

Dec. 1, 1964

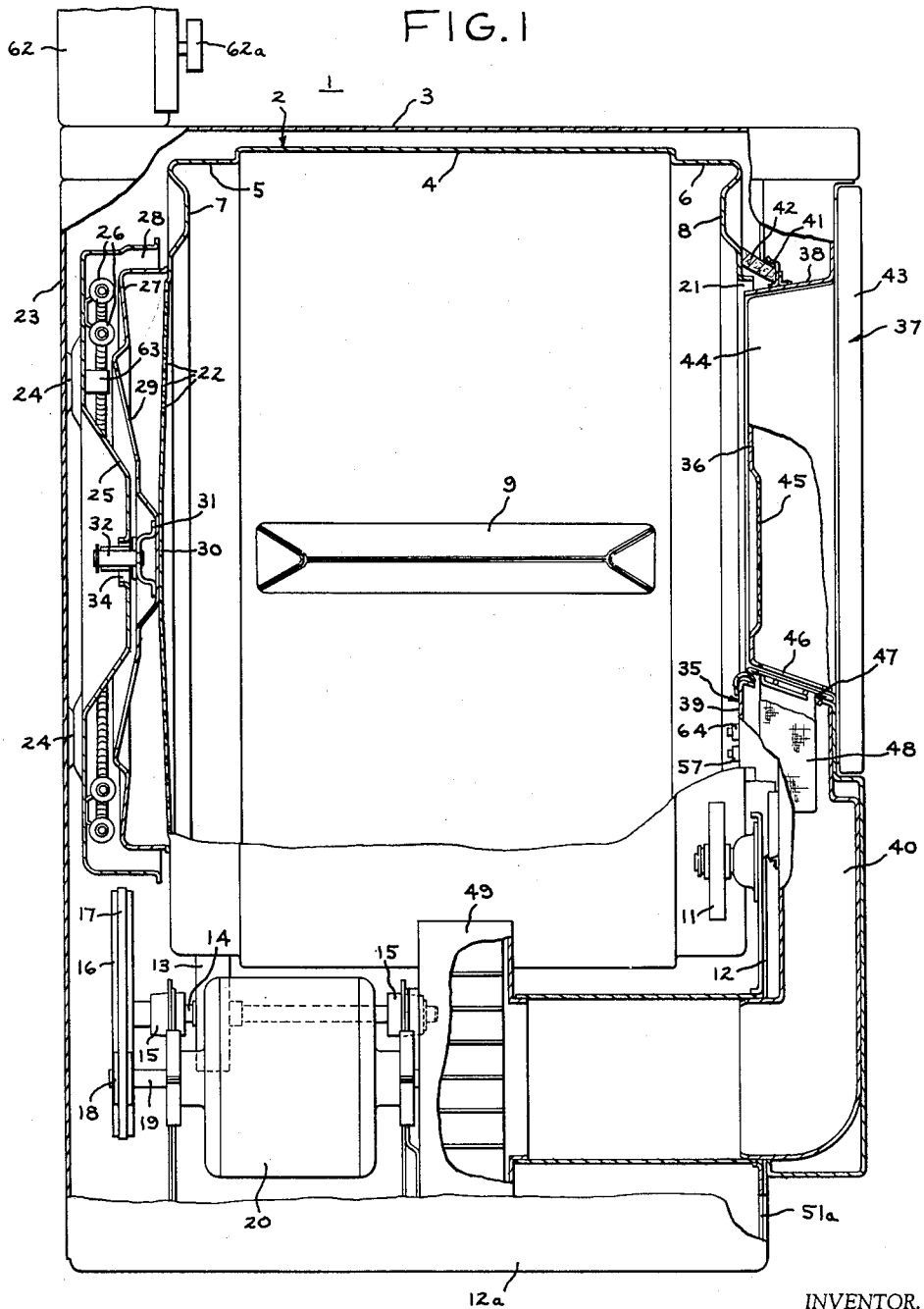
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3,159,465

CLOTHES DRYER CONTROL SYSTEM

Filed March 20, 1961

3 Sheets-Sheet 1



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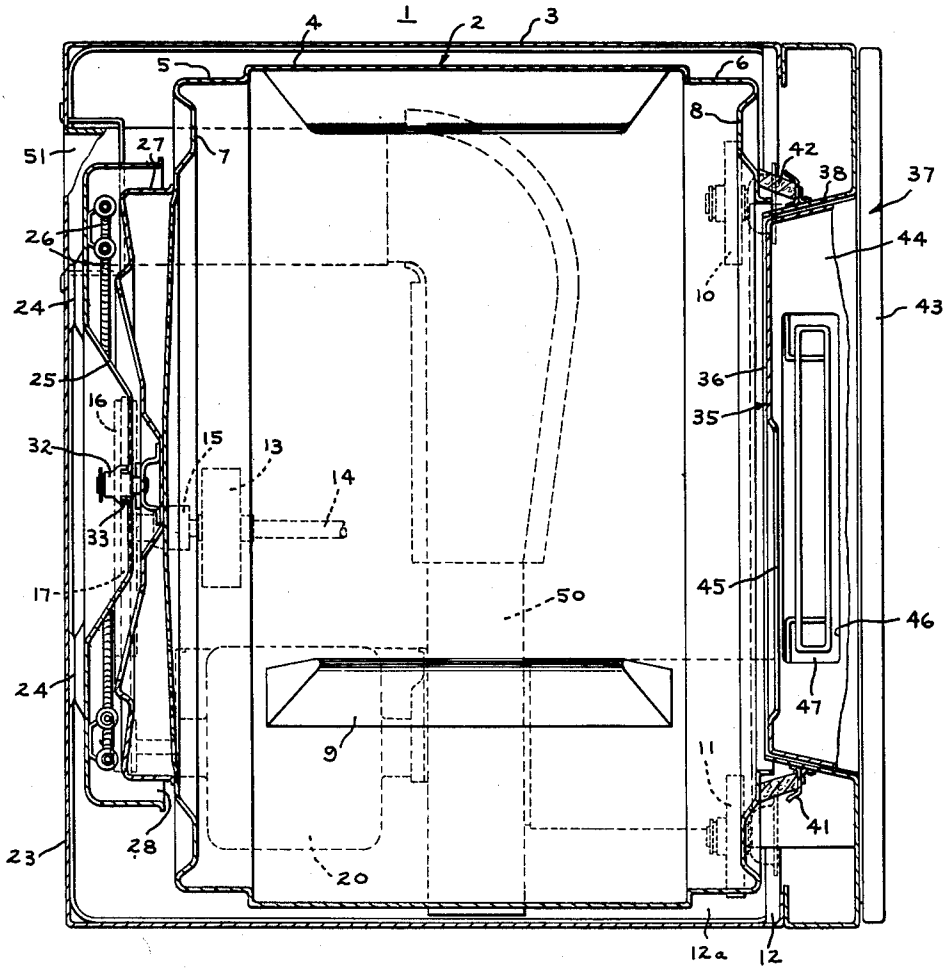


FIG. 2

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CLOTHES DRYER CONTROL SYSTEM

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FIG. 3

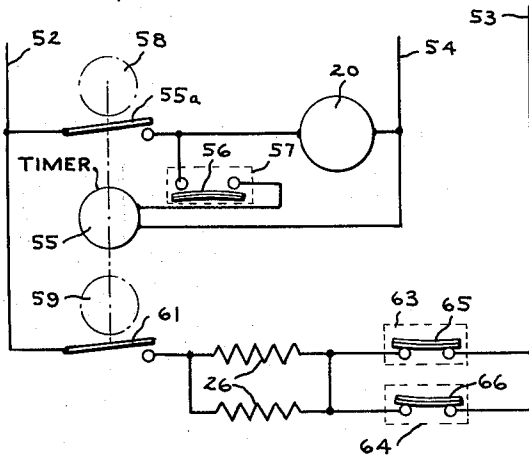


FIG. 5

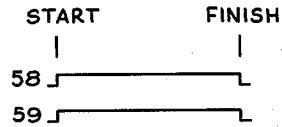


FIG. 4

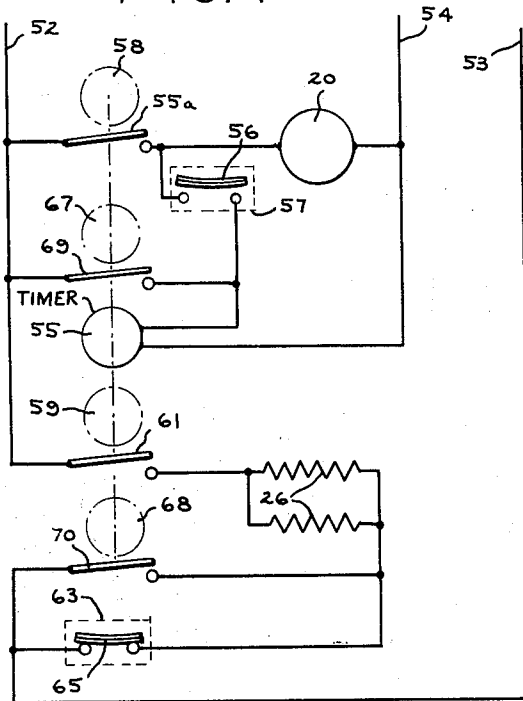
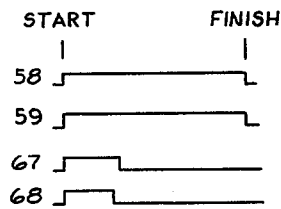


FIG. 6



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CLOTHES DRYER CONTROL SYSTEM

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8 Claims. (Cl. 34-45)

This invention relates to automatic clothes dryers, and more particularly to systems for such dryers wherein termination of the drying operation is brought about primarily by the condition of the clothes rather than purely by a lapse of time.

There are available, at the present time, domestic clothes dryers which provide a drying operation wherein, when the clothes are substantially dry, the machine automatically terminates operation. Most of the systems wherein the operation is thus terminated responsive to the condition of the clothes are based on the temperature of the air used in the drying operation after it has contacted the clothes. Such systems are based on the proven logic that, initially, when clothes have a substantial amount of moisture available to be evaporated, most of the energy put into the clothes in the form of heat is used up to evaporate the moisture; in other words, this heat energy input causes only a gradual rise in temperature once the point is reached at which the rate of energy put into the evaporation of moisture almost equals the energy input in heat. It is only after substantially all the available moisture has been evaporated that there is a surplus of heat energy to cause a substantial temperature rise. Therefore, during a drying operation, there will be a temperature plateau, i.e., a gradual rise while the clothes are drying, followed by a relatively sharp rise once the clothes are dry.

Such systems have been found highly effective. However, in order to obtain optimum results it has been found necessary to vary the trip temperature, that is, the temperature at which the clothes are presumed dry, in accordance with changes in the ambient atmosphere from which the drying air is taken. In other words, different ambient temperatures, unless compensated for, cause the plateaus to be established at different temperatures and the rapid temperature rise at the end of the plateaus will therefore also start at different temperatures; thus, two different temperatures can, in such an event, indicate the same degree of dryness of the clothes.

One way to take care of this situation is by controlling the input air temperature so as to keep it constant; with a constant input air temperature, it will readily be seen that the plateau will always occur at substantially the same level and therefore the same clothes temperature may be used at all times to indicate dryness.

In a system of this type, where the clothes temperature is used to indicate dryness and wherein the input air temperature is controlled, it is my purpose to provide the improvement whereby the provision of a constant input air temperature by control of the air heater is provided only after a predetermined period of continuous heater operation. This relationship is based on the thought that when the clothes in the machine are in a very wet state, they can absorb virtually all the energy that the heaters put in without becoming overheated. This avoids the undesirable effect from input temperature regulation that the operation may be lengthened by virtue of the fact that the clothes are not receiving as much energy at the beginning of the operation as they could—without harm—accept.

It is therefore an object of my invention to provide, in a machine having a thermostatically controlled input air temperature and a thermostatically controlled cycle termination, means for overriding or bypassing the input air control during an initial part of the drying operation.

In carrying out my invention in one form thereof, I provide a clothes dryer wherein a drying chamber has a first opening connected to an inlet conduit and a second opening providing the outlet from the chamber. Suitable means are provided for circulating a stream of air from the conduit into the chamber through the first opening, and then out from the second opening, it being understood that the air is heated in the conduit prior to entry into the chamber so that it will dry damp fabrics in the container. The temperature of the air entering the container is controlled by first thermostatic means in such a manner that the temperature is held substantially constant. I also provide second thermostatic means which is positioned to be responsive to the temperature of the fabrics; the second thermostatic means also controls the heating means, either directly or indirectly, so as to terminate the operation of the heating means after a predetermined fabric temperature is reached.

By my invention, I contemplate the provision of means for bypassing the first thermostatic means so as to cause substantially continual operation of the heating means entirely independently of the first thermostatic means. In conjunction with this arrangement, I provide for disabling the bypassing means after an initial period of operation of the heating means. Thus, initially, when the fabrics are at their wettest, the heating means operates continuously whereas in the latter part of the cycle, which is when the input air temperature control is necessary to determine when a dry fabric condition is reached, the structure performs as desired.

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 of the type which may advantageously incorporate my improved control arrangement, the view being partially broken away and partially sectionalized to illustrate details;

FIGURE 2 is a horizontal sectional view of the dryer of FIGURE 1, with the drum removed, and certain surfaces broken away and partly sectionalized to illustrate further details;

FIGURE 3 is a circuit diagram illustrating a control system provided in accordance with my invention and suitable for use in the machine of FIGURES 1 and 2;

FIGURE 4 is a second embodiment of my improved control system suitable for use in a machine of the type shown in FIGURES 1 and 2.

FIGURE 5 is a time chart showing the operation of switches by cams in the control system of FIGURE 3; and

FIGURE 6 is a time chart showing the control of switches by cams in the control system of FIGURE 4.

Referring now to the drawings, I have shown therein a typical domestic clothes dryer 1 which includes a clothes tumbling receptacle or drum 2 provided within a suitable outer casing or cabinet 3 which completely encloses it. The drum is mounted for rotation within cabinet 3 on a substantially horizontal axis, and is generally cylindrical in shape, having a first central outer wall portion 4, second and third outer wall portions 5 and 6 located respectively adjacent the ends of the drum, a back wall 7, and a front wall 8. Outer wall sections 4, 5, and 6 are imperforate over their entire length, so that the entire outer shell of the basket is imperforate; on the interior surface of section 4 is provided a plurality of clothes tumbling ribs 9.

The front of drum 2 is rotatably supported within the

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outer casing 3 by means of a pair of idler roller wheels 10 and 11 which are rotatably secured to the top of an upwardly extending member 12 secured at its bottom to the base 12a of the machine (FIGURE 1). It will be observed that rollers 10 and 11 are disposed beneath the drum in contact with portion 6 thereof. The rear end of the drum receives its support from a roller wheel 13 which is positioned beneath portion 5 of the drum in supporting and frictionally driving engagement therewith.

Roller 13 is mounted on a shaft 14 supported in bearings 15. Shaft 14 is secured to a pulley 16 which is driven from a belt 17 in turn powered by a pulley 18 mounted on the end of the shaft 19 of an electric motor 20. The motor, pulleys, and roller 13 are so proportioned to drum 2 and to each other that drum 2 is rotated by roller 13 at an appropriate speed to provide tumbling action for articles of clothing placed therein.

In order that a stream of drying air may be introduced into it and passed through the clothes drum, the drum is provided with a central aperture 21 in its front wall 8 and with a plurality of perforations 22 extending in an annulus around back wall 7. Rigidly secured to the rear wall 23 of casing 3 by any desired means, such as for instance welding at suitable points 24, there is a baffle member 25 which has secured thereto heating means 26 appropriately insulated from the baffle member. Heating elements 26 may be annular in shape so as to be generally coextensive with the perforations 22 in drum 2. A baffle member 27 is rigidly secured to the back wall 7 of the drum outside the ring of perforations 22 and within the stationary baffle 25 so that an annular air inlet 28 is in effect formed by the two baffles 25 and 27. Baffle 27 is further provided with an annular series of openings 29; in this manner, a conduit, provided by the cooperation of the baffles, leads the air from annular opening 28, over heating elements 26, through openings 29 and then through perforations 22 into the interior of drum member 2.

In addition to the air guiding function in which they form a conduit, the baffles 25 and 27 help the rollers 10, 11, and 13 support the drum 2. Secured to the central portion 30 of baffle 27 is a bracket 31 to which in turn is secured a stub shaft member 32 arranged substantially coaxially with drum 2. The central portion 30 of baffle 27 has an opening 34 formed therein in the form of a slot. The slot is suitably formed (as more fully described in application Serial No. 789,869, filed January 29, 1959, by William F. Simpson and assigned to the same assignee as this invention) so as to permit stub shaft 32 a limited amount of movement in a vertical direction but virtually no movement in the horizontal direction. Thus, the slight vertical motions of the drum which result from the tumbling of the clothes can be accommodated while at the same time undesirable horizontal motion is affirmatively prevented by the engagement of stub shaft 32 in slot 34.

The front opening 21 of the drum is substantially closed by means of a stationary bulkhead generally indicated by the numeral 35. Bulkhead 35 is made up of a number of adjacent members including the inner surface 36 of an access door 37 mounted on the dryer cabinet, a stationary frame 38 for the door, the inner surface 39 of an exhaust duct 40, and an annular flange 41 mounted on the frame 38 and on the duct wall. It will be noted that a suitable clearance is provided between the inner edge of the drum opening 21 and the edge of bulkhead 35 so that there is no rubbing between the drum and the bulkhead during rotation of the drum. In order to prevent any substantial air leakage through opening 21 between the interior and the exterior of the drum, a suitable ring seal 42, preferably formed of felt-like material, is secured to flange 41 in sealing relationship with the exterior surface of drum wall 8.

Front opening 21, 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

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the drum. The door 37, whose inner surface forms part of the bulkhead closing the opening, is mounted on cabinet 3 and when the door is opened clothes may be inserted into or removed from the drum through the door frame 38. It will be noted that the door includes an outer flat imperforate section 43 and an inwardly extending hollow section 44 mounted on the flat outer section. Hollow section 44 extends into the door frame 38 when the door is closed, and the door surface 36 which comprises part of the combination bulkhead 35 is actually the inner wall of this hollow section.

The air outlet from the basket is provided by a perforated opening 45 formed in the inner wall 36 of hollow door section 44. The bottom wall section of door 37 and the adjacent wall of door frame 38 are provided with aligned openings 46 and 47, opening 47 providing the entrance to duct 40. As shown, a lint trap 48, which may comprise a fine mesh bag, is preferably positioned in exhaust duct 40 at opening 47, the bag being supported by the door frame 38.

Duct 40 leads to suitable air moving means which may, as shown, comprise a centrifugal blower 49 mounted on the motor shaft and thus driven by motor 20. The outlet of blower 49 communicates with an outlet duct 50 (FIGURE 2) which extends through an opening 51 in the back 23 of cabinet 3. During operation of motor 20, the rotation of blower 49 causes a stream of air to be drawn into cabinet 3 from atmosphere through suitable openings such as that shown at 51a (FIGURE 1), through annular opening 28 into the conduit formed by the baffles so as to pass over heaters 26, through openings 29 and then through perforations 22 into drum 2, across the drum, out through the perforated openings 45 and the aligned openings 46 and 47 into duct 40, and then through the blower 49, the outlet duct 50, and opening 51 to atmosphere.

The operation of dryer 1 is controlled by a system which incorporates my invention, one embodiment of which appears in the circuit diagram of FIGURE 3. As shown there, the entire control system of the machine is energized across a three-wire power supply system including supply conductors 52 and 53 and a neutral conductor 54. For domestic use, conductors 52 and 53 will normally be connected across a 220 volt power supply, with 110 volts appearing between the neutral line 54 and each of these conductors. The control system includes a timer motor 55 which is connected through a switch 55a and the bimetallic element 56 of a thermostat 57 across conductors 52 and 54. The timer motor 55 may be of any suitable type, such as for instance a small synchronous motor, and is arranged in controlling relation to cams 58 and 59, which in turn control switch 55a and 61 respectively.

The synchronous motor, cams, and switches are conventionally formed as a unitary control assembly located in the conventional manner in a backplasher panel assembly 62 positioned at the back and the top of the cabinet 3. A suitable control dial 63 is provided for the manual rotation of cams 58 and 59 to a desired position for the initiation of a timer operation. It will further be understood that in such an operation initiating position, switches 55a and 61 are closed. The closure of switch 55a is initially without effect on the timer motor because thermostat 57 is normally open, moving to closed position only when a predetermined high temperature is attained. However, the closure of switch 55a does complete an energizing circuit for motor 20 between conductors 52 and 54 so that the motor thus is energized and operates as described previously. The closure of switch 61 permits energization of heaters 26 which are also under the control of a pair of normally closed thermostats 63 and 64.

Thermostat 63 includes a bimetallic temperature sensitive element 65 which forms a normally closed switch, it being understood that when a predetermined high temperature is reached the switch snaps to open position, and when the temperature decreases the switch closes

again. The thermostat 64 includes a normally closed bi-metal element 66, and it will be seen that thermostat 64 is in a circuit which, in effect, forms a bypass around thermostat 63. It will be noted that elements 65 and 66 normally close their associated circuits whereas the element 56 of thermostat 57 is in a normally open position in which it precludes energization of the timer motor 55.

Referring again now to FIGURE 1 of the drawings, it will be noted that thermostat 63 is located just outside openings 29 in the conduit formed by the arrangement for causing air to pass over the heaters 26 and then into basket 2 as previously described. In other words, the thermostat 63 is downstream of the heaters 26 but upstream of the basket 2 so that it is responsive to the temperature of the heated air entering the basket. Both thermostats 57 and 64 are located at the front of the dryer on the bulkhead 35 directly below the air outlet 45 from the drum. The thermostatic elements 57 and 64 are effective to sense the temperature of the exhaust air leaving the drum; this temperature is close to the actual clothes temperature, and is directly responsive to the actual clothes temperature.

The thermostat 63 is designed to maintain the input air temperature relatively constant. To achieve this, it can be seen that when element 66 of thermostat 64 is open, the position of element 65 of thermostat 63 will control the energization of heaters 26 during a cycle of operation (that is, when switch 61 is closed). This provides the constant input air temperature which is discussed in the early part of this specification as being a known expedient for eliminating the difficulties encountered as a result of varying ambient atmospheric conditions. Thermostat 57 is set so that the element 56 thereof trips to a closed position at a temperature which indicates dryness of the clothes.

It is in the addition of means to bypass the thermostat 63 during the initial part of a cycle that my invention lies, and this is achieved in the embodiment of FIGURE 3 by the provision of the thermostat 64 located similarly to thermostat 57 so as to sense the temperature of clothes. There is the difference between the two thermostats, however, that thermostat 64 is calibrated so as to open its element 66 at a somewhat lower temperature than the trip point of thermostat 57. Preferably, the trip point of thermostat 64 occurs toward the latter portion of the gradual temperature rise or plateau which occurs during the evaporation of the major part of the moisture from the clothes.

It will readily be seen that opening and closing of thermostat 63 is ineffective as long as element 66 of thermostat 64 is closed to complete a bypass circuit. In other words if thermostat 64 is closed and switch 61 is closed, the heaters 26 will be energized regardless of the position of element 65 of thermostat 63. As a result, the heaters 26 are energized continuously during the early part of a drying operation. This is based on the concept that, when the clothes have a very substantial amount of moisture in them, a substantial amount of energy input is desirable in order to speed up the drying operation; this high energy input during the initial part of an operation does not cause clothes temperatures high enough to indicate dryness because of the fact that so much of the energy put in is being used for moisture evaporation. However, this state of affairs must not be allowed to continue after the major initial part of the moisture has been removed from the clothes.

It is this factor that is taken care of by my additional thermostat 64 which is calibrated so that, after the initial part of the moisture has been removed from the clothes, the thermostat will trip; this disables the bypass arrangement and thermostat 63 is then in command of the heater operation. As a result, after the initial high energy input with the resultant expediting of the operation, the thermostat 64 opens to permit the thermostat 63 to regu-

late the air input temperature in the manner necessary to obtain accurate sensing of the condition of the clothes. With the input air temperature thus regulated by thermostat 63 during the latter part of the cycle, the thermostat 57, upon tripping, indicates a dry condition of the clothes.

When the thermostat 57 trips it energizes the timer motor 55 which then, after a very brief period, causes cam 59 to open switch 61 to deenergize the heaters 26. Either at the same time, or slightly thereafter to provide a cool-down operation, the timer motor causes the switch 55a to be opened so as to terminate the tumbling and air moving operation, and to deenergize itself. The operation of switches 55a and 61 may readily be seen by referring to FIGURE 5 wherein it is shown that during the cycle of operation of the machine both cams are in a position to cause closure of their associated switches and both open their associated switches at the end of the cycle.

In this manner, a drying operation may be provided which dispenses with the need for ambient compensation by, during the critical last portion of the drying operation, regulating the input air temperature so as to permit the outlet air temperature to be an accurate representation of the condition of the clothes; at the same time, because of my invention, this is done without impairing the efficient input of a high amount of energy during the initial stage of the drying operation at the time when it is most necessary because of a large amount of moisture to be removed. As an illustration of suitable temperature values which may be utilized, it has been found that if the thermostats 57, 63 and 64 are set to trip at, respectively, 150-155° F., 230° F., and 135-140° F., and to reset at, respectively, 130-135° F., 220° F., and 115-120° F., a suitable control over the dryness of the clothes and the end of the operation is obtained; at the same time, the entire operation is permitted to be expedited by the input of the large quantity of energy desired initially.

Referring now to FIGURE 4 of the drawings, there is shown a second control circuit for dryers of the type shown in FIGURE 1 in which my inventive concept is incorporated. While, in the case of FIGURE 4, the same broad concept as before of delaying the control of heaters 26 by thermostat 64 is included, the delay in the control is achieved by timer operated means rather than by the thermostatic means of FIGURE 3.

In brief, using the same numerals as in FIGURE 3 where the parts are identical, I energize my system from three conductors 52, 53 and 54 as before, and I provide a timer motor 55 connected across conductors 52 and 54. The timer motor controls the rotation of cams 58 and 59 as before and again cams 58 and 59 respectively control switches 55a and 61, switch 55a being in series with the motors 20 and 55 and switch 61 being in series with the heaters 26. In addition, timer motor 55 controls a pair of cams 67 and 68 which respectively control switches 69 and 70. Switch 69 is in parallel with the bimetallic element 56 of thermostat 57 while switch 70 is in parallel with the bimetallic element 65 of thermostat 63, i.e., it is in a bypass circuit around the thermostat.

In operation, as before, the cams may be manually rotated to a starting position in which all of their various associated switches 55a, 61, 69 and 70 are closed. As a result of the closure of the switch 55a, motor 20 is energized as before, and as a result of the closure of the switch 61 energization of the heaters 26 is enabled as before. The closure of the switch 69 causes the timer motor to be energized and to run, as opposed to the deenergized condition of the timer motor at the initial part of the cycle in FIGURE 3. Also, the timer operated switch 70 being closed causes continuous energization of heaters 26 regardless of the condition of the thermostat 63. As a result the heaters, the drive motor and the timer motor all run continuously during the initial part of a cycle, the heaters providing a substantial amount of energy by their continuous energization so as to effect the most rapid

removal possible of the moisture in the clothes at the time when a large amount of moisture is present in them.

After a predetermined length of time, the timer motor, through its rotation of cams 67 and 68 opens switches 69 and 70 as shown in FIGURE 6. The opening of switch 69 deenergizes the timer, it being understood that the thermostat 57, as before, has a bimetal 56 normally in an open condition. The opening of switch 70 places the heaters under the control of the cycling thermostat 63 so that the temperature of the input air is then regulated in the same manner as previously described. The cycle then continues until the thermostat 57 trips to cause energization of the timer motor which in turn opens switches 55a and 61 as shown in FIGURE 6, deenergizing the drive motor and itself and disabling the heaters to terminate the cycle. In effect, it will be seen that the system of FIGURE 4 provides the desired delaying of the air input temperature control by a straight timer type of control rather than by the thermostatic control provided in connection with FIGURE 3.

While in accordance with the patent statutes I have described what at present are considered to be the preferred embodiments 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 clothes dryer comprising: means defining a drying chamber having first and second openings; inlet conduit means connected to said first opening; means for circulating a stream of air from said conduit means to said first opening, and through said chamber to said second opening; heating means in said conduit means for heating the air so as to dry damp fabrics in said chamber; first thermostatic means responsive to the temperature of the air entering said chamber, said first thermostatic means controlling said heating means so as to maintain substantially constant the temperature of air entering said chamber; second thermostatic means responsive to the temperature of the fabrics, said second thermostatic means also controlling said heating means and causing operation of said heating means to terminate after a predetermined fabric temperature is reached; bypassing means for causing substantially continual operation of said heating means independently of said first thermostatic means; and means for disabling said bypassing means prior to termination by said second thermostatic means of operation of said heating means after an initial period of continual operation of said heating means, whereby said first thermostatic means controls said heating means only during the latter portion of the drying operation.

2. The apparatus defined in claim 1 wherein said disabling means comprises third thermostatic means responsive to the temperature of the fabrics, said third thermostatic means tripping to disable said bypassing means in response to a rise in temperature to a level substantially below that required to trip said second thermostatic means.

3. The apparatus defined in claim 1 wherein said disabling means comprises a timer switch for opening said bypassing means, and means for opening said timer switch after a predetermined length of time.

4. A clothes dryer comprising: means defining a drying chamber having first and second openings; inlet conduit means connected to said first opening; means for circulating a stream of air from said conduit means through said chamber from said first opening to said second opening; electric heating means in said conduit means for heating the air so as to dry damp fabrics in said chamber; first thermostatic means responsive to the temperature of the air entering said chamber and including a switch in series with said heating means, said first thermostatic means switch being normally closed and opening at a

predetermined temperature so as to maintain substantially constant the temperature of the air entering said chamber; second thermostatic means responsive to the temperature of the fabrics, second thermostatic means also controlling said heating means and causing operation of said heating means to terminate after a predetermined fabric temperature is reached; a bypass circuit around said first thermostatic means switch in series with said heating means for causing substantially continual operation of said heating means independently of said first thermostatic means switch; and means for opening said bypass circuit prior to termination by said second thermostatic means of operation of said heating means after the initial period of operation of said heating means whereby said first thermostatic means controls said heating means only during the latter portion of a drying operation.

5. A clothes dryer comprising: means defining a drying chamber having first and second openings; inlet conduit means connected to said first opening; means for circulating a stream of air from said conduit means through said chamber from said first opening to said second opening; heating means in said conduit means for heating the air so as to dry damp fabrics in said chamber; first thermostatic means responsive to the temperature of the air entering said chamber, said first thermostatic means controlling said heating means so as to maintain substantially constant the temperature of air entering said chamber; timer means effective when energized to deenergize said heating means and said air circulating means after a predetermined period; second thermostatic means responsive to the temperature of the fabrics, said second thermostatic means energizing said timing means at a predetermined temperature thereby to cause operation of said heating means to terminate after a predetermined fabric temperature is reached; bypassing means for causing substantially continual operation of said heating means independently of said first thermostatic means; and means for disabling said bypassing means prior to termination by said second thermostatic means of operation of said heating means after an initial period of operation of said heating means whereby said first thermostatic means controls said heating means only during the latter portion of a drying operation.

6. A clothes dryer comprising: means defining a drying chamber having first and second openings; inlet conduit means connected to said first opening; means for circulating a stream of air from said conduit means through said chamber from said first opening to said second opening; electric heating means in said conduit means for heating the air so as to dry damp fabrics in said chamber; first thermostatic means responsive to the temperature of the air entering said chamber, said first thermostatic means including a normally closed switch connected in series with said heating means, said switch opening and reclosing at predetermined high and low temperatures whereby said first thermostatic means maintains substantially constant the temperature of air entering said chamber; second thermostatic means responsive to the temperature of the fabrics, said second thermostatic means also controlling said heating means and causing operation of said heating means to terminate after a predetermined fabric temperature is reached; a bypass circuit around said switch and in series with said heating means for causing operation of said heating means independently of said first thermostatic means; and third normally closed thermostatic means also responsive to the temperature of the fabrics and arranged to open at a fabric temperature lower than said second thermostatic means, said third thermostatic means being connected in series with said heating means and in said bypass circuit, whereby said third thermostatic means opens said bypass circuit after an initial period of operation of said heating means and said first thermostatic means then controls said heating means during the latter portion of a drying operation.

7. A clothes dryer comprising: means defining a drying chamber having first and second openings; inlet conduit means connected to said first opening; means for circulating a stream of air from said conduit means through said chamber from said first opening to said second opening; electric heating means in said conduit means for heating the air so as to dry damp fabrics in said chamber; first thermostatic means responsive to the temperature of the air entering said chamber, said first thermostatic means including a normally closed switch connected in series with said heating means so as to maintain substantially constant the temperature of air entering said chamber; second thermostatic means normally open and responsive to the temperature of the fabrics to close; timing means for tolling a drying operation including a timer motor and first, second and third switches controlled thereby, said first timer switch and said second thermostatic means being connected in series with said timer motor and in parallel with each other thereby to control operation of said timer motor; said second timer switch being connected in series with both said heating means and said first thermostatic means; said third timer switch being connected in series with said heating means and in parallel with said first thermostatic means; said timer motor causing closure of all three of said timer switches during an initial portion of a drying operation, opening said first and third switches during a subsequent part of each drying operation, and opening all said switches upon reenergizaion by closure of said second thermostatic means during a third part of the drying operation.

8. A clothes dryer comprising:
- (a) means defining a drying chamber having first and second openings;
 - (b) inlet conduit means connected to said first opening;
 - (c) means for circulating a stream of air from said conduit means through said chamber from said first opening to said second opening;

- (d) heating means in said conduit means for heating the air so as to dry damp fabrics in said chamber;
- (e) first thermostatic means responsive to the temperature of the air entering said chamber, said first thermostatic means controlling said heating means so as to maintain substantially constant the temperature of air entering said chamber;
- (f) timer means effective when energized to de-energize said heating means and said air circulating means after a predetermined period;
- (g) second thermostatic means responsive to the temperature of the fabrics, said second thermostatic means energizing said timer means upon reaching a predetermined temperature whereby said timer means tolls the predetermined period when said second thermostatic means is at its predetermined temperature;
- (h) and third thermostatic means providing a normally closed bypass around said first thermostatic means so as to cause substantially continual operation of said heating means independently of said first thermostatic means, said third thermostatic means being positioned to be responsive to the temperature of the fabrics and being arranged to trip open to disable said bypassing means in response to a rise in temperature to a level substantially below that required to trip said second thermostatic means.

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