

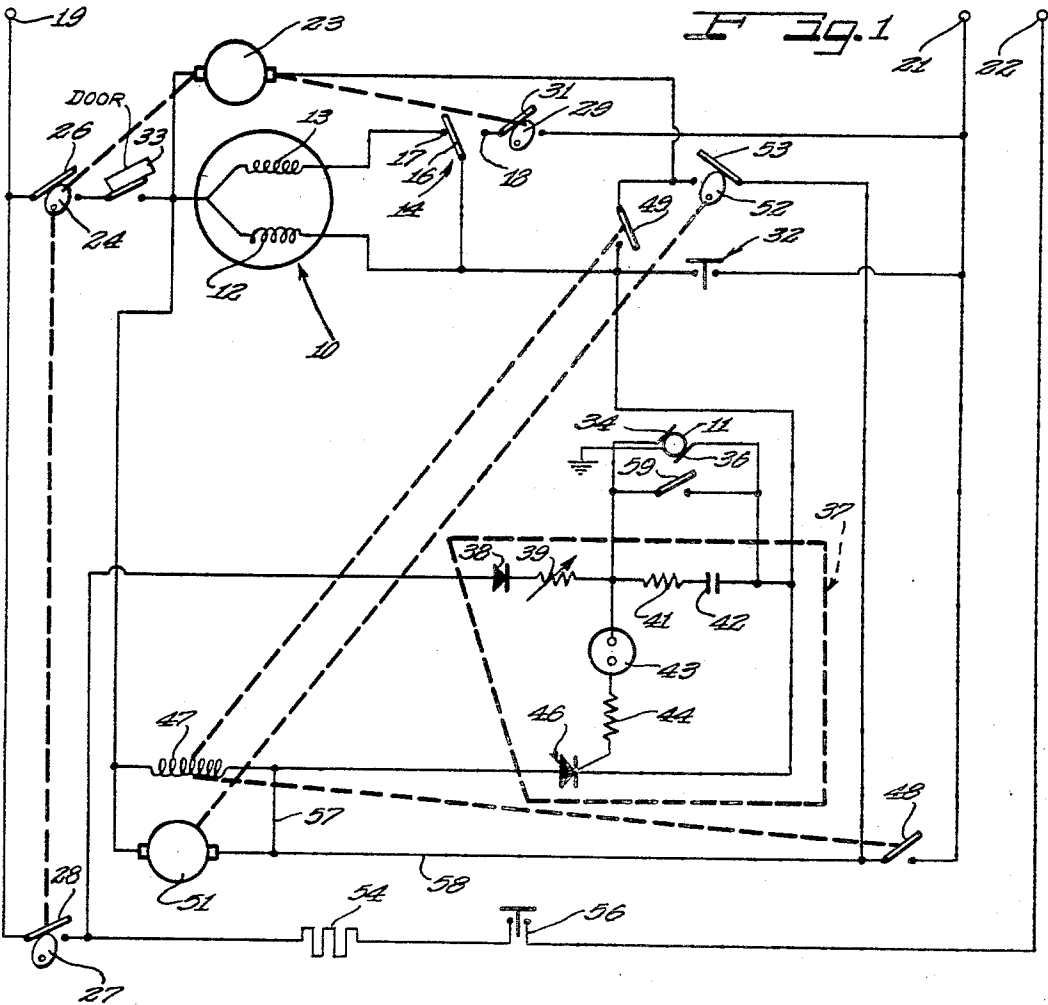
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DRYER WITH ANTIWRINKLE CYCLE

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TIME SCHEDULE

SWITCH CLOSED	CYCLE			
	DRY	COOL DOWN	ANTI-WRINKLE	OFF
26				
28				
31				

Fig. 2

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DRYER WITH ANTIWRINKLE CYCLE
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ABSTRACT OF THE DISCLOSURE

A control circuit for a clothes dryer having a drying operation followed by an antiwrinkle period of intermittent tumbling of the clothes load. The circuit includes a relay for automatically transferring control of the dryer following the drying operation from an electronic control circuit to a timer motor circuit to time the antiwrinkle period.

The present invention relates to improvements in fabric drying apparatus and, more specifically, to improvements in control circuitry and mechanisms for incorporating an antiwrinkle cycle in the operation of such dryers.

In other applications assigned to the same assignee as the present application, there are disclosed a method and apparatus for preventing deep set wrinkles in clothes that are left in a dryer after the termination of the normal drying cycle. Specifically, these applications disclose means for periodically tumbling the fabrics in the dryer for short periods of time, usually about 5 to 10 seconds, at predetermined regular intervals which may be 4 to 5 minutes or so. The resulting rearrangement of the fabrics in the drum has been found to reduce significantly the amount of deep set wrinkles which otherwise would occur if the fabrics were left for substantial periods of time in the dryer after the drying cycle had been completed.

While the improvements of the present invention are applicable to all types of dryers, they find particular utility in dryers employing electronic sensing devices to determine relative dryness of the fabrics in the drum. Such sensing devices usually employ a plurality of spaced electrodes mounted within the drum and arranged to be bridged by the fabrics being dried. As the drying proceeds and the moisture content of the fabric is reduced, the electrical resistance of the path between the electrodes increases and this change in resistance can be detected by a number of different types of sensing instruments. When the fabrics reach a predetermined dryness as reflected in the resistance changes, the signal derived from the electrodes can be used to operate suitable control equipment to terminate the drying phase of the operation.

An antiwrinkle cycle is an operation which should be continued until such time as the fabrics are removed from the drum. Thus, it is desirable to arrange the control circuitry such that when the access door to the dryer is opened, the antiwrinkle cycle will be automatically terminated. Such a circuit should contain a memory device so that reclosing the door does not re-initiate the antiwrinkle cycle.

In dryers utilizing electronic sensing devices, it is necessary to provide means for transferring control of the dryer from one device to another. In most dryers of this type, this transfer is from an electronic control system used to control the drying cycle to a cool down thermostat used to control the length of the cool down cycle which follows the termination of heated air into the drum and is the last step in the normal drying operation. The system of the present operation provides a control circuit which uses only a single relay to transfer the operation of the dryer from one control device to another and

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thereafter operates as a memory device for terminating the antiwrinkle cycle upon opening of the access door.

One of the objects of the present invention is to provide an improved control circuit for incorporating an antiwrinkle cycle into a fabric drying apparatus with a minimum of additional parts.

Another object of the invention is to provide an improved fabric drying apparatus of the electronic sensing type with an antiwrinkle cycle consisting of a compact unit which transfers the operation of the dryer from one control device to another and also operates as part of a memory device for terminating the antiwrinkle cycle.

A further object of the invention is to provide an improved electronic control circuit for drying apparatus which prevents re-initiation of the antiwrinkle cycle once the access door has been opened.

Other objects and features of the present invention will become apparent to those skilled in the art from the following description of the attached sheet of drawings which illustrates a preferred embodiment of the invention.

In the drawings:

FIGURE 1 is a circuit diagram illustrating somewhat schematically a dryer assembly which incorporates the improvements of the present invention; and

FIGURE 2 is a chart illustrating the condition of various timer operated switches during the complete sequence of dryer operation.

As shown in the drawings:

In FIGURE 1, reference numeral 10 indicates generally a drive motor for rotating the drying drum represented schematically at reference numeral 11. The drive motor 10 includes a running winding 12 and a starting winding 13. A centrifugal switch 14 has a switch arm 16 movable between a contact 17 connected to the starting winding 13 and a contact 18 associated with the running winding 12, depending upon the speed of rotation of the drum.

Line voltage is supplied to the assembly from a pair of terminals 19 and 21 supplied with 120 volts of alternating current potential. Another terminal 22 supplies a higher voltage, say 240 volts, to the heater elements of the circuit.

A timer motor 23 controls the position of a plurality of cams located on its motor shaft. One of the cams, identified at reference numeral 24 is used to open and close a switch 26 in the drive motor energizing circuit, the switch 26 being closed during the drying, cool down, and antiwrinkle cycles as illustrated in the chart of FIGURE 2. Timer motor 23 also has a cam 27 which operates a switch arm 28 to energize the heater circuit during the drying interval, as seen in the chart of FIGURE 2. A third cam 29 operates a switch 31, which switch is closed during the drying and cool down cycles as evident from an inspection of FIGURE 2.

After the timer has been manually reset to initiate a new drying operation, the initial operation of the assembly is commenced by operating a start switch 32 in the motor energizing circuit. A door switch 33 located adjacent the access door to the dryer is also in the energizing line for the drive motor 10, and ultimately serves to disable the antiwrinkle cycle components as will be apparent from the succeeding discussion.

The sensing devices located within the drum 11 have been illustrated diagrammatically as contacts 34 and 36 in FIGURE 1. As the heated air is introduced into the dryer drum, the electrical resistance between the contacts 34 and 36 is increased as the moisture is removed from the fabrics. This change in resistance constitutes a signal which is passed through a control circuit generally identified at reference numeral 37. During the normal drying cycle, a half wave rectified voltage is impressed across the contacts 34 and 36 by a diode 38 in series with a variable

resistor 39. When the fabrics are wet, the resistance is low and current passing through diode 38 and resistor 39 is passed to ground through the contacts 34 and 36. A resistor 41 and a capacitor 42 form an RC network across the contacts 34 and 36.

The control circuit 37 includes an electronic switch, this circuit including a gas discharge device such as a neon tube 43 in series with a current limiting resistor 44. The current passing through the neon tube 43 provides a signal for a silicon controlled rectifier 46. This silicon controlled rectifier 46 is in series with a coil 47 of a relay which has a pair of normally open contacts 48 and 49 which are closed when the relay coil 47 is energized.

A pulser motor 51 has a cam 52 connected to its shaft, which cam operates a switch contact 53 to periodically energize the drive motor 10 for short increments of time during predetermined intervals of the antiwrinkle cycle.

The heater circuit includes an electrical heater element 54 and a centrifugal switch 56 which closes when the drive motor 10 begins to rotate.

The following is a description of a typical operating cycle. With the control knob set in the start position, the timer 23 is preset, and the timer operated switches 26, 28, and 31 are all closed. When the start switch 32 is pushed, the circuit to the drive motor 10 is completed from terminal 19 through switch 26, the closed door switch 33, and the start switch 32. When the drive motor 10 starts to accelerate, the switch arm 16 moves from engagement with the terminal 17 to engagement with the terminal 18, thereby deenergizing the starting winding 13 as well as providing an alternate path to the other side of the energizing line when the start switch 32 is released. The rotation of the drive motor 10 causes the centrifugal switch 56 to close, thereby completing the circuit to the heater 54, since the switch arm 28 is also closed.

During the drying cycle, neither timer motor 23 nor pulser motor 51 are energized because the relay contacts 48 and 49 remain open. The relay coil 47 is deenergized because at this time in the cycle, the silicon controlled rectifier 46 is in a nonconductive state.

As the fabrics are tumbled in the drum, they bridge across the contacts 34 and 36. When the fabrics are wet, the resistance is low and current passing through the diode 38 and the resistor 39 is passed to ground through the contacts 34 and 36. As the fabrics become drier, the resistance increases and a charge begins to build up on the capacitor 42. When the voltage across the capacitor 42 reaches the firing voltage of the neon tube 43, at which time there is a predetermined level of dryness in the fabrics, the neon tube 43 will become conductive, and the capacitor 42 discharges through the tube 43 and resistor 44 to provide a gate signal for the silicon controlled rectifier 46, causing it to become conductive. The relay coil 47 is then energized through a circuit running from terminal 19, switch arms 26 and 33, relay coil 47, silicon controlled rectifier 46, switch arm 16, and switch arm 31. Energization of the relay coil 47 causes the normally open contacts 48 and 49 to close. The closing of the switch arm 48 provides a holding circuit for the relay coil through conductors 57 and 58 and also completes the circuit for the pulser motor 51. The closing of the switch arm 49 provides a completed circuit for the timer motor 23 through switch arm 26, switch arm 33, switch arm 49, switch arm 16 and switch arm 31. By this operation, the relay coil 47 transfers the control of the dryer from the electronic control circuit 37 to the timer motor 23.

Shortly after the timer motor 23 is energized, the cam 27 opens the switch 28, thereby opening the circuit to the heater element 54 and terminating the drying cycle. This commences the cool down cycle, wherein the drive motor 10 rotates the drum 11, and drives the blower (not shown) to cool the fabrics.

After a predetermined time interval, the timer motor 23 opens the switch 31, thereby opening the circuit to the drive motor 10 and to the timer motor 23. This ter-

minates the cool down period and commences the anti-wrinkle cycle.

During the anti-wrinkle cycle, the timer operated switch 26 remains closed, and therefore both the pulser motor 51 and the relay coil 47 remain energized through conductor 58 and the closed relay switch arm 48. The operation of the drive motor 10 and the timer motor 23 is thus placed under the control of the pulser motor 51 and its associated switch 53. Once every four or five minutes, the pulser motor 51 rotates the cam 52 into position where the switch 53 is closed, thereby energizing the drive motor 10 and the timer motor 23 for a five to ten second interval. The antiwrinkle cycle continues in this manner until the door has been opened, thereby opening the switch 33, or until a predetermined amount of time has elapsed.

If the operator should open the door during the anti-wrinkle cycle, the opening of the switch 33 deenergizes the relay coil 47 and switches 48 and 49 return to their normally opened position. When the door is reclosed, the pulser motor 51 is not reenergized since the switch 48 is now open. Thus, the opening of the access door serves to completely terminate the antiwrinkle cycle and the dryer will no longer operate until the timer motor 23 is reset. A door operated switch 59 closes upon opening of the access door to dissipate any charge which may remain on the capacitor 42.

If during the antiwrinkle cycle, the access door is not opened after a predetermined time interval, the timing motor 23 will eventually accumulate sufficient running time to open the switch 26, and thereby terminate dryer operation just as though the access door had been opened during this period.

From the foregoing, it will be understood that the control circuit of the present invention provides an antiwrinkle cycle for dryers, which circuit is particularly useful in connection with dryers having electronic sensing means. The control circuitry uses a small number of components and therefore does not add appreciably to the total cost of the dryer apparatus.

It should be evident that various modifications can be made to the described embodiments without departing from the scope of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A fabric drying apparatus comprising:
 - a rotatable drum for receiving fabrics to be dried;
 - a door providing access to the interior of said drum;
 - drive means for rotating said drum;
 - sensing means in said drum for sensing the degree of dryness of fabrics in said drum;
 - circuit means associated with the sensing means for terminating the drying cycle upon receipt of a signal derived from said sensing means;
 - a pulser means actuated by said circuit means and arranged to operate said drive means for predetermined short intervals of time periodically after completion of said drying cycle; and
 - switch means adjacent said door for disabling said pulser means from further operation upon opening of said door.
2. The drying apparatus of claim 1 which includes a timer means actuated by said circuit means to provide energization of said drive means for a cool down period of predetermined duration prior to operation of said drive means by said pulser means.
3. The drying apparatus of claim 1 which includes an RC network in parallel with said sensing means and an electronic switch triggered by the build-up of a sufficient voltage across such network to initiate operation of said pulser means.
4. A fabric drying apparatus comprising:
 - a rotatable drum for receiving fabrics to be dried;
 - a door providing access to the interior of said drum;
 - drive means for rotating said drum;

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sensing means in said drum for sensing the degree of dryness of fabrics in said drum;

circuit means associated with the sensing means for terminating the drying cycle upon receipt of a signal derived from said sensing means, said circuit means including an electronic switch and a relay energized by said electronic switch;

a pulser means actuated by said relay and arranged to operate said drive means for predetermined short intervals of time periodically after completion of said drying cycle; and

switch means adjacent said door for disabling said pulser means from further operation upon opening of said door.

5. A fabric drying apparatus comprising:

a rotatable drum for receiving fabrics to be dried, said apparatus having an access door;

drive means for rotating said drum;

means for continuously energizing said drive means during a first period of operation;

means for intermittently energizing said drive means for short periods of time during a second period of operation following said first period;

first control means for controlling said drying apparatus during a first portion of said first period;

second control means for controlling said drying apparatus during a second portion of said first period and operable to terminate said first period;

transfer means transferring control of said drying apparatus from said first control means to said second control means in response to a predetermined dryness of said fabric as determined by said first control means, said transfer means energizing said means for intermittently energizing said drive means;

door actuated switch means for terminating said second period upon opening of said door means; and

means including said transfer means for precluding further operation of said drying apparatus upon reclosing of said door means.

6. The fabric drying apparatus of claim 5 wherein said transfer means includes switch means connected with said second control means and a relay coil for operating said switch means whereupon energization of said relay coil in response to a predetermined dryness of said fabrics closes said switch means and thereby transfers control of said drying apparatus from said first control means to said second control means.

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7. A fabric drying apparatus comprising:

a rotatable drum for receiving fabrics to be dried;

a door providing access to the interior of said drum;

heating means for supplying heated air to the interior of said drum;

drive means for rotating said drum;

sensing means in said drum responsive to changes in electrical resistance in said fabrics as a measure of the dryness of said fabrics;

control circuit means including an electronic switch actuated by said sensing means when the electrical resistance sensed thereby reaches a predetermined value;

a relay coil energized by operation of said electronic switch;

a timer means;

a first contact operated by energization of said relay to energize said timer means;

first switch means actuated by said timer means to de-energize said heating means;

second switch means actuated by said timer means at a predetermined interval after actuation of said first switch means to deenergize said drive means;

a pulsing means energized through said relay means arranged to energize said drive means for short periods of predetermined regular intervals after de-energization of said drive means through said second switch means; and

a switch operated by opening said access door to disable further energization of said relay until said timer means is reset.

8. The drying apparatus of claim 7 in which said electronic switch includes an RC circuit and a gas discharge device.

9. The drying apparatus of claim 7 in which said pulsing means includes a pulser motor and a cam operated switch.

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