May 9, 1967 G. R. CHAFEE, JR 3,318,016

AUTOMATIC DRYER CONTROL CIRCUIT

Filed June 21, 1965 2 Sheets-Sheet 1

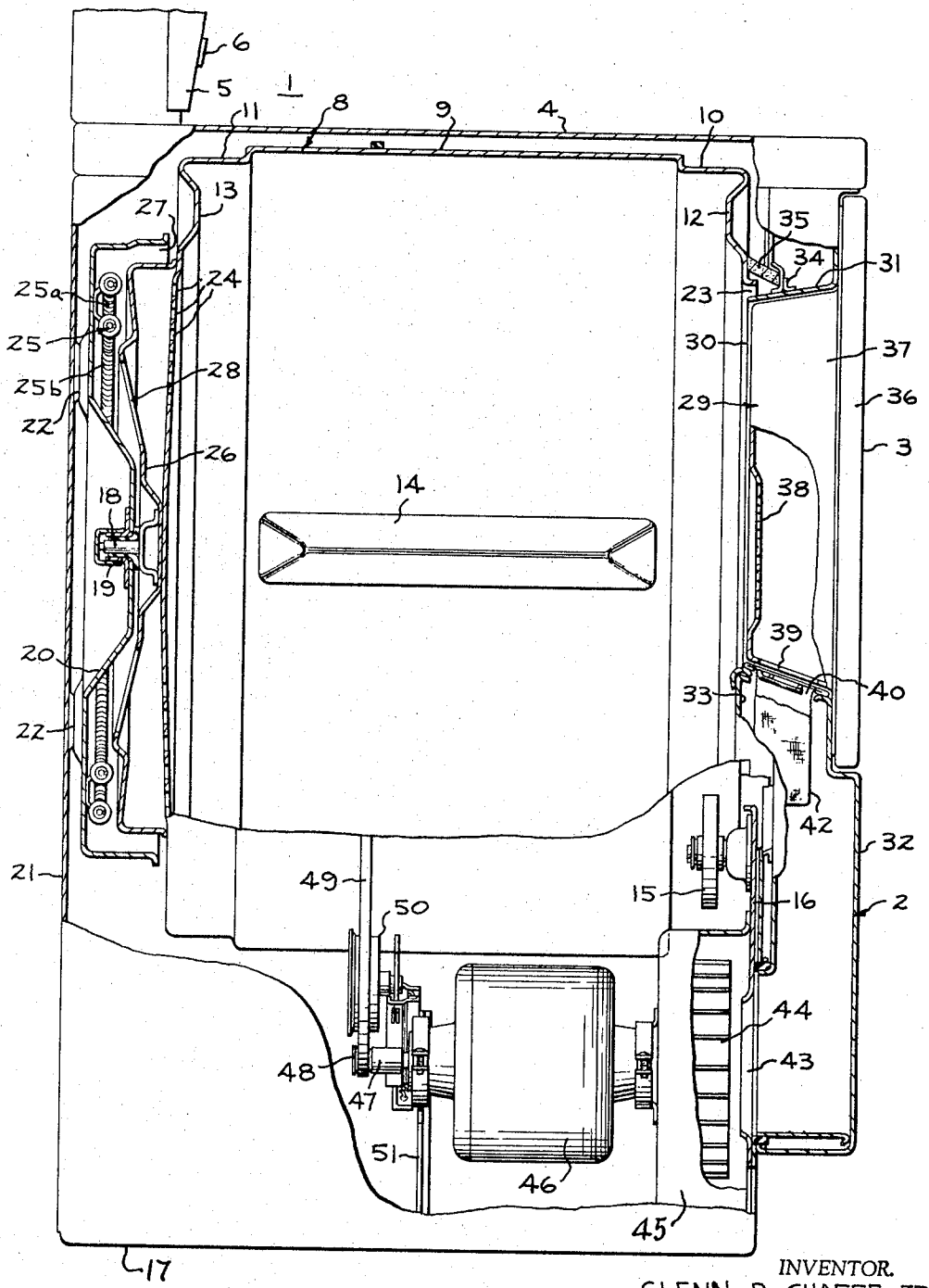

FIG. 1

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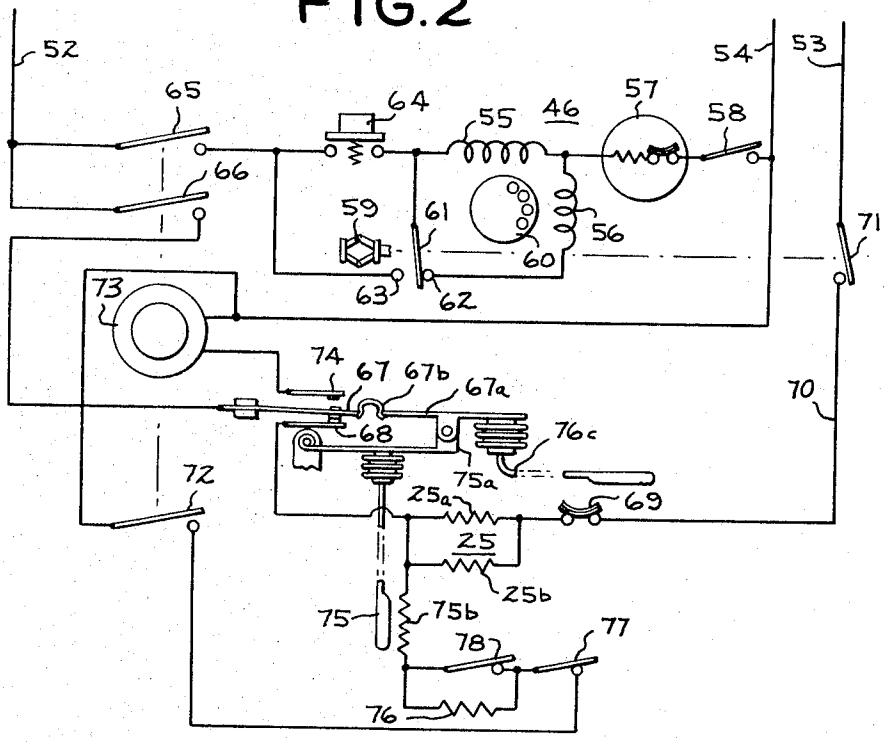
Filed June 21, 1965 2 Sheets-Sheet 2

FIG. 2



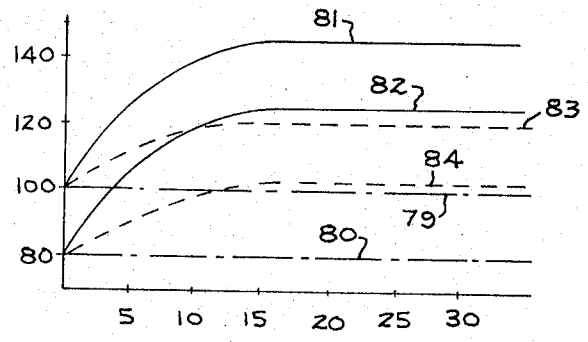


FIG. 3

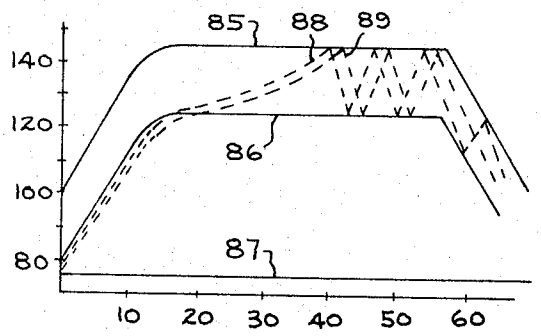


FIG. 4

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United States Patent Office 3,318,016 Patented May 9, 1967

3,318,016

AUTOMATIC DRYER CONTROL CIRCUIT

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Filed June 21, 1965, Ser. No. 465,263
11 Claims. (Cl. 34—45)

This invention relates to domestic clothes drying machines, and more particularly to a control system for use in electric clothes dryers.

An object of this invention is to provide a dryer control circuit of the timer operated type which insures that the fabrics being dried are in a temperature range comfortable for handling at the end of the dryer cycle.

Another object of this invention is to provide such a control system that is effective selectively to give damp dry or dry clothes.

A further object of this invention is to provide such a circuit which may selectively provide high and low heat automatic drying cycles as well as a damp dry cycle.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. My invention, however, both as to organization and method of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings.

In the drawings,

FIGURE 1 is a side elevational view of a clothes dryer incorporating my improved dryer control circuit, the view being partly broken away and partly sectionalized for purposes of illustration;

FIGURE 2 is a schematic wiring diagram showing one embodiment of my new and improved dryer control circuit;

FIGURE 3 is a schematic illustration of operating temperature ranges of a control thermostat utilized in the circuit of FIGURE 2; and

FIGURE 4 is a schematic diagram illustrating two typical temperature cycles of operation of the clothes dryer of FIGURE 1.

Referring now to FIGURE 1, the machine illustrated is a domestic clothes dryer generally indicated by the numeral 1. Dryer 1 is provided in the usual way with a cabinet 2 having a front door 3 to provide access to the interior of the cabinet for loading and unloading clothes. Provided on the top wall 4 of the cabinet 2 is a control panel 5 which may, in the conventional way, include a suitable control 6 mounted in panel 5. By manual operation of control 6, the machine may be caused to start and automatically proceed through a cycle of operation.

Within cabinet 2 there is provided a clothes tumbling container or drum 8 mounted for rotation on a substantially horizontal axis. Drum 8 is substantially cylindrical in shape, having a first, central cylindrical wall portion 9, second and third, outer cylindrical wall portions 10 and 11 located respectively adjacent the front and back of the drum, a front wall 12, and a back wall 13. Cylindrical wall portions 9, 10 and 11 are imperforate over their entire length so that the outer shell of the drum is imperforate. On the interior surface of central portion 9 there may be provided a plurality of clothes tumbling ribs 14 so that clothes are lifted up when the drum rotates, and then tumbled back down to the bottom of the container.

The front of drum 8 may be rotatably supported within outer casing 2 by suitable idler wheels, one of which is shown by the numeral 15. These wheels are rotatably secured to the top of a member 16 which extends up from base 17 of the machine. Wheels 15 are disposed

beneath the drum in contact with portion 10 thereof so as to support portion 10 on each side to provide a suitable support.

The rear end of drum 8 receives its support by means of a stub shaft 18 extending from the center of wall 13. Shaft 18 is secured within a bearing 19 formed in a baffle 20 which, in turn, is rigidly secured to the back wall 21 of cabinet 2 by any suitable means such as, for instance, welding at a number of points 22. With the arrangement shown the drum may rotate on a horizantal axis, with rollers 15 providing the front support and stub shaft 18 within bearing 19 providing the rear support.

In order to provide for the flow of a stream of drying air through the clothes drum, the drum is provided with a central aperture 23 in its front wall 12 and with an opening in the form of a plurality of perforations 24 in its rear wall 13, the perforations in the present case being formed to extend around the rear wall in an annulus.

As has been stated, baffle member 20 is rigidly secured to rear wall 21 of cabinet 2. Baffle member 20 also serves to support heating means 25 which includes two electrical resistance heating elements 25*a* and 25*b* appropriately insulated from the baffle member. Elements 25*a* and 25*b* may be annular in shape so as to be generally coextensive with perforations 24 in drum 8. A baffle member 26 is rigidly secured to the back wall 13 of the drum outside of the ring of perforations 24 and within the stationary baffle 20, so that an annular air inlet 27 is, in effect, formed by baffles 20 and 26. In this manner a passage is formed for air to enter annular inlet opening 27 between the baffles, pass over the heater 25, and then pass through openings 28 formed in baffle 26 to the interior of drum 8.

The front opening 23 of the drum is substantially closed by means of a stationary bulkhead generally indicated by the numeral 29. The bulkhead 29 is made up of a number of adjacent members including the inner surface 30 of access door 3, a stationary frame 31 for the door formed as a flange of front wall 32 of the cabinet, the inner surface member 33 of an exhaust duct which is formed by the cooperation of member 33 with the front wall 32 of the cabinet, and an annular clearance 34 mounted on frame 31 and on the duct wall. It will be noted that a suitable flange is provided between the inner edge of the drum opening 23 and the edge of bulkhead 29 so that there is no rubbing between the drum and bulkhead during rotation of the drum. In order to prevent any substantial air leakage through the opening 23 between the interior and exterior of the drum, a suitable ring seal 35, preferably formed of felt-like material, is secured to flange 34 in sealing relationship with the exterior surface of drum wall 12.

Front opening 23, in addition to serving as part of the air flow path through the drum, also serves as a means whereby clothes may be loaded into and unloaded from the drum. Door 3, whose inner surface forms part of the bulkhead closing the opening, is mounted on cabinet 2 so that when the door is opened clothes may be inserted into and removed from the drum through the door frame 31. It will be noted that the door includes an outer, flat imperforate section 36 and an inwardly extending hollow section 37 mounted on the flat outer section. Hollow section 37 extends into the door frame 31 when the door is closed, and the door surface 30 which comprises part of the combination bulkhead 29 is actually the inner wall of hollow section. An air outlet from the drum is provided by an appropriate opening 38 formed in the inner wall 30 of hollow door section 37. The bottom wall section of door 3 and the adjacent wall of door frame 31 are provided with aligned openings 39 and 40, opening 40 providing an

entrance to the duct 41 formed by the cooperation of member 33 with front wall 32. As shown, a lint trap 42 is preferably positioned in the exhaust duct 41 and opening 40, the trap being supported by the door frame 31.

Duct 41 leads downwardly to an opening 43 formed in the member 16 which supports wheels 15. Opening 43 constitutes the inlet to a blower member 44 contained within housing 45 and directly driven by an electric motor 46. The blower draws ambient air in over the heater 25, then through the drum, then through the door 3 and duct 41, and then into the blower. From the blower the air passes through an appropriate duct (not shown) out of cabinet 2 so as to be exhausted from the machine.

In addition to driving blower 44, motor 46 constitutes the means for effecting rotation of drum 8. In order to effect this rotation, motor 46 is provided with a shaft 47, having a small pulley 48 formed at the end thereof. A belt 49 extends around pulley 48 and also entirely around cylindrical wall section 9 of drum 8. The relative circumstances of pulley 48 and wall section 9 cause the drum to be driven by the motor at a speed suitable to effect tumbling of clothes therein. In order to effect proper tensioning of belt 49, there is provided a suitable idler assembly 50 secured on the same support 51 which supports one end of the motor. Thus, the air is pulled through the drum and at the same time the fabrics within the drum are tumbled. When the air is heated by heating elements 25*a* and 25*b*, the air passing through the drum causes vaporization of moisture from the clothes. The vapor is carried off with the air as it passes out of the machine.

The operation of dryer 1 is controlled by the new and improved control system or circuit shown in the circuit diagram of FIGURE 2. As shown therein, the entire control system of the machine may be energized across a three-wire electrical power supply system and includes supply conductors 52, 53 and 54 adapted to be connected to such power supply system. For domestic use, conductors 52 and 53 will normally be connected across a 220 volt power supply, with 110 volts appearing between the neutral conductor 54 and each of the power conductors, the neutral conductor being at ground potential. Motor 46, connected between conductors 52 and 54, is a single phase induction type motor having a main winding 55 and a start winding 56, both connected at a common end to a conventional motor overload protector 57. The overload protector 57 is connected through a conventional door switch 58 to conductor 54. Door switch 58 is closed when the door 3 is closed and is opened when the door is open so that the door 3 must be closed in order for the motor 46 to rotate.

Start winding 56 is connected in parallel with main winding 55 under the control of a speed responsive device such as that indicated at 59, which is schematically shown as connected to rotor 60 of the motor. Speed responsive device 59 controls a switch 61 which is engageable either with a contact 62 or a contact 63. Switch 61 is engaged with contact 62 when the machine is at rest, and moves into engagement with contact 63 as the motor comes up to speed. In can readily be seen that engagement with contact 62 connects the start winding 56 in parallel with the main winding 55, while movement of switch 61 away from this position opens the start winding. Thus, as rotor 60 comes up to speed the start winding becomes de-energized and the motor then continues to run on the main winding 55 alone.

The starting of the motor is effected by a manually operable switch 64 which may, for instance, in the structure of FIGURE 1 be moved to its closed position by depressing control 6. Switch 64 connects the motor to supply conductor 52 through a cam operated switch 65, and is normally biased to the open position shown. When member 6 is depressed, assuming switch 65 to be closed, energization of the motor is provided, and within less than a second under normal circumstances, the motor comes up to speed so that switch 61 engages contact 63. As a result of this movement of the centrifugally operated switch 61, the main winding 55 of motor 46 continues to be energized by a bypass around switch 64 when member 6 is released and switch 64 opens.

An energizing circuit is provided for heater 25 through the following circuit; starting at conductor 52, the circuit proceeds through cam operated switch 66, themostatically operated switch 67, and contact 68 to heater 25; then through a conventional safety thermostat 69 to a conductor 70 leading through a switch 71 to conductor 53. Switch 71 is controlled by speed responsive device 59, being closed only when the motor has come up to speed so that there can be no energization of the heater 25 except when motor 46 is operating properly.

A timer is provided to control timer operated switches 65 and 66 as well as a switch 72 and includes a timer motor 73 schematically shown as mechanically connected to switches 65, 66 and 72. Timer motor 73 is electrically connected between a contact 74 and conductor 54. Thus it can be seen that thermostatically operated switch 67 is effective to cause alternative operation of heater 25 and timer motor 73. When switch 67 is in engagement with contact 68 heater 25 is energized between conductor 52 and conductor 53 while, when switch 67 is in engagement with contact 74, timer motor 73 is connected between conductor 52 and neutral conductor 54.

Switch 67 forms part of a biased thermostat means which is effective at a first, higher predetermined temperature to trip (that is to cause switch 67 to engage contact 74) and at a second, lower predetermined temperature to reset (that is to cause switch 67 to move out of engagement with contact 74 and into engagement with contact 68). Thus, the thermostat means of which switch 67 forms a part has an effective operating temperature range and, by exposing the thermostat means to air passing through duct 41, switch 67 may be caused to energize heater 25 in response to a predetermined low temperature of fabrics in the dryer and to de-energize heater 25 and energize timer motor 73 in response to a predetermined high temperature of fabrics in the dryer.

A biased thermostat means of the general type suitable for inclusion in the present dryer is shown and described in Patent 2,878,580, issued to Philip G. Hughes on Mar. 24, 1959, and assigned to General Electric Company, assignee of the present invention. Such a thermostat means include switch 67 which is moved by pivoted link 67*a*. Link 67*a* is connected at one end to switch 67 by toggle spring 67*b* and at the other end to a typical thermostat bulb 67*c*. Thermostat bulb 67*c* is exposed to the temperature of the clothes, as by placing it in duct 41.

A second thermostat bulb 75 is placed to sense ambient temperature and is effective to move the pivot 75*a* of link 67*a* in response to changes in ambient temperature. The operating temperature range may be varied for any ambient temperature by positioning a bias heater 75*b* to heat thermostat bulb 75.

Heater 75*b* is connected between contact 68 and switch 72 in series with a dropping resistor 76 and a manually operable switch 77, switch 72 being connected to neutral conductor 54. Thus, assuming switch 72 and switch 77 to be closed, bias heater 75*b* is connected between power conductor 52 and neutral conductor 54 when thermostatically operated switch 67 is in engagement with contact 68. On the other hand, when thermostatically operated switch 67 is not in engagement with contact 68, bias heater 75*b* is connected between power conductor 53 and neutral conductor 54 in series with main heater 25. The voltage drop across bias heater 75*b* is essentially the same regardless of which position thermostatically operated switch 67 assumes. This is a result of the fact that both heating elements 25*a* and 25*b* are of relatively small value while bias heater 75*b* has a relatively large resistance.

By way of example I have found that in a suitable circuit for a domestic clothes dryer each of main heater elements **25***a* and **25***b* may have a value of about 19.2 ohms, giving a parallel circuit value of about 9.6 ohms, while bias heater **75***b* may have a resistance of about 1325 ohms. Therefore when main heater **25** is connected in series with bias heater **75***b* most of the voltage drop will appear across bias heater **75***b* and very little across main heater **25**. Thus when main heater **25** is connected in series with bias heater **75***b*, main heater **25** is effectively de-energized and the air being forced through the dryer is not heated.

Bias heater **75***b* is effective to alter the operating temperature range of the thermostat means so that the thermostat means will trip and reset in order to cause switch **67** to move back and forth between contacts **68** and **74** at higher levels than if bias heater **75***b* were not present. It may be desirable to operate the dryer at a temperature range between that provided by the thermostat means in its unbiased condition and when biased to the full extent possible by bias heater **75***b*. To this end dropping resistor **76** is provided in series with bias heater **75***b* and, by way of example, may be of a value of about 750 ohms. A manual switch **78** is provided in parallel with dropping resistor **76** so that dropping resistor **76** selectively may be connected in series with bias heater **75***b*.

Referring now to FIGURE 3 there is shown therein the operating curves of a typical biased thermostat means suitable for inclusion in my control system, in which temperature in degrees Fahrenheit is plotted against time in minutes. In FIGURE 3 an ambient temperature of 75° is assumed and line **79** indicates the approximate temperature at which the thermostat means will trip, that is at which time switch **67** will disengage from contact **68** and engage contact **74**. Line **80** indicates the approximate temperature at which the thermostat means will reset, that is, the temperature at which the switch **67** will disengage from contact **74** and re-engage contact **68**. It may be seen from FIGURE 3 that a suitable thermostat means may have an operating temperature range of approximately 20° with its lower or reset temperature being approximately 5° above ambient. Lines **81** and **82** indicate the trip and reset temperatures of the same thermostat means under the high bias condition of bias heater **75***b*, that is, with dropping resistor **76** shorted out by switch **78**. It will be noted that, once the bias heater has had full effect, the operating temperature range is still approximately 20°, but that both temperatures have been raised so that the trip-temperature is about 145° and the reset temperature is about 125°. Lines **83** and **84** indicate the operating temperature range of the same thermostat means with a low bias, that is with dropping resistor **76** connected in series with bias heater **75***b* so that there is less voltage drop across bias heater **75***b*. In this circumstance the trip temperature has risen to about 120° and the reset temperature to about 100°. Thus, it is clear that, by use of the bias heater and dropping resistor, the operating temperature range of the biased thermostat means including switch **67** may be varied.

I take advantage of this characteristic of biased thermostats in order to provide my new and improved control circuit. The timer mechanism of which timer motor **73** is a part is constructed so that manual rotation of a control, such as that indicated at **6** closes switches **65**, **66** and **72**. These switches remain closed for predetermined periods of timer operation, that is for predetermined periods of cumulative timer motor operation; at which time the timer opens the various switches. The opening of the switches may be accomplished in any conventional way, such as, for instance, by cams. I cause the timer to be constructed in such a manner that it opens switch **72** after a predetermined period of timer motor operation which is less than the predetermined period of timer motor operation required prior to the timer opening switches **65** and **66**.

I have found that with a proper relationship between the various elements of the control circuit it is possible to use the same amount of predetermined timer run time selectively to obtain either dry clothes or damp dry clothes merely by utilizing or not utilizing the bias heater **75***b*. To this end I include manually operable switch **77**, which may be termed a damp dry control. With switch **77** in the closed position bias heater **75***b* is operative and the thermostat means functions at an elevated operating temperature range until switch **72** is open, after which the operating temperature range of the thermostat means decays or falls so that, at the conclusion of the drying operation, the temperature of the clothes have been reduced to a temperature level which is comfortable for handling. With the switch **77** in the open position the circuit from bias heater **75***b* to neutral conductor **54** is broken regardless of the position of switch **72**, and no bias is placed upon the thermostat bulb **75**. Under these conditions the dryer operates at the lower, unbiased operating temperature range. I have found that the same amount of pedetermined timer run time to give a dry condition with any particular type of load when switch **77** is closed will also result in a damp dry condition of the same load with switch **77** in the open position.

Referring now to FIGURE 2 a typical cycle of operation of dryer **1** will be described. By appropriate means such as, for example, rotation of control **6**, timer operated switches **65**, **66** and **72** are closed, manually operated switches **77** and **78** are closed. Door switch **58** is closed by door **3** being closed and a predetermined amount of timer motor operation is scheduled. Then, when pushbutton **64** is depressed, as by depressing manual control **6**, motor **46** begins to rotate and quickly comes up to speed so that switch **61** moves from engagement with contact **62** to engagement with contact **63** under control of speed responsive device **59**, which at the same time, closes switch **71**. Thereafter power is provided to main heater **25** through a circuit from conductor **52** through switch **66**, switch **67** and contact **68** to the heater **25** and then, from the heater **25** through protector **69**, conductor **70** and switch **71** to conductor **53**. It will be remembered that below the thermostat trip temperature, switch **67** is in engagement with contact **68**.

At the same time switch **67** connects bias heater **75***b* from conductor **52** to conductor **54**. Bias heater **75***b* provides a high level bias to the thermostat means including switch **67** because switch **78** is closed to short out dropping resistor **76** while switches **77** and **72** are closed to complete the circuit. Thus the temperature of the clothes in the dryer rises and, at the same time, the trip temperature of the thermostat means rises until it reaches its high biased trip temperature plateau. The temperature of the clothes continues to rise until it reaches the value of the thermostat means trip temperature. Switch **67** then is caused to be disengaged from contact **68** and to engage contact **74**. This energizes timer motor **73** between conductor **52** and conductor **54** and effectively de-energizes main heater **25**, because it connects main heater **25** between conductor **53** and conductor **54** in series with the much larger resistance of bias heater **75***b*. The position of switch **67** has no effect on motor **46** therefore it continues to draw air through the drum **8**. As a result, the temperature of the clothes within the drum falls until it reaches the reset temperature of the thermostat means, at which time switch **67** again moves into engagement with contact **68** to re-activate main heater **25**. This cyclic operation repeats itself with alternative energization of main heater **25** and timer motor **73**.

The dryer operation continues in this fashion within the operational temperature range of the thermostat means until the cumulative period of timer motor operation has been reached at which the timer is effective to cause switch **72** to open. Thereafter bias heater **75***b* is effectively de-energized and the operating temperature range of

the thermostat means begins to decay or reduce in temperature value. The alternative cyclic operation of the main heater **25** and timer motor **73** continue as before, except that the trip and reset temperatures of the thermostat means are continually decreasing. Then, after an additional predetermined period of timer motor operation the timer is effective to open switches **65** and **66**. This effectively de-energizes both the motor circuit and the heater circuit so that the dryer is completely deactivated.

Referring now to FIGURE 4, there is shown therein two typical dryer operation curves for the high biased condition of the thermostat means. Line **85** shows the thermostat means trip temperature, line **86** shows the thermostat means reset temperature and line **87** shows an assumed ambient temperature of 75° (which is quite prevalent in basement and garage dryer installations). It will be seen that the trip temperature and reset temperature quickly rise to the values determined by the bias heater **75***b*. They maintain this level for a predetermined period of timer motor operation, after which they decay or decrease toward the unbiased operating temperature range. Line **88** shows one typical dryer operational temperature curve while line **89** shows a second typical curve. Small differences in the operating temperature curve may result from a number of factors such as the amount of water in the clothes load, a difference in the make-up of the clothes load, or differences in the original temperature of the clothes. It will be noted that, with the operation curve shown by line **88**, the thermostat means does not reset after the bias heater has been de-activated; while the operating curve shown by line **89** indicates that the thermostat means does reset so that the main heater is turned on after the bias heater has been de-activated. Each of these curves portrays a fairly typical dryer operation and they are included in order to make it clear that, with my new and improved dryer control circuit, it is immaterial whether the main heater is energized after the bias heater has been de-activated. As a result of the elevated temperature at which the dryer has been operated, it is assured that the clothes will be dry. At the same time, the ever decreasing operating temperature range of the thermostat means and a reasonable amount of timer motor operation after bias heater de-activation will insure an acceptable clothes temperature at the conclusion of the dryer operation regardless of whether the main heater is activated after the bias heater has been de-activated.

If it is desired to obtain a damp dry condition of the fabrics to be dried all that is required is that switch **77** is opened. With switch **77** opened bias heater **75***b* cannot be activated, regardless of the positioning of timer operated switch **72**, and the dryer operates in the low, unbiased operating temperature range of the thermostat means. The same amount of predetermined timer run time will, in this setting, give a damp dry condition for the same load as is dried in the high biased condition.

I have found that with a circuit and thermostat means operating characteristic generally such as that described the heat reduction caused by opening switch **78** so that dropping resistor **76** is connected in series with bias heater **75***b* will give a suitable delicate cycle without further change from the setting required for drying a typical load of mixed clothes. The delicate cycle results from the fact that, with switch **78** open and switch **77** closed, the voltage drop across bias heater **75***b* is less and thus the operating temperature range of the thermostat means is increased a lesser amount than if dropping resistor **76** is effectively shorted out of the circuit by switch **78**.

The unique and improved operating characteristics of my new and improved dryer control circuit give an improved operation with a minimum number of parts. Additionally, my new and improved circuit offers opportunity for reducing the complexity of the controls which the user must set to select a cycle of operation. For instance, a single dial could be used and marked with various typical dryer loads so that turning the dial to the marked section would provide the predetermined amount of timer motor run time required to dry that type of load. The dial could also include a section marked "Delicate" which would have the same timer run time as an average load of mixed clothes and additionally cause switch **78** to be opened. Then a single pushbutton could be provided and marked "Damp Dry," which would be used to manually open switch **77**. Thus, if the user wanted to dry a particular type of load all that would be necessary would be to turn the dial to the setting corresponding to that type of load and then push the manual start button. If the user wishes to obtain a delicate cycle she merely turns the control to the area marked "Delicate" and pushes the start button. If the user desires to obtain damp dry fabrics she merely turns the control to the appropriate load type, pushes the damp dry button and pushes the start button.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and it is therefore aimed in the appended claims to cover all such equivalent variations as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A fabric drying machine comprising:
(a) a fabric drying container;
(b) main heating means for supplying drying heat to fabrics in said container;
(c) a control circuit adapted to connect said main heating means to a source of electrical energy;
(d) a timer connected in said control circuit and adapted to deactivate said drying machine after a first predetermined period of timer operation,
(e) thermostat means connected in said control circuit and adapted to cause alternative operation of said main heating means and said timer,
(f) a bias heater connected in said control circuit and adapted to raise the operating temperature range of said thermostat means,
(g) said timer being adapted to disconnect said bias heater from said control circuit after a second predetermined period of timer operation, said second period of timer operation being less than said first period of timer operation.

2. A fabric drying machine comprising:
(a) a fabric drying container;
(b) main heating means for supplying drying heat to fabrics in said container;
(c) a control circuit adapted to connect said main heating means to a source of electric energy;
(d) a timer connected in said control circuit and adapted to deactivate said drying machine after a first predetermined period of timer operation;
(e) thermostat means connected in said control circuit, said thermostat means being responsive to a first, relatively low, operating temperature to energize said main heating means and de-energize said timer and responsive to a second, relatively high operating temperature to de-energize said main heating means and energize said timer;
(f) a bias heater connected in said control circuit and adapted to raise the effective level of both said first and said second operating temperatures;
(g) said timer being adapted to disconnect said bias heater from said control circuit after a second predetermined period of timer operation, said second period of timer operation being less than said first period of timer operation.

3. A fabric drying machine comprising:
(a) a fabric drying container:
(b) main heating means for supplying drying heat to fabrics in said container;

(c) a control circuit adapted to connect said main heating means to a source of electrical energy;
(d) a timer connected in said control circuit and adapted to deactivate said drying machine after a first predetermined period of timer operation,
(e) thermostat means connected in said control circuit and adapted to cause alternative operation of said main heating means and said timer,
(f) a bias heater connected in said control circuit and adapted to raise the operating temperature range of said thermostat means,
(g) said timer being adapted to disconnect said bias heater from said control circuit after a second predetermined period of timer operation, said second period of timer operation being less than said first period of timer operation;
(h) a manually operable switch provided in said control circuit in series with said bias heater and effective when open to prevent energization of said bias heater.

4. A fabric drying machine comprising:
(a) a fabric drying container;
(b) main heating means for supplying drying heat to fabrics in said container;
(c) a control circuit adapted to connect said main heating means to a source of electrical energy;
(d) a timer connected in said control circuit and adapted to deactivate said drying machine after a first predetermined period of timer operation;
(e) thermostat means connected in said control circuit, said thermostat means being responsive to a first, relatively low, operating temperature to energize said main heating means and deenergize said timer and responsive to a second, relatively high operating temperature to de-energize said main heating means and energize said timer;
(f) a bias heater connected in said control circuit and adapted to raise the effective level of both said first and said second operating temperatures;
(g) said timer being adapted to disconnect said bias heater from said control circuit after a second predetermined period of timer operation, said second period of timer operation being less than said first period of timer operation;
(h) a manually operable switch provided in said control circuit in series with said bias heater and effective when open to prevent energization of said bias heater.

5. A fabric drying machine comprising:
(a) a fabric drying container;
(b) main heating means for supplying drying heat to fabrics in said container;
(c) a control circuit adapted to connect said main heating means to a source of electrical energy;
(d) a timer connected in said control circuit and adapted to deactivate said drying machine after a first predetermined period of timer operation,
(e) thermostat means connected in said control circuit and adapted to cause alternative operation of said main heating means and said timer,
(f) a bias heater connected in said control circuit and adapted to raise the operating temperature range of said thermostat means,
(g) a dropping resistor connected in series with said bias heater so that said bias heater raises the operating temperature range of said thermostat means to a first level;
(h) a manually operable switch connected in parallel with said dropping resistor and effective when closed to short said dropping resistor so that said bias heater raises the operating temperature range of said thermostat means to a second level,
(i) said timer being adapted to disconnect said bias heater from said control circuit after a second predetermined period of timer operation, said second period of timer operation being less than said first period of timer operation.

6. A fabric drying machine comprising:
(a) a fabric drying container;
(b) main heating means for supplying drying heat to fabrics in said container;
(c) a control circuit adapted to connect said main heating means to a source of electrical energy;
(d) a timer connected in said control circuit and adapted to deactivate said drying machine after a first predetermined period of timer operation,
(e) thermostat means connected in said control circuit and adapted to cause alternative operation of said main heating means and said timer,
(f) a bias heater connected in said control circuit and adapted to raise the operating temperature range of said thermostat means,
(g) a dropping resistor connected in series with said bias heater so that said bias heater raises the operating temperature range of said thermostat means to a first level;
(h) a manually operable switch connected in parallel with said dropping resistor and effective when closed to short said dropping resistor so that said bias heater raises the operating temperature range of said thermostat means to a second level,
(i) said timer being adapted to disconnect said bias heater from said control circuit after a second predetermined period of timer operation, said second period of timer operation being less than said first period of timer operation,
(j) a manually operable switch provided in said control circuit in series with said bias heater and effective when open to prevent energization of said bias heater.

7. A fabric drying machine comprising:
(a) a fabric drying container;
(b) main heating means for supplying drying heat to fabrics in said container;
(c) a control circuit adapted to connect said main heating means to a source of electrical energy;
(d) a timer connected in said control circuit and adapted to deactivate said drying machine after a first predetermined period of timer operation;
(e) thermostat means connected in said control circuit, said thermostat means being responsive to a first, relatively low, operating temperature to energize said main heating means and deenergize said timer and responsive to a second, relatively high operating temperature to de-energize said main heating means and energize said timer;
(f) a bias heater connected in said control circuit and adapted to raise the effective level of both said first and said second operating temperatures;
(g) a dropping resistor connected in series with said bias heater so that said bias heater raises the effective level of both said first and said second operating temperatures to a first set of values;
(h) a manually operable switch connected in parallel with said dropping resistor and effective when closed to short said dropping resistor so that said bias heater raises the effective level of both said first and said second operating temperatures to a second set of values,
(i) said timer being adapted to disconnect said bias heater from said control circuit after a second predetermined period of timer operation, said second period of timer operation being less than said first period of timer operation.

8. A fabric drying machine comprising:
(a) a fabric drying container;
(b) main heating means for supplying drying heat to fabrics in said container;
(c) a control circuit adapted to connect said main heating means to a source of electrical energy;

(d) a timer connected in said control circuit and adapted to deactivate said drying machine after a first predetermined period of timer operation;

(e) thermostat means connected in said control circuit, said thermostat means being responsive to a first, relatively low, operating temperature to energize said main heating means and deenergize said timer and responsive to a second, relatively high operating temperature to de-energize said main heating means and energize said timer;

(f) a bias heater connected in said control circuit and adapted to raise the effective level of both said first and said second operating temperatures;

(g) a dropping resistor connected in series with said bias heater so that said bias heater raises the effective level of both said first and said second operating temperatures to a first set of values;

(h) a manually operable switch connected in parallel with said dropping resistor and effective when closed to short said dropping resistor so that said bias heater raises the effective level of both said first and said second operating temperatures to a second set of values;

(i) said timer being adapted to disconnect said bias heater from said control circuit after a second predetermined period of timer operation, said second period of timer operation being less than said first period of timer operation;

(j) a manually operable switch provided in said control circuit in series with said bias heater and effective when open to prevent energization of said bias heater.

9. A fabric drying machine comprising:

(a) a fabric drying container;

(b) main heating means for supplying drying heat to fabrics in said container;

(c) a control circuit adapted to connect said main heating means to a three-wire source of electrical energy including first, second and third conductors, said first and second conductors being power conductors and said third conductor being a neutral conductor;

(d) timer means including an electric timer motor adapted to be connected in said control circuit, said timer means being adapted to deactivate said drying machine after a first predetermined period of operation of said timer motor;

(e) thermostat means connected in said control circuit, said thermostat means being responsive to a first, relatively low, operating temperature to connect said main heating means between said first and second conductors and to de-energize said timer motor and responsive to a second, relatively high, operating temperature to connect said main heating means between said second and third conductors and to connect said timer motor between said first and third terminals;

(f) a bias heater adapted to be connected in said control circuit and effective to raise both said first and said second operating temperatures;

(g) said thermostat means being responsive to said first operating temperature to connect said bias heater between said first and third conductors and responsive to said second operating temperature to connect said bias heater in series with said main heating means;

(h) said timer being adapted after a second predetermined period of timer motor operation to interrupt that portion of said control circuit for connecting said bias heater and said main heating means to said third conductor, said second period of timer motor operation being less than said first period of timer motor operation.

10. A fabric drying machine as set forth in claim 9; further comprising a dropping resistor connected in series with said bias heater so that said bias heater raises the effective level of both said first and second operating temperatures to a first set of values and a manually operable switch connected in parallel with said dropping resistor and effective when closed to short said dropping resistor so that said bias heater raises the effective level of both said first and second operating temperatures to a second set of values.

11. A fabric drying machine as set forth in claim 9; further comprising a manually operable switch provided in said control circuit in series with said bias resistor and effective when open to interrupt said portion of said control circuit for connecting said bias heater and said main heating means to said third terminal.

References Cited by the Examiner

UNITED STATES PATENTS

2,878,580	3/1959	Hughes	34—45
3,031,768	5/1962	Kurowski	34—45
3,116,983	1/1964	Chafee	34—48 X

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