July 30, 1968 D. E. JANKE 3,394,465

DRYER WITH ANTI-WRINKLE CYCLE

Filed Sept. 26, 1966 2 Sheets-Sheet 1

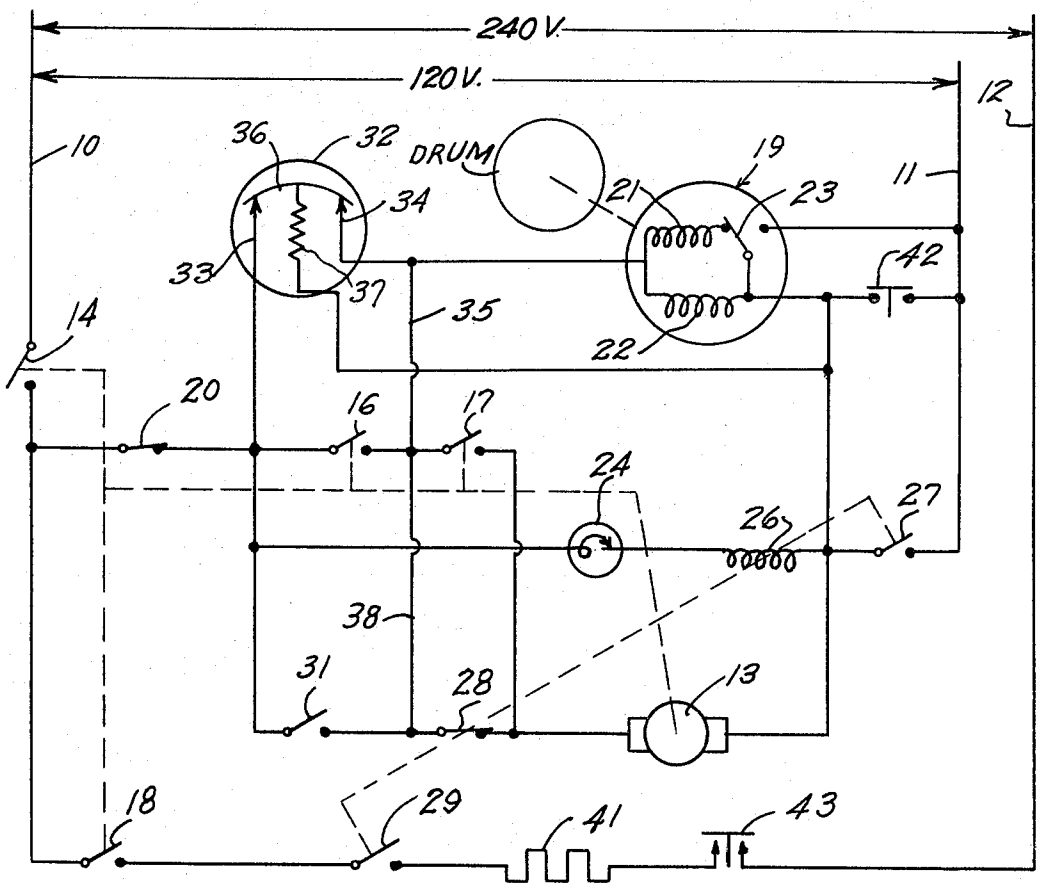

Fig. 1

Fig. 2

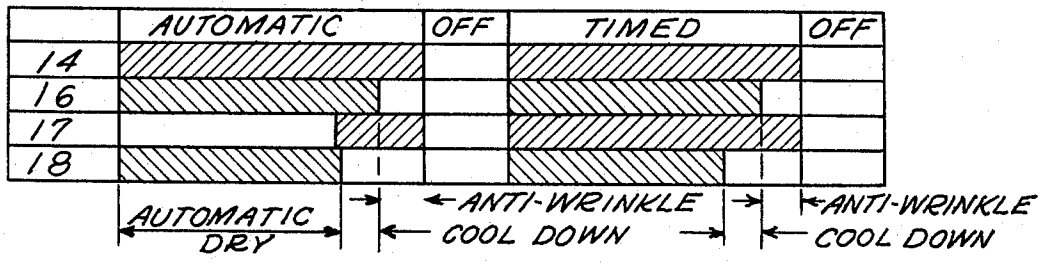

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Fig. 4

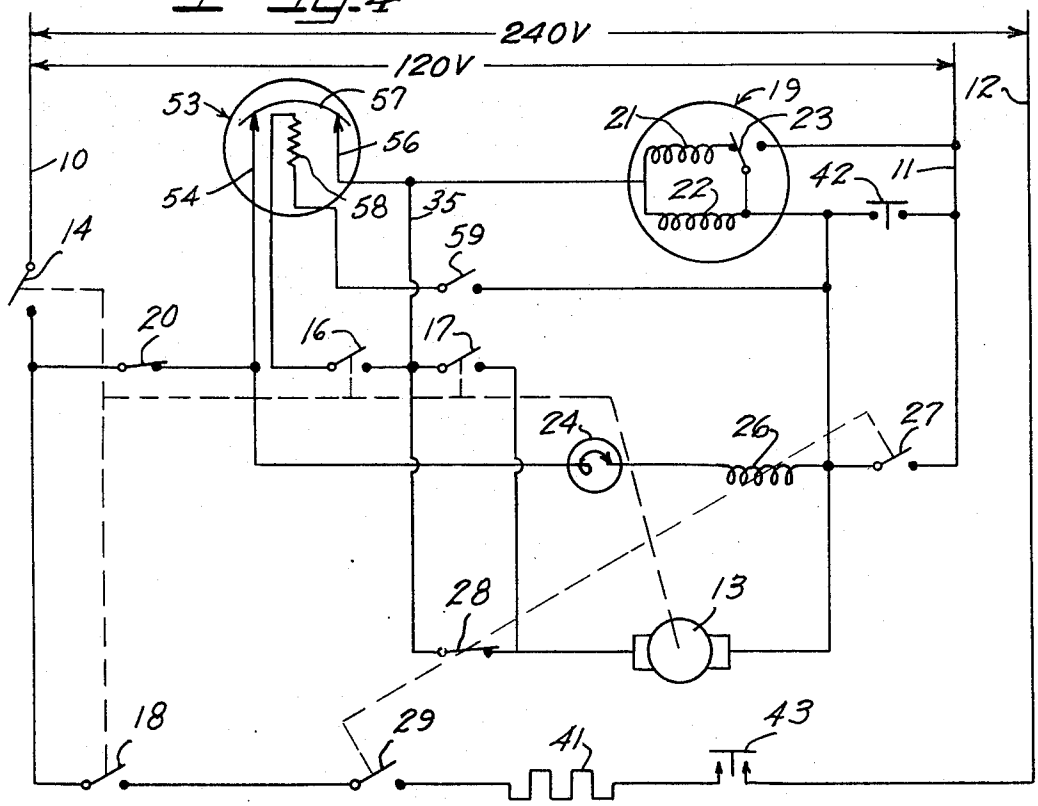


Fig. 5

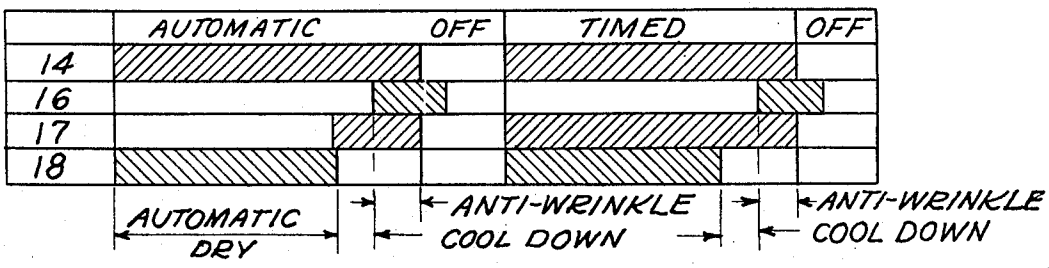
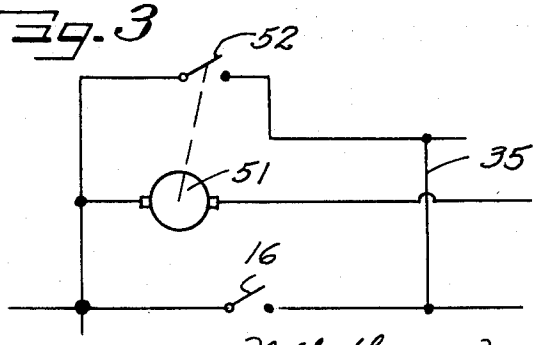


Fig. 3



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DRYER WITH ANTI-WRINKLE CYCLE

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8 Claims. (Cl. 34—45)

ABSTRACT OF THE DISCLOSURE

A clothes dryer having a control to provide intermittent tumbling of clothes after the normal drying period. The control is associated with a timer which is energized only for the intermittent periods of operation following the normal drying period to extend the total operation of the dryer.

The present invention relates to an improved automatic clothes dryer and, more specifically, to a control system for a dryer which includes an "anti-wrinkle" cycle.

In a copending application of Orr and Miller, Ser. No. 373,169, filed June 8, 1964, now Patent No. 3,286,359, and assigned to the same assignee as the present invention, there is disclosed a means for preventing the setting of wrinkles in clothes which have been allowed to remain in the dryer drum for any length of time. Specifically, that application showed that deep set wrinkles which tend to occur when clothes are left in the dryer for significant times after the drying cycle has been completed can be largely eliminated by a periodic fluffing of the clothes within the dryer for short periods of time at intervals.

The improved dryer of the present invention makes use of a conventional rotatable dryer drum, and drive means for rotating the same, together with a timer motor for providing a programmed series of drying operations including a normal drying period followed by a cool down period wherein the dryer operates without the addition of heat for a predetermined length of time.

The duration of the anti-wrinkle cycle is normally much longer than either the drying or cooling down cycles. Consequently, when an anti-wrinkle cycle is incorporated into a dryer assembly, it might be necessary to provide costly timing motor gear reduction equipment during the anti-wrinkle cycle in order that the entire cycle of operation might be represented on a control dial within 360° of rotation or less. The present invention eliminates this necessity by actuating the timer motor only intermittently during the anti-wrinkle cycle so that the timer motor is energized only for a matter of about 5 or 10 seconds every four to five minutes.

Another object of the invention is to provide an improved control circuit for dryers having an anti-wrinkle cycle wherein the timer motor used to time the drying and cool down cycles also terminates the anti-wrinkle cycle after a preselected time.

Another object of the invention is to provide a control circuit for a dryer of the type described with an impulsing means to energize the drive motor during the anti-wrinkle cycle, the impulser being operative only during the duration of the anti-wrinkle cycle.

Other objects and features of the present invention will become apparent to those skilled in the art from the following description of the attached sheets of drawings which illustrate several embodiments of the invention.

In the drawings:

FIGURE 1 is an electrical schematic diagram of a clothes dryer control system embodying one form of the present invention;

FIGURE 2 is a chart showing the condition of various timer operated switches during portions of the clothes drying cycle using the circuit of FIGURE 1;

FIGURE 3 is an electrical schematic of a portion of a control circuit which can be used in the placement of the impulser mechanism shown in FIGURE 1;

FIGURE 4 is an electrical schematic circuit of still another form of the invention;

FIGURE 5 is a chart showing the condition of the various timer operated switches of the circuit of FIGURE 4 showing the operation of the control circuit.

As shown in the drawings:

In FIGURE 1 reference numeral **10** has been applied to one side of an energizing voltage line, the other side being identified at reference numeral **11** for applying the circuitry with an alternating voltage of 120 volts. A third line **12** provides a voltage of 240 volts for operating the heater elements, as will be apparent from a succeeding portion of this description.

A timer motor **13**, which may be of the conventional type wherein a plurality of cams are disposed on the motor shaft to operate switches in desired timed relationship, operates a switch **14** in the line **10**, a switch **16** and a switch **17** in series. Another switch **20** is disposed in series with switches **16** and **17** operated by the timer, the switch **20** being located adjacent the door of the cabinet and being closed except when the door is opened.

The timer motor **13** also operates a switch **18** in the heater circuit.

The drive motor for a conventional rotating drum (not shown) is identified at reference numeral **19**, and includes a starting winding **21** and a running winding **22**. A centrifugal switch **23** constitutes part of the motor circuit.

An operating thermostat **24**, normally closed, is connected in series with a relay coil **26**, the relay coil **26** serving to operate a contact **27** in series with the coil **26**, a contact **28** in series with the timer motor **13**, and a contact **29** in the heater circuit.

A switch **31** is included in the circuit to selectively introduce the anti-wrinkle components into the circuitry, as will be apparent from a succeeding portion of this description.

Intermittent operation of the drive motor **19** is provided by the action of an impulser **32** having contacts **33** and **34** together with a bimetallic element **36**, and an electrical resistance heating element **37** coupled to the bimetallic element **36**.

The dryers of the present invention can be of the completely automatic type, that is, they can be provided with a sensing means which terminates the drying operation when the moisture content in the clothes reaches a predetermined low value. Alternatively, the dryers can be operated solely by the expiration of a predetermined time interval. It is contemplated that the operator would have the option to select either the automatic or the timed cycle. If the automatic cycle is selected, the operating thermostat **24** has control over the operation of the timer motor **13**, that is, the timer motor **13** will run only when the thermostat is open and the heater is off. If a timed cycle is selected, the operating thermostat loses control of the timer motor and the timer motor runs continuously so that the drying cycle is directly proportional to the elapsed time period.

Assuming an automatic cycle, the cycle begins with contacts **14**, **16** and **18** closed as shown in the chart of FIGURE 2. Line **10** is thereby connected to the driver motor **19** by means of the switch **14**, the door switch **20**, the switch **16** and a conductor **35** running to the motor **19**. The relay coil is connected to line **10** by means of switch **14**, door switch **20**, and the operating thermostat **24**. The timer motor **13** has one side connected to line **10** by means of a circuit which includes switch **14**, door switch **20**, switch **16**, a conductor **38** and the normally closed relay contact **28**.

The heater 41 is located in the line which is connected to the line 10 through switches 14 and 18, and normally open relay contact 29.

A start switch 42 connects the other side of the motor 19 to the line 11. Momentarily closing the start switch 42 completes the energizing circuit for the drive motor 19, the relay coil 26, and the timer motor 13. Once the motor 19 gets up to speed, the centrifugal switch 23 operates to cut out the starting winding 21 and to bypass the start switch 42. Upon energization of the relay 26, contact 27 closes to provide still another path around the start switch 42. Energization of the relay coil 26 also serves to open the contact 28, thereby preventing the timer motor 13 from running. After this sequence of events, the start switch 42 may be released.

Energization of the relay coil 26 also serves to close the contact 29 which energizes the heater 41. A second centrifugal switch 43 also closes when the motor 19 commences rotation, thereby completing the energizing circuit of the heater 41.

In automatic operation, introduction of heated air and tumbling of the fabrics within the rotating drum is continued until such time as the operating thermostat 24 senses a sufficiently high temperature in the air being vented from the dryer. The opening of the thermostat 24 deenergizes the relay coil 26. The contact 29 thereupon opens, terminating energization of the heater, and contact 28 closes to start operation of the timer motor 13.

When the temperature drops sufficiently to reclose the thermostat 24, the relay coil 26 is reenergized. The opening of the contact 28 thereupon deenergizes the timer motor 13 and closing of the contact 29 reenergizes the heater 41. This sequence of operations occurs throughout the drying part of the cycle when it is on automatic operation.

After the timer motor 13 has accumulated a predetermined amount of running time, one or more of its cams opens the contact 18 and closes the contact 17. It may be necessary that contact 17 is arranged to close slightly ahead of the time that contact 18 is arranged to open. Since contact 14 remains closed, contact 20 remains closed, and contact 16 remains closed, an energizing circuit is completed through the timer motor 13, so that it is no longer under the control of the operation of the thermostat 24. The timer then goes into the cool down phase. The closed contact 17 parallels the relay contact 28 to keep the timer motor 13 running regardless of whether contact 28 is open or closed.

During the cool down period, the operating thermostat 24 will reclose and reenergize the relay coil 26. Relay contact 27 then closes to provide an alternate path to line 11. Since the heater 41 is now off, the operating thermostat 24 will not reopen to drop out the relay contact 27 for the remainder of this cycle.

The timer motor 13 takes the timer into the anti-wrinkle cycle by opening the contact 16 as illustrated in the chart of FIGURE 2. The relay coil is still energized since the contact 14 is still closed and the thermostat 24 is closed. The drive motor 19 is then supplied with its energizing voltage through contact 14, door switch 20 and contacts 33 and 34 of the impulser 32. The timer motor remains energized through the same path, in addition to closed contact 17.

The bimetallic element 36 of the impulser 32 will snap open in a matter of seconds after energization by the electrical current due to motor current plus the heat generated by heater element 37. When it opens, both drive motor 19 and timer motor 13 stop and centrifugal switch 23 opens. The relay coil 26 remains energized since contact 27 is still closed. In a matter of a few minutes, the impulser 32 cools down enough to reclose. Then, drive motor 19 and timer motor 13 will re-start. After another predetermined short interval the impulser 32 will again open, and this oscillation continues until the timer motor running time has accumulated enough to reach the off position and open all the timer contacts. Thus it will be seen the timer motor is actuated only intermittently during the anti-wrinkle cycle so that final termination of the anti-wrinkle cycle may not occur for a considerable period of time after the drying and cool-down cycles. If at any time during the cycle, the door switch 20 is opened, the relay 26 drops out, thereby opening the contact 27 to prevent any further start up once the door is reclosed.

Switch 31 provides a manual control to selectively introduce the anti-wrinkle cycle into the operating cycle of the automatic clothes dryer. If switch 31 is closed, the contacts 33 and 34 of the impulser are bypassed, the timer motor 13 continues to run, and switch 14 and switch 17 are soon opened, completely terminating the operating cycle. However, if switch 31 is open, the intermittent operation of the drive motor and the timer motor continues throughout the anti-wrinkle cycle, as described above.

As illustrated in FIGURE 2, the sequence of operations in the timed type of operation is very similar to that occurring during the automatic operation, except that the contact 17 remains closed from the start of the operation through the end of the anti-wrinkle cycle. In this condition, the operating thermostat 24 loses control over the timer motor 13 and the timer motor 13 runs continuously so that the drying cycle is directly proportional to elapsed time.

The circuit of FIGURE 3 shows an alternative form of the invention where, instead of using an impulser of the bimetallic type such as shown in FIGURE 1, a second timer motor is employed for the impulsing function. In this form, a timer motor 51 and its associated contact 52 operated by a cam off the shaft of the timer motor 51 cooperate such that the contact 52 is opened repeatedly for an interval of several minutes, and then closed for a matter of 5 to 10 seconds to energize the drive motor 19 and the timer motor 13 during the anti-wrinkle cycle.

The circuit shown in FIGURE 4 is in some respects similar to that shown in FIGURE 1. Where possible, comparable reference numerals have been used in the two figures. The circuit of FIGURE 4, however, uses a slightly modified impulser 53. The impulser 53 includes a pair of contacts 54 and 56 normally bridged by a bimetallic strip 57 which is separate from an electrical resistant heating element 58 contained in the impulser. In this instance, however, the anti-wrinkle selector switch 59 is incorporated in the energizing lead of the heater 58 so that the heater 58 is periodically energized only during the anti-wrinkle cycle.

The main circuit to the drive motor 19 is through the impulser switch including contacts 54, 56, and 57. The timer operated switch 16 is closed at the end of the cool down cycle and thereby energizes the impulser heater 58 through the contacts 54, 56, and 57, contact 16 and the anti-wrinkle switch 59. In a very short time after the heater 58 is energized, the impulser switch opens to shut off the drive motor 19 and the heater 58. After 4 or 5 minutes of cool down, the impulser again closes to turn on the drive motor 19 and to energize the impulser heater 58. After 5 to 10 seconds, the impulser heater has heated sufficiently to again open the impulser switch, and the operation continues to repeat in this manner until the timer motor 13 has accumulated enough drive motor running time to cause the contact 14 to open, whereupon the operation of the dryer is completely terminated.

The chart of FIGURE 5 shows the differences occurring in the timer operation as between automatic and timed drying cycles. The significant difference occurs in the closing of the contact 17 from the beginning of the drying cycle to the end of the anti-wrinkle cycle in the case of the timed operation, whereas in the case of the automatic operation, the contact is closed only at the end of the automatic dry period.

From the foregoing, it will be understood that the control circuits of the present invention provide an anti-

wrinkle cycle for a clothes dryer which provide a convenient means for periodic tumbling of the clothes for short intervals after the termination of the normal drying cycle thereby minimizing the tendency to produce deep set wrinkles in the clothes. It should also 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. In a fabric drying apparatus including a rotatable drum, drive means for rotating said drum, and a timer motor, a control system comprising:

first switch means actuated by said timer motor for energizing said drive means through a drying period,

impulser means connected to said drive means for intermittently energizing said drive means and said timer motor jointly for short periods of time at the conclusion of said drying period, and

second switch means actuated by said timer motor for deenergizing said impulser means after the elapse of a predetermined amount of running time of said drive means.

2. The apparatus of claim **1** in which said impulser means are rendered operative only after the completion of a normal drying period.

3. In a fabric drying apparatus including a rotatable drum, drive means for rotating said drum, and a timer motor, a control circuit comprising:

a first normally closed switch arranged to continuously energize said drive means through a drying period,

impulser means for intermittently opening and closing said first switch, and

a second switch actuated by said timer motor to energize said impulser means at the conclusion of said drying period for intermittently energizing said drive means.

4. The apparatus of claim **3** wherein said timer motor is connected in series with said first switch, and said control system includes a third switch actuated by said timer motor for deenergizing said drive means after said timer motor has accumulated a predetermined amount of running time.

5. In a clothes drying machine including a rotatable drum, drive means for rotating said drum, and a timer, a control circuit comprising:

a first timer operated switch,

a second timer operated switch in series with said first switch,

a third timer operated switch in series with said second switch, said first, second and third switches, when closed, serving to connect one side of said timer to one side of an energizing line,

means including a relay operated switch connecting the other side of said timer to the other side of said energizing line,

a relay coil arranged to close said relay operated switch,

a heater for introducing heated air into said drum,

a fourth timer operated switch in the energizing circuit for said heater,

said timer being arranged to actuate said machine through a drying cycle of predetermined duration, terminated by the opening of said fourth switch to thereby deenergize the heater, said third switch closing approximately upon the opening of said fourth switch to maintain said timer energized, said second switch opening after a predetermined cool down interval after the opening of said third switch, and said first switch opening a predetermined interval after said second switch to thereby provide a predetermined anti-wrinkle cycle,

and means intermittently energizing said drive means to rotate said drum for short discrete intervals during said anti-wrinkle cycle.

6. The machine in claim **5** in which said last named means includes a bimetallic element.

7. The machine of claim **5** in which said last named means includes a second timer.

8. The machine in claim **6** in which said last named means is actuated only after the completion of said drying cycle.

References Cited

UNITED STATES PATENTS

3,286,359	11/1966	Orr et al.	34—53 XR
3,286,364	11/1966	Morrison et al.	34—53 XR

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,394,465 Dated July 30, 1968

Inventor(s) Donald E. Janke

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the drawings:

Figures 4 and 5, change "16" to read --16a--.

In the specification:

Column 4, lines 52 and 54, change "16" to read --16a--.

Column 6, line 24, change "opening" to read --closing--.

Signed and sealed this 10th day of August 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents