of the heater 40. Also, when operation of the motor 28 is arrested, rotation of the drum 17 is arrested and operation of the blower 44 is arrested. Also at this time, when the voltage drop across the electrodes 56 and 57 of the humidistat 50 becomes controlling, this voltage drop is sufficiently high to ignite the signal tube 68, whereby the glow produced by this neon tube 68 is indicative of the circumstance that the drying cycle of the machine 10 has been completed.

In passing, it is noted that at this time an alternative bridge circuit is completed between the outside line 100 and the neutral line 102 that includes the door switch 74, the conductor 103, the resistor R1, the resistor R2, the wiper 104, the conductor 105, the tube 68 and the resistor R3, whereby the discharge of the tube 68 is maintained so as to maintain the glow and consequent signal thereof, as noted above. In this alternative bridge circuit, the resistance of the resistor R3 is such that the tube 68 passes a proper discharge current; however, the resistance of the

resistor R3 is so high that the voltage drop across the resistor R1 is so low that the rectified voltage that is applied to the capacitor C and to the winding of the relay 95 is quite low in order that the relay 95 is maintained in its restored position, the relay 95 being of the marginal type, as previously noted.

The arrangement of the capacitor C connected in parallel relation with the winding of the relay 95 prevents momentary or transitory variations in the voltage drop across the resistor R1 from affecting the position of the relay 95. For example, during the normal drying cycle should the resistance of the circuit path through the fibrous material 60 become momentarily very high, the voltage drop across the resistor R1 would correspondingly become momentarily very low, whereby the rectified voltage produced by the diode 97 would become momentarily very low; however, the voltage across the capacitor C does not fall momentarily; whereby the winding of the relay 95 is energized from the capacitor C during this transitory condition so as to retain the relay 95 in its operated position. On the other hand, at the end of the drying cycle, the resistance of the circuit path through the fibrous material 60 between the electrodes 56 and 57 is sustained at a high value, whereby the voltage drop across the resistor R1 is sustained at a low value so that the capacitor C is discharged through the winding of the relay 95 to the low value mentioned bringing about the restoration of the relay 95, it being of the marginal type, in the manner previously explained.

Again considering the control circuit, it will be observed that with the control dial 67 in its bone-dry position, the resistor R2 is substantially removed from the bridge circuit so that there is very little voltage drop thereacross, whereby the voltage drop through the circuit path through the fibrous material 60 must be increased to a very substantial value in order to reduce the voltage drop across the resistor R1 sufficiently to bring about the restoration of the relay 95. On the other hand, when the control dial 67 occupies its damp-dry position, a substantial portion of the resistor R2 is included in the series bridge circuit so that a substantial voltage drop is present thereacross, in order that the resistance of the circuit path through the fibrous material 60 between the electrodes 56 and 57 must be increased only moderately to bring about a reduction in the voltage drop across the resistor R1 so as to effect the restoration of the relay 95.

In view of the foregoing, it will be understood that the setting of the control dial 67 out of its off position not only closes the combination switch and resistor R2, but it effectively sets the portion of the resistor R2 that is included in the bridge circuit, thereby setting the control point of the humidistat 50. Moreover, this setting of the control point of the humidistat 50 is in no way governed by the load of wet clothes that is to be dried in the drum 17. In other words, it will take a longer time in the operating cycle of the machine 10 to dry 8# of clothes than it will take to dry 4# of clothes, but when the load of clothes is dried to the required state as preset by the position of the control dial 67, the humidistat 50 will reach its control point effecting the restoration of the relay 95; which condition is dependent only upon the state of dryness of the load of clothes and not upon the weight of the load of clothes. Thus, the present arrangement is very advantageous as it eliminates the necessity of weighing wet clothes in order to estimate the time interval of the drying cycle of the machine 10, and moreover, eliminates any consideration of the character of the fabrics included in the load of clothes with reference to the capacity thereof to absorb moisture. In other words, the operator must set only the state of dryness desired of the load of clothes upon the control dial 67, and without reference to the weight of the load of clothes, or the amount of moisture initially absorbed thereby.

Of course, the operator also sets the desired operating temperature range of the machine 10 upon the dial 66 as

certain fabrics (nylon, etc.) should not be dried at high temperatures. Thus during the normal operation of the machine 10 in its drying cycle, should the temperature of the drying chamber 32 exceed that preset by the control dial 66, the thermal bulb 72 responds to the over-temperature effecting operation of the temperature control switch 65 so that the contact bridging member 71 is operated into its open position to deenergize the heater 40, notwithstanding the closed positions of the contact bridging members 91 and 92. Subsequently, when the over-temperature mentioned subsides, the thermal bulb 72 responds to govern the temperature control switch 65 so as to operate the contact bridging member 71 back into its closed position in order again to energize the heater 40 so as to continue the drying cycle. This operation of the temperature control switch 65 governed by the temperature in the drying chamber 32 has no effect upon the position of the relay 95 that is controlled at this time entirely by the humidistat 50, as previously explained.

The arrangement of the solder pot switch 75 in the control circuit is very advantageous in view of the circumstance that it provides a three-minute time interval, at the very beginning of the drying cycle, for the humidistat 50 to reach a stable condition with respect to the adsorption of moisture from the wet clothes that have been placed into the drum 17. In other words, at the very beginning of the drying cycle of the machine 10, it may be necessary for the drum 17 to be rotated a suitable number of revolutions before the water from the contained wet clothes penetrates the fibrous material 60, establishing the low resistance therethrough between the electrodes 56 and 57. However, since the humidistat 50 is short-circuited by the solder pot switch 75 during the first three minutes of the operating cycle of the machine 10, this small time interval required by the humidistat 50 to reach its stable condition is of no consequence.

Moreover, this arrangement accommodates another feature regarding the possibility of producing an additional three-minute time interval of operation of the machine 10 notwithstanding the circumstance that the clothes may be bone-dry. In other words, immediately after a cycle of operation of the machine 10, the operator upon opening the door 15 may feel the clothes in the drum 17 and decide that small additional drying is necessary, notwithstanding the circumstance that the clothes in the drum 17 are, in fact, bone-dry and the humidistat 50 is already in its control condition to effect the restoration of the relay 95. In this case, when the door 15 is reclosed by the operator, the solder pot switch 75 is reoperated into its closed position effecting reoperation of the relay 95 and the consequent reoperation of the motor 28 and reenergization of the heater 50. Now at the expiration of the three-minute time interval, the solder pot switch 75 is returned into its normal position so that the control is transferred to the humidistat 50, whereby the relay 95 is immediately restored, since the humidistat 50 is already in its control condition. Upon restoring, the relay 95 effects arresting of operation of the motor 28 and the consequent deenergization of the heater 40.

In view of the foregoing, it is apparent that there has been provided in a clothes drying machine of the home-laundry type, an improved control circuit arrangement that is governed by a humidistat, whereby the state of dryness of the clothes undergoing the drying operation is measured directly by the humidistat and this measurement is employed directly as the control for arresting the drying operation after it has been manually initiated.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a clothes drying machine including a drum

mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried, a heater operative to heat said drum in order to evaporate moisture from the clothes therein, and a motor operative to rotate said drum in order to tumble the clothes therein; the combination comprising a power switch operative into a closed position to cause initiating of operation of both said motor and said heater and operative into an open position to cause arresting of operation of both said motor and said heater, a control switch having a normal position and an operated position, manually operable means for actuating said control switch from its normal position into its operated position, timing means for returning said control switch from its operated position back into its normal position a given time interval after actuation thereof, a humidistat governed in accordance with the amount of moisture carried by the clothes in said drum and operative into a control condition when the clothes in said drum are in a predetermined state-of-dryness, and means responsive to the actuation of said control switch into its operated position for operating said power switch into its closed position and responsive jointly to the return of said control switch into its normal position and to the operation of said humidistat into its control condition for operating said power switch into its open position.

2. The clothes drying machine combination set forth in claim 1, wherein said timing means is of the thermally controlled type.

3. In a clothes drying machine including a drum mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried, an electric heater operative to heat said drum in order to evaporate moisture from the clothes therein, and an electric motor operative to rotate said drum in order to tumble the clothes therein; the combination comprising a source of electric power, a relay provided with a winding, switching means responsive to operation of said relay for initiating operation of said motor from said power source and for effecting energization of said heater from said power source and responsive to restoration of said relay for arresting operation of said motor and for effecting deenergization of said heater, a control circuit for energizing the winding of said relay, means including a manually operable control device for completing said control circuit, and a humidistat included in said control circuit and having a variable resistance controlled by the amount of moisture carried by the clothes in said drum, said humidistat having a relatively low resistance when the clothes in said drum are wet and having a relatively high resistance when the clothes in said drum are dry, said relay being of the marginal type so that when the winding thereof is energized it is respectively operated and restored when the resistance of said humidistat is respectively low and high.

4. In a clothes drying machine including a drum mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried, an electric heater operative to heat said drum in order to evaporate moisture from the clothes therein, and an electric motor operative to rotate said drum in order to tumble the clothes therein; the combination comprising a source of electric power, a relay provided with a winding, switching means responsive to operation of said relay for initiating operation of said motor from said power source and for effecting energization of said heater from said power source and responsive to restoration of said relay for arresting operation of said motor and for effecting deenergization of said heater, a control circuit for energizing the winding of said relay, means including a manually operable control device for completing said control circuit, a humidistat included in said control circuit and having a variable resistance controlled by the amount of moisture carried by the clothes in said drum, said humidistat having a relatively low resistance when the

clothes in said drum are wet and having a relatively high resistance when the clothes in said drum are dry, said relay being of the marginal type so that when the winding thereof is energized it is respectively operated and restored when the resistance of said humidistat is respectively low and high, and a gaseous discharge device connected in multiple with said humidistat and having a break-down voltage that is reached only when the resistance of said humidistat is high, whereby the glow of said gaseous discharge device when it is conductive serves as a signal that said relay has restored to arrest operation of said motor and to effect deenergization of said heater, the current conducted by said gaseous discharge device being entirely too small to accommodate sufficient energization of the winding of said relay to effect reoperation thereof.

5. In a clothes drying machine including a drum mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried, an electric heater operative to heat said drum in order to evaporate moisture from the clothes therein, and an electric motor operative to rotate said drum in order to tumble the clothes therein; the combination comprising a source of electric power, a relay provided with a winding, switching means responsive to operation of said relay for initiating operation of said motor from said power source and for effecting energization of said heater from said power source and responsive to restoration of said relay for arresting operation of said motor and for effecting deenergization of said heater, a variable resistor, a humidistat having a variable resistance controlled by the amount of moisture carried by the clothes in said drum, a control circuit for connecting the winding of said relay and said resistor and said humidistat in series relation, manually operable means for completing said control circuit and for selectively setting the resistance of said resistor, said humidistat having a relatively low resistance when the clothes in said drum are wet and having a relatively high resistance when the clothes in said drum are dry, said relay being of the marginal type so that when the winding thereof is energized via said control circuit it is selectively operated and restored jointly in accordance with the resistance of said resistor and the resistance of said humidistat, whereby the setting of the resistance of said resistor by said manually operable means selectively sets the state-of-dryness of the clothes in said drum at which said humidistat effects the restoration of said relay.

6. In a clothes drying machine including a drum mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried, said drum being provided with a substantially tubular perforated side wall, an electric heater operative to heat said side wall in order to evaporate moisture from the clothes in said drum, and an electric motor operative to rotate said drum in order to tumble the clothes therein; the combination comprising a source of electric power, a control shoe arranged in contact with said side wall, a pair of electrodes embedded in said control shoe, the resistance of said control shoe between said pair of electrodes being selectively governed in accordance with the amount of moisture carried by the clothes in said drum, and means governed by the resistance of said control shoe between said pair of electrodes for controlling both operation of said motor from said power source and energization of said heater from said power source.

7. In a clothes drying machine including a drum mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried, said drum being provided with a substantially tubular perforated side wall, an electric heater operative to heat said side wall in order to evaporate moisture from the clothes in said drum, and an electric motor operative to rotate said drum in order to tumble the clothes therein; the combination comprising a source of A. C. electric power, a control shoe arranged in contact with said side wall, a

pair of electrodes embedded in said control shoe, the resistance of said control shoe between said pair of electrodes being relatively low when the clothes in said drum are wet and being relatively high when the clothes in said drum are dry, a resistor, a control circuit for connecting said resistor and said pair of electrodes in series relation across said power source, manually operable means for completing said control circuit, a relay provided with a winding, a rectifier, the winding of said relay and said rectifier being bridged in series relation across said resistor, said relay being of the marginal type so that when the winding thereof is energized it is operated when the resistance of said control shoe between said pair of electrodes is low and restored when the resistance of said control shoe between said pair of electrodes is high, and switching means responsive to operation of said relay for initiating operation of said motor from said power source and for effecting energization of said heater from said power source and responsive to restoration of said relay for arresting operation of said motor and for effecting deenergization of said heater.

8. The clothes drying machine combination set forth in claim 7, and further comprising a capacitor bridged across the winding of said relay for preventing said relay from following transitory variations in the resistance of said control shoe between said pair of electrodes.

9. In a clothes drying machine including a drum mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried, a casing enclosing said drum and provided with an opening rendering the interior of said drum accessible from the exterior, a door associated with said opening and movable between open and closed positions with respect thereto, an electric heater operative to heat said drum in order to evaporate moisture from the clothes therein, and an electric motor operative to rotate said drum in order to tumble the clothes therein; the combination comprising a source of electric power, a relay, switching means responsive to operation of said relay for initiating operation of said motor from said power source and for effecting energization of said heater from said power source and responsive to restoration of said relay for arresting operation of said motor and for effecting deenergization of said heater, a control circuit for said relay, a timer operative through a timed cycle in response to initiation of operation thereof, means responsive to movement of said door into its closed position for initiating operation of said timer, first means controlled by operation of said timer for governing said control circuit to effect operation of said relay, a humidistat governed in accordance with the amount of moisture carried by the clothes in said drum and operative into respective wet and dry control conditions when the clothes in said drum are respectively wet and dry, and second means responsive to said wet control condition of said humidistat for governing said control circuit to retain operated said relay and responsive to said dry control condition of said humidistat for governing said control circuit to effect restoration of said relay.

10. In a clothes drying machine including a drum mounted for rotation about a substantially horizontal axis and adapted to receive the clothes to be dried, an electric heater operative to heat said drum in order to evaporate moisture from the clothes therein, and an electric motor operative to rotate said drum in order to tumble the clothes therein; the combination comprising a source of electric power, a relay provided with a winding, switching means responsive to operation of said relay for initiating operation of said motor from said power source and for effecting energization of said heater from said power source and responsive to restoration of said relay for arresting operation of said motor and for effecting deenergization of said heater, a control circuit for energizing the winding of said relay, a humidistat included in said control circuit and having a variable

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resistance controlled by the amount of moisture carried by the clothes in said drum, said humidistat having a relatively low resistance when the clothes in said drum are wet and having a relatively high resistance when the clothes in said drum are dry, said relay being of the marginal type so that when the winding thereof is energized it is respectively operated and restored when the resistance of said humidistat is respectively low and high, a timer operative through a timed cycle in response to initiation of operation thereof, manually operable means for initiating operation of said timer, a switch included in said control circuit and governed by said timer and operated into its closed position only during operation of said timer through its timed cycle, and a path

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including said switch in its closed position for short-circuiting said humidistat so as to effect operation of said relay during operation of said timer independently of the resistance of said humidistat.

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