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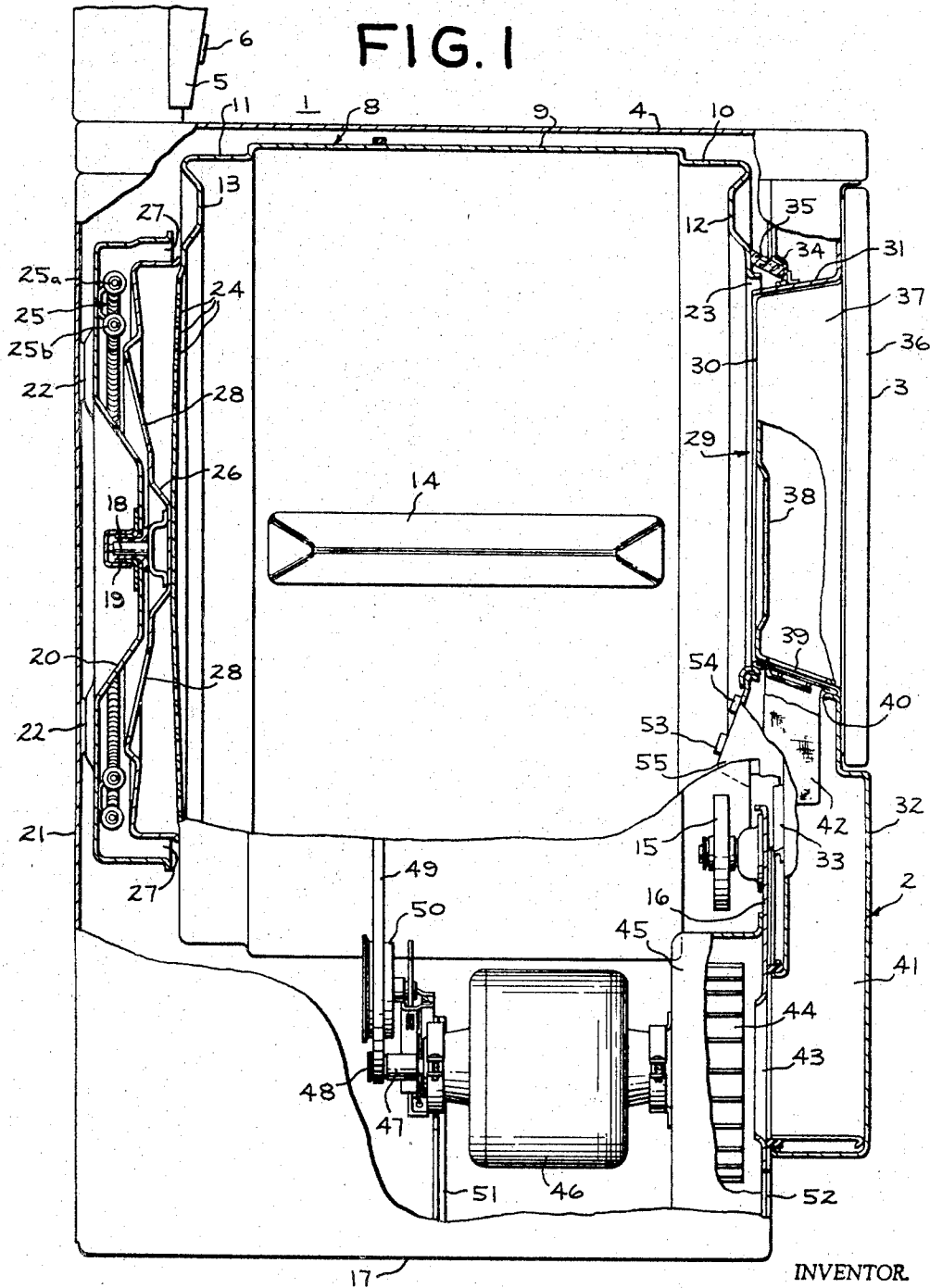
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3,404,466

ELECTRONIC DRYER CONTROL

Filed June 28, 1967

2 Sheets-Sheet 1



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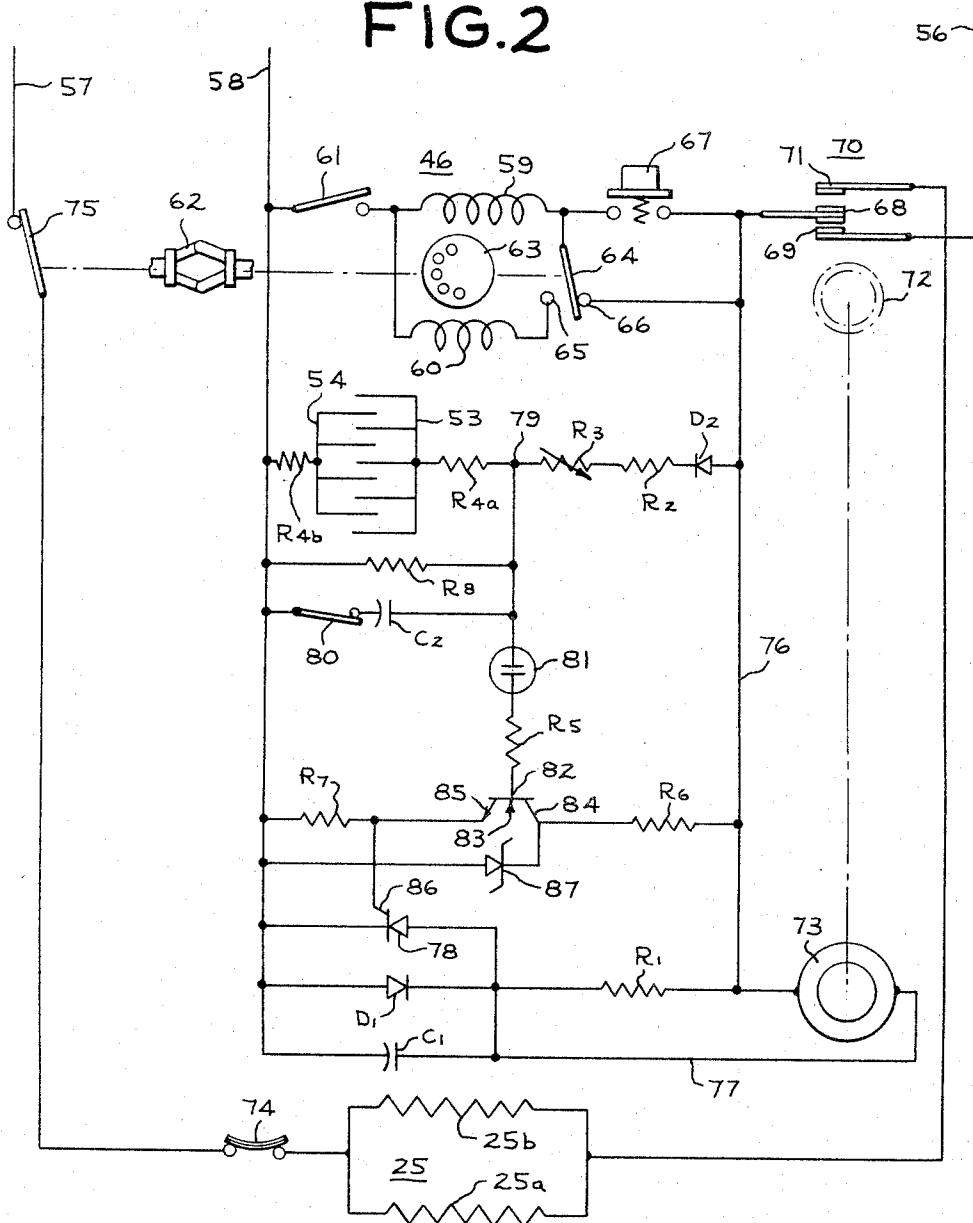
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2 Sheets-Sheet 2

FIG. 2



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ELECTRONIC DRYER CONTROL

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ABSTRACT OF THE DISCLOSURE

A clothes resistance measurement dryer control of the type utilizing a capacitor as a signal integrator is provided with a large resistance in parallel with the capacitor and a switch effective selectively to disconnect the capacitor from the control. With the capacitor in the control, the resistor compensates for load variations so that the fabrics will be properly dried regardless of variations in the amount of fabrics being dried. With the capacitor effectively out of the control, the resistor will cause control operation so as to give "damp-dry" fabrics regardless of the amount of fabrics being dried.

Background of the invention

In the past few years clothes dryer controls which use a measurement of the resistance of the fabrics being dried as the control basis have come into vogue. In the more popular approach for this type of control, sensors in the dryer drum are connected across a storage capacitor and control the voltage to which the charge on the capacitor builds. When the charge reaches a predetermined level some means is initiated to terminate the dryer operation.

The capacitor serves as an integrator, that is, it averages the instantaneous voltages across the sensors to prevent an incorrect momentary "dry" voltage from terminating dryer operations. Such incorrect "dry" signals occur either when an isolated item, which is much dryer than the rest of the load, engages the sensors or when no fabrics at all engage the sensors.

Prior art controls have not been completely successful in dealing with the problem of fabrics not touching the sensors. Most prior controls have the sensors mounted on the rotating drum which tends to keep the sensors in contact with at least some part of the load. However, this approach involves complicated and expensive electrical connections between the rotating and the stationary portions of the dryer and does not completely solve the problem.

From the standpoint of simplicity of design, ease of manufacture, and economy; it is desirable to use sensors which are mounted on a stationary portion of the machine. Such past constructions have had substantial problems with fabrics not contacting the sensors. This condition is a function of the amount of fabrics in the dryer. That is, when the dryer is fully loaded, fabrics almost invariably are in contact with the sensors. On the other hand, when small loads are in the dryer, there may be substantial periods when no fabrics contact the sensors.

An object of this invention is to provide an improved dryer control of the resistance sensing type which compensates for variations in the amount of fabrics being dried.

Another object of this invention is to provide such an improved control which may employ stationary sensors.

A further object of the invention is to provide such an

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improved control which is effective, selectively to provide either "dry" or "damp dry" fabrics.

Summary of the invention

In accordance with one form of this invention there is provided a control for a dryer having means for tumbling items being dried which includes timing means effective to terminate operation of the dryer after a predetermined amount of operation of the timing means. Sensing means are positioned to contact items being dried to establish a current path through the items, having a resistance which is a function of the moisture content of the items. A capacitor is connected in parallel with the sensing means to be charged to a voltage responsive to the moisture content of the items. Circuit means interconnects the capacitor and the timing means and causes operation of the timing means in response to the charge on the capacitor reaching a predetermined level, corresponding to a predetermined moisture content of items being dried. A resistance is connected in parallel with the sensing means and capacitor. The resistance is effective to cause the charge to reach the predetermined level in the event no items contact the sensing means, thereby compensating for variations in the amount of items being dried.

Brief description of the drawings

FIGURE 1 is a side elevational view of a clothes dryer suitable for incorporation of my improved dryer control, the view being partly broken away and partly sectionalized to illustrate details; and

FIGURE 2 is a schematic electric circuit diagram of one embodiment of my invention.

Description of the preferred embodiments

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 or unloading fabrics. Provided on the top wall 4 of cabinet 2 is a control panel 5 which may include a suitable control 6 mounted in a panel 5. By manual manipulation 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 fabric tumbling container, or drum 8, mounted for rotation on a substantially horizontal axis. Drum 8 is substantially cylindrical in shape, having a first outer 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. Outer wall portions 9, 10 and 11 are imperforate over their entire length so that the outer shell of the basket is imperforate. A plurality of clothes tumbling ribs 14 are provided on the interior of wall portion 9 so that fabrics are lifted up by the ribs when the drum rotates, and then tumbled back down to the bottom of the drum.

The front of drum 8 may be rotatably supported within the outer casing 2 by suitable idler wheels, one of which is shown at 15. These wheels are rotatably secured to the top of a member 16 which extends up from base 17 of the machine. The 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 stable support. The rear end of drum 8 receives a support by means of a stub shaft 18 extending from the center of wall 13.

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Shaft 18 is secured within a bearing 19 supported by a baffle 20 which, in turn, is rigidly secured to the back wall 21 of cabinet 2 by any suitable means such as welding at a number of points 22. With the arrangement shown, the drum may rotate on a horizontal 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 the stream of drying air through the 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.

Baffle member 20 also serves to support heating means 25 which, in the machine illustrated, includes two electrical resistance heating elements 25a and 25b, appropriately insulated from the baffle member. Elements 25a and 25b may be annular in shape so as to be generally coextensive with perforations 24 in drum 8. A second baffle member 26 is rigidly secured to the back wall 13 of the drum outside 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 heating means 25, then pass through openings 28, formed in baffle 26, and then through the perforations 24 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. 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 the front wall 32 of the cabinet; the inner surface member 33 of an exhaust duct which is formed by cooperation of member 33 with the front wall 32 of the cabinet; and an annular flange 34 mounted on frame 31 and on the duct wall. It will be noted that a suitable clearance is provided between the inner edge of 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 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 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 or 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 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 the hollow section.

The air outlet from the drum is provided by a perforated opening 38 formed in the inner wall 30 of the hollow door section 37. The bottom wall section of the door 3 and the adjacent wall of door frame 31 are provided with aligned openings 39 and 40. Opening 40 provides the entrance to the duct 41 formed by the cooperation of member 33 with front wall 32. As shown, a lint trap 42 is positioned in the exhaust duct 41 at 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 the wheels 15. Opening 43 constitutes the inlet to a blower member 44 contained within a housing 45 and directly driven by an electric motor 46. An inlet, such as the opening 52 is provided so that the blower means draws ambient air in through opening 52, over the heating means 25, then through the

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basket, 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 the cylindrical wall section 9 of drum 8. The relative circumferences of pulley 48 and wall section 9 cause the drum to be driven by the motor at a speed suitable to effect tumbling of the clothes therein. In order to effect proper tensioning of belt 49, there may be provided a suitable idler assembly 50 secured on the same support 51 which supports one end of the motor. Thus, air is pulled through the drum and at the same time the fabrics in the drum are tumbled. When the air is heated by heating elements 25a and 25b, the heated air passing through the drum causes vaporization of moisture from the clothes and the vapor is carried off with the air as it passes out of the machine.

In order to sense the amount of moisture in the fabrics being dried in the drum 8, and thus obtain a suitable signal for controlling the operation of the dryer 1, sensing means are provided to contact and be bridged by the items being dried. In the machine of FIGURE 1 the sensing means is in the form of a pair of spaced conductors 53 and 54 which are mounted on an inwardly extending portion 55 of member 33. The extension 55 is formed so that the conductors 53 and 54 are exposed to the interior of the drum and positioned to be readily contacted and bridged by the fabrics as they tumble within the drum 8.

The operation of dryer 1 is controlled by the new and improved control arrangement schematically illustrated in the circuit diagram of FIGURE 2. As shown therein, the entire control system of the machine may be energized across a three-wire power supply system which includes supply conductors 56 and 57 and a neutral conductor 58. For domestic use, the conductors 56 and 57 normally will be connected across a 220 volt, alternating current power supply, with 110 volts appearing between neutral conductor 58 and each of the supply conductors, and with the neutral conductor being at ground voltage. Motor 46, connected between conductors 56 and 58, is a single phase induction type motor having a main winding 59 and a start winding 60, both connected at a common end to conductor 58 through a conventional door switch 61, which is closed when the door 3 is closed and is opened when door 3 is opened.

Start winding 60 is connected in parallel with main winding 59 under the control of a speed responsive device such as that shown at 62, which is schematically shown as connected to rotor 63 of the motor. The speed responsive device 62 controls a switch 64 which is engageable with either a contact 65 or a contact 66. Switch 64 is engaged with contact 65 when the machine is at rest, and moves into engagement with contact 66 as the motor comes up to speed. It readily can be seen that engagement of switch 64 with contact 65 connects the start winding 60 in parallel with main winding 59, while movement of switch 62 away from this position opens the start winding. Thus, as rotor 63 comes up to speed the start winding becomes de-energized and the motor then continues to run on the main winding 59 alone.

The starting of the motor is provided by a manually operable switch 67 which may, for instance, in the structure of FIGURE 1 be moved to its closed position by pressing control member 6. Switch 67 connects the motor to supply conductor 56 through contacts 68 and 69 of a switch 70, also having a contact 71. The switch 67 is normally biased to the open position as shown in FIGURE 2. When member 6 is depressed, assuming that contacts 68 and 69 are closed, energization of the motor is provided, and within less than a second, under normal circumstances, the mo-

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tor comes up to speed so that switch 64 moves from contact 65 to contact 66. As a result of this movement of the centrifugally operated switch 64, the main winding 59 of motor 46 continues to be energized by a bypass around switch 67 when member 6 is released and switch 67 opens. The switch 70 is controlled by a cam 72 which, in turn is controlled by a timing motor 73, as shown schematically in FIGURE 2. The cam and timing motor also are connected to manual control 6 so that rotation of the manual control causes the cam to rotate and close the contacts 68, 69 and 71 of switch 70. Thereafter the cam 72 is controlled by motor 73 and, after predetermined periods of operation of the timing motor, the cam is effective to cause the various contacts of switch 70 to be opened for terminating the cycle of operation of the machine.

An energizing circuit for the heating means 25 is completed through the following circuit. Starting at conductor 56, the circuit proceeds through switch 70 to the heating means 25, then through a conventional safety thermostat 74 and a centrifugally responsive switch 75 to supply conductor 57. Switch 75 is controlled by centrifugal member 62, being closed only when the motor has come up to speed so that there can be no energization of the heating means 25 except when motor 46 is operating properly.

One side of the motor 73 of the timing means is connected through a conductor 76 to contact 68 and thence through contact 69 to supply conductor 56. The other side of the motor is connected to a conductor 77 which leads to neutral conductor 58 through either of two paths. The first of these paths is through the anode-cathode path of a controlled rectifier 78, while the other path is the anode-cathode path of a diode D1. As indicated by FIGURE 2, the anode-cathode path of the controlled rectifier 78 and the anode-cathode path of the diode D1 are connected in opposite polarity. If gated, the controlled rectifier will conduct when supply conductor 56 is positive with respect to neutral conductor 58 while diode D1 conducts when supply conductor 56 is negative with respect to neutral conductor 58. The motor 73 is of the induction type and, therefore, will not run in response to only the half cycles of power conducted by diode D1. Thus, the controlled rectifier 78 must be gated to conduct at least a portion of the other half cycles of applied energy for the motor 73 to run.

It will be understood that motors such as 73 are inductive loads, wherein there is a large phase angle between the voltage and the current. In order to compensate for this situation and insure proper turn-off of the controlled rectifier and diode at the proper time, the resistance R1 is connected in parallel with the motor 73 and the capacitor C1 is connected in parallel with the parallel arrangement of the controlled rectifier 78 and diode D1.

The sensors 53 and 54 are used to provide the control signal for gating the controlled rectifier 78. To this end the sensors are connected in the control circuit in the following manner. A connection is provided from conductor 76 through a diode or rectifier D2, a fixed resistor R2 and a manually adjustable resistor R3 to a junction 79. From junction 79 the circuit extends through fixed resistor R4a to sensor 53. Sensor 54 is connected through a similar fixed resistor R4b to a neutral conductor 58. With the circuit thus far described, fabrics bridging the sensors 53 and 54 complete a circuit from conductor 76 to neutral conductor 58. The voltage between junction 79 and neutral conductor 58 will be a function of the relation between the total resistance of R4a, R4b and the resistance of the fabric bridging the sensors as compared to the total control resistance, made up of R2 and R3. A capacitor C2 is connected between junction 79 and neutral conductor 58 in series with a manual switch 80. With the switch 80 closed the capacitor C2 effectively is connected in parallel with the sensors 53 and 54 and will be charged to a level responsive to the voltage appearing across the sensors.

The junction side of the capacitor C2 also is connected to one side of a voltage break down device such as neon

lamp 81, the other side of which is connected through a limiting resistor R5 to the base terminal 82 of a transistor 83. The collector terminal 84 of the transistor is connected to conductor 76 through a limiting resistor R6 and the emitter terminal 85 is connected to neutral conductor 58 through a limiting resistor R7. The gate terminal 86 of the control rectifier 78 is connected between the emitter 85 and the limiting resistor R7. A semiconductor device 87, of the type known as a Zener diode, is connected between the neutral conductor 58 and the collector terminal 84 to transistor 83.

With the circuit as thus far described operation of the machine is begun by closing switch 61, rotating control 6 so as to cause cam 72 to close the contacts 68, 69 and 71 of switch 70 and momentarily depressing control 6 to close switch 67. The motor begins to rotate and quickly comes up to speed, causing switch 64 to engage contact 66 and switch 75 to close. The motor continues to run to rotate the drum for tumbling the fabrics and drawing air through the dryer and the heating means 25 is energized to heat the air to evaporate moisture from the clothes. During half cycles of applied energy when supply conductor 56 is positive with respect to neutral conductor 58, current flows from contact 68 through conductor 76, diode D2, resistor R2, resistor R3, resistor R4a, the sensor 53, fabrics bridging the sensors, sensor 54 and resistor R4 to neutral conductor 58. Current also attempts to flow through the motor 73 from conductor 76 to conductor 58; however, the diode D1 is connected in the circuit to block such current and the controlled rectifier 78 will block such current unless it is gated. Therefore, until the controlled rectifier is gated, current does not flow through motor 73 during these half cycles. The current flow through the sensors, assuming fabrics are bridging them, causes a voltage to be impressed on capacitor C2 so as to charge the capacitor toward that voltage. Current will not flow through the voltage break down device or neon lamp 81 until the lamp begins to conduct, which will be in response to the voltage of C2 reaching the neon lamp's break down voltage. Additionally, a very small leakage current may flow through resistor R6, the collector to emitter path through the transistor 83 and resistor R7 to neutral conductor 58. When the voltage level of conductor 76 reaches the breakdown voltage of Zener diode 87, the zener diode will begin to conduct current from conductor 76 to conductor 58. However, this has no effect on the operation of the control.

During half cycles of the opposite polarity, that is, when supply conductor 56 is negative with respect to the neutral conductor 58, the diode D1 will conduct and current flows through motor 73. However, so long as controlled rectifier 78 does not conduct the motor 73 will not run. Additionally, Zener diode 87 acts as a normal diode in this polarity of applied voltage and bypasses the transistor 83 to insure that an undesirably high reverse voltage is not placed across the collector-emitter path of a transistor. No current will flow through the other portions of the control circuit because diode D2 will block it.

This type of operation continues with the charge on capacitor C2 rising toward the level of the voltage appearing across the sensors 53 and 54. Since this voltage is a function of the amount of moisture in the fabrics bridging the sensors, the level of the charge on the capacitor C2 slowly rises as the fabrics get dryer until the voltage on C2 reaches the break down voltage of the lamp 81. At this time the charge on the capacitor C2 causes the lamp 81 to break down and begin to conduct. The current flows through the lamp and limiting resistor R5 into the base 82 of the transistor. Thereafter, the current out of the transistor through emitter 85 becomes a rather large current rather than merely the leakage current which has occurred heretofore.

The passage of this large current through resistor R7 provides a voltage pulse each half cycle which is applied to the gate 86 of the controlled rectifier 78 to turn it on.

Therefore, the control rectifier 78 conducts during one half cycle of the applied energy and the diode D1 conducts during the other half cycle. This causes the motor 73 of the timing means to rotate and turn cam 72. Assuming the fabrics are uniformly dry, this condition will continue to exist with the rectifier D1 conducting in one direction and the controlled rectifier 78 conducting in the other direction so that the timing motor rotates at a speed at least close to its full designed speed. After a predetermined amount of rotation of the timing motor the cam 72 causes contact 71 to be opened, de-energizing the heating means. After an additional period of time sufficient for the fabrics in the dryer to cool down the cam causes contacts 68 and 69 to be opened. This de-energizes the motor 46 and the control circuit to complete the cycle of operation of the machine.

With regard to the circuit as thus far described, it will be noted that should wet fabrics bridge the sensors 53 and 54 after the controlled rectifier has begun to conduct, a discharge path will be provided for the capacitor C2 and it will quickly fall below the level required to fire the neon lamp. At the completion of that half cycle of applied energy the lamp will turn off and the controlled rectifier will no longer conduct until the charge on the capacitor has again built up to the level required to turn on the lamp. Thus, the circuit compensates for variation in the drying time of different fabrics in the same load by causing the timing motor to stop whenever wet fabrics bridge the sensors. The degree of dryness, or the amount of moisture remaining in the fabrics, at which the timing motor begins to run may be varied. This variation between machines may be done at the factory for calibration purposes. Additionally R3 could be connected to some member such as control 6 to provide customer selection. The effect of such variations in R3 will be readily understood since the resistance of R3, in conjunction with resistor R2, forms a voltage dividing network with the resistance of the fabrics across the sensor, in conjunction with the resistors R4a and R4b.

In this regard R2 and R3 are shown as a fixed resistor and a variable resistor respectively because, as a matter of economy, this is most desirable. The R2-R3 leg of the network should have some minimum resistance and be variable up to some other maximum resistance. This could be provided by a single variable resistance having appropriate minimum and maximum values; however, potentiometers which may be varied from 0 to a predetermined level are much less expensive than those which are calibrated to be varied between two different resistance values. Thus, it is more economical to include a fixed resistor R2, corresponding to the minimum desired resistance, and then have a potentiometer R3 which may be varied between 0 and some set value to give the maximum resistance.

The resistors R4a and R4b are primarily current limiting resistors to control the current flow between the sensors 53 and 54. By putting one before and one after the sensors it is insured that the sensors 53 and 54 will be safe for the user, even if someone should improperly connect the machine so that the neutral conductor 58 is actually a supply conductor and supply conductor 56 is the neutral conductor.

With the circuit as thus far described there are two areas of something less than optimum performance. Assuming that no fabrics bridge the conductors 53 and 54, the voltage divider is open circuited at that point and a large voltage is impressed across C2 so that it quickly builds up to the level necessary to fire the lamp 81. With large loads of fabrics this is not particularly a problem because fabrics are almost invariably bridging the conductors; however, with small loads of fabrics, which occupy only a relatively small percentage of the space within the drum 8, an open circuit between the sensors will occur quite often. This causes the control, as thus far described, to tend either to underdry a small load or

to overdry a large load depending on the setting of R3. Also, with the control as thus far described, there would have to be a setting of R3 for each type of fabric if you desire to have a dry load and a different setting if you desire to have a damp-dry load since damp drying takes less time.

As an important aspect of this invention I provide a large compensating resistance R8, which is connected in parallel with the capacitor C2 and the sensors 53 and 54 between junction 79 and the neutral conductor 58. Assuming the switch 80 to be closed and assuming a large load so that fabrics generally bridge the sensors 53 and 54, the effective resistance in the portion of the voltage divider network in parallel with the capacitor C2 is effectively the resistance of the fabrics taken in parallel with the value of resistor R8. Since the resistance value of the clothes at the time when it is desired to begin running the timing motor 73 is substantially lower than the value of R8 the effective parallel resistance will be substantially that of the fabrics and the operation of the circuit is essentially the same as without resistor R8. However, when there is a small load of clothes in the drum there are relatively long periods of time when no fabrics are bridging the sensors 53-54. At these times the sensors present an open circuit and the resistor R8 forms the voltage divider network with the resistors R2 and R3. This causes the charge on capacitor C2 to build to the required level to fire the lamp 81 with a predeterminable time delay. Thus, by proper selection of the components, the control may be made to compensate for the differences in drying time between large loads and small loads and the dryer will provide correctly dried clothes regardless of the size of the load.

The resistance R8 is used in conjunction with the switch 80 to provide an effective damp-dry control without the necessity of varying the resistor R3 from the setting which would be used to completely dry the same load. With the capacitor C2 connected in the control, that is, with the switch 80 closed, the capacitor initially looks like a very low resistance, thus reducing the voltage at junction 79. As the capacitor charges, its resistance rises so that the voltage at the junction 79 will rise. This causes a short time delay after the resistance of the fabrics corresponds to the break down voltage of the neon lamp before that voltage is actually applied to the lamp. Even though, in controls of this general type, the capacitor corresponding to C2 will cause only a short time delay of this kind each time the lamp is fired, over a drying cycle which may last as long as twenty to forty minutes these repeated time delays cause an abbreviation of the amount of timing motor operation. When switch 80 is opened, the capacitor C2 is effectively disconnected from the circuit. The voltage at junction 79 is determined by the resistance voltage divider network. Thus, whenever the parallel resistance of the fabrics and the resistor R8 is sufficient compared to the combined resistance of R2 and R3, the neon lamp 81 will be fired, without any time delay, as would be the case when C2 is connected in the circuit. This causes slightly more operation of the timing motor 73 in a given elapsed period of time. Thus, the predetermined amount of timing means operation to cause the dryer to be de-energized will occur quicker and the fabrics will be damp-dry, ready for ironing, rather than completely dried. The resistor R8 performs a function in this mode of operation similar to its function in the normal dry operation. That is, it again compensates for variations in the load sizes by causing the timing motor to run more often with a small load than with a large load so that the same setting of R3 will provide appropriate drying regardless of the load size. Thus the control 6 may be calibrated to reflect the type of load, such as cotton, linen or delicate. The control will give proper drying regardless of the load size and may be varied between regular dry and damp dry merely by closing and opening one switch.

For an electric dryer of the type presently marketed by the General Electric Company, assignee of the present invention, the following components have been found to be satisfactory for the control described:

- D1—Semiconductor rectifier sold by General Electric Company under the Catalog No. A13B2 5
- D2—Semiconductor rectifier sold by General Electric Company under the Catalog No. A13B2
- C1—.1 microfarad, 200 working volts D.C.
- C2—1 microfarad, 200 working volts D.C. 10
- Control rectifier 78—General Electric Company Catalog No. C106B1
- Zener Diode 87—General Electric Company Catalog No. 2N2926
- Neon lamp 81—General Electric Company Catalog No. NE81 15
- R1—10 kilohms
- R2—270 kilohms
- R3—Variable from 0 to 150 kilohms
- R4a and R4b—Each 33 kilohms 20
- R5—47 kilohms
- R6—22 kilohms
- R7—1 kilohm
- R8—22 megohms 25

The foregoing is a description of the illustrative embodiment of the invention, it is applicant's intention in the appended claims to cover all forms which fall within the scope of the invention.

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

1. A control for a dryer having means for tumbling items being dried; including:
 - (a) shut-off means effective to terminate operation of the dryer after energization of said shut-off means; 35
 - (b) sensing means positioned to contact items being dried to establish a current path therethrough having a resistance which is a function of the moisture content of the items bridging said sensing means;
 - (c) a capacitor connected in parallel circuit with said sensing means to be charged to voltage responsive to the moisture content of items bridging said sensing means; 40
 - (d) circuit means interconnecting said capacitor and said shut-off means to cause energization of said shut-off means in response to said charge on said capacitor reaching a predetermined level corresponding to a predetermined moisture content of items being dried; and 45
 - (e) a compensating resistance connected in parallel circuit with said sensing means and said capacitor, said compensating resistance being effective to control said charge reaching said predetermined level in the event no items bridge said sensing means thereby to compensate for variations in the amount of items being dried. 50
2. A control as set forth in claim 1 wherein manually operable switch means are connected in series with said capacitor, selectively to remove said capacitor from said circuit.
3. A control as set forth in claim 1 wherein said circuit means includes a controlled rectifier connected in controlling relationship with said shut-off means and a voltage break down device connected between said capacitor and said controlled rectifier. 60
4. A control for a dryer having means for tumbling items being dried; including: 65
 - (a) timing means effective to terminate operation of the dryer after a predetermined amount of timing means operation;
 - (b) sensing means positioned to contact items being dried to establish a current path therethrough having a resistance which is a function of the moisture content of items bridging said sensing means; 70
 - (c) a capacitor connected in parallel circuit with said sensing means to be charged to a voltage responsive 75

- to the moisture content of items bridging said sensing means;
- (d) circuit means interconnecting said capacitor and said timing means to cause operation of said timing means in response to said charge on said capacitor reaching a predetermined level corresponding to a predetermined moisture content of items being dried; and
- (e) a compensating resistance connected in parallel with said sensing means and said capacitor, said resistance being effective to control said charge reaching said predetermined level in the event no items bridge said sensing means thereby to compensate for variations in the amount of items being dried.
5. A control as set forth in claim 4 wherein manually operable switch means are connected in series with said capacitor, selectively to remove said capacitor from said circuit.
6. A control as set forth in claim 4 wherein said circuit means includes a controlled rectifier connected in controlling relationship with said timing means and a voltage break down device connected between said capacitor and said controlled rectifier.
7. A control as set forth in claim 4 wherein said sensing means is connected in series circuit with a control resistance to form a voltage divider; so that the voltage across said sensing means, to charge said capacitor, is a portion of the applied voltage responsive to the moisture content of items bridging said sensing means.
8. A control as set forth in claim 7 wherein said control resistance is variable to vary the moisture content of items being dried which corresponds to said predetermined level of charge.
9. In a dryer having a cabinet, a drum mounted for rotation within the cabinet to tumble items being dried and heating means to heat the items being dried; a control, including:
 - (a) a circuit to connect the dryer to a source of alternating current electrical energy;
 - (b) timing means effective to terminate operation of the dryer after a predetermined amount of timing means operation;
 - (c) said timing means being connected in said circuit in series with the parallel connection of a diode and a controlled rectifier connected in opposite polarity, so that said timing means operates when said controlled rectifier is gated;
 - (d) sensing means positioned to contact items being dried to establish a current path therethrough having a resistance which is a function of the moisture content of items bridging said sensing means;
 - (e) a rectifier connected in said circuit in series with said sensing means to apply a pulsating direct voltage to said sensing means;
 - (f) a capacitor connected in said circuit in parallel with said sensing means to be charged to a voltage responsive to the moisture content of items bridging said sensing means;
 - (g) means interconnecting said capacitor and said controlled rectifier to gate said rectifier in response to said charge on said capacitor reaching a predetermined level, corresponding to a predetermined moisture content of items being dried; and
 - (h) a compensating resistance connected in parallel with said sensing means and said capacitor, said compensating resistance being effective to control said charge reaching said predetermined level in the event no items contact said sensing means, thereby to compensate for variations in the amount of items being dried.
10. A control as set forth in claim 9 wherein manually operable switch means are connected in series with said capacitor, selectively to remove said capacitor from said circuit.
11. A control as set forth in claim 9 wherein said means interconnecting said capacitor and said controlled recti-

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fier includes a transistor with its collector-emitter path connected in said circuit and a voltage break down device connected between said capacitor and the base of said transistor; the gate of said controlled rectifier being connected to the collector-emitter path of said transistor.

12. A control as set forth in claim 9 wherein said sensing means is connected in said circuit in series with a control resistance to form a voltage divider; so that the voltage across said sensing means, to charge said capacitor, is a portion of the pulsating direct voltage responsive to the moisture content of items bridging said sensing means.

13. A control as set forth in claim 12 wherein said con-

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trol resistance is variable to vary the moisture content of items being dried which corresponds to said predetermined level of charge.

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