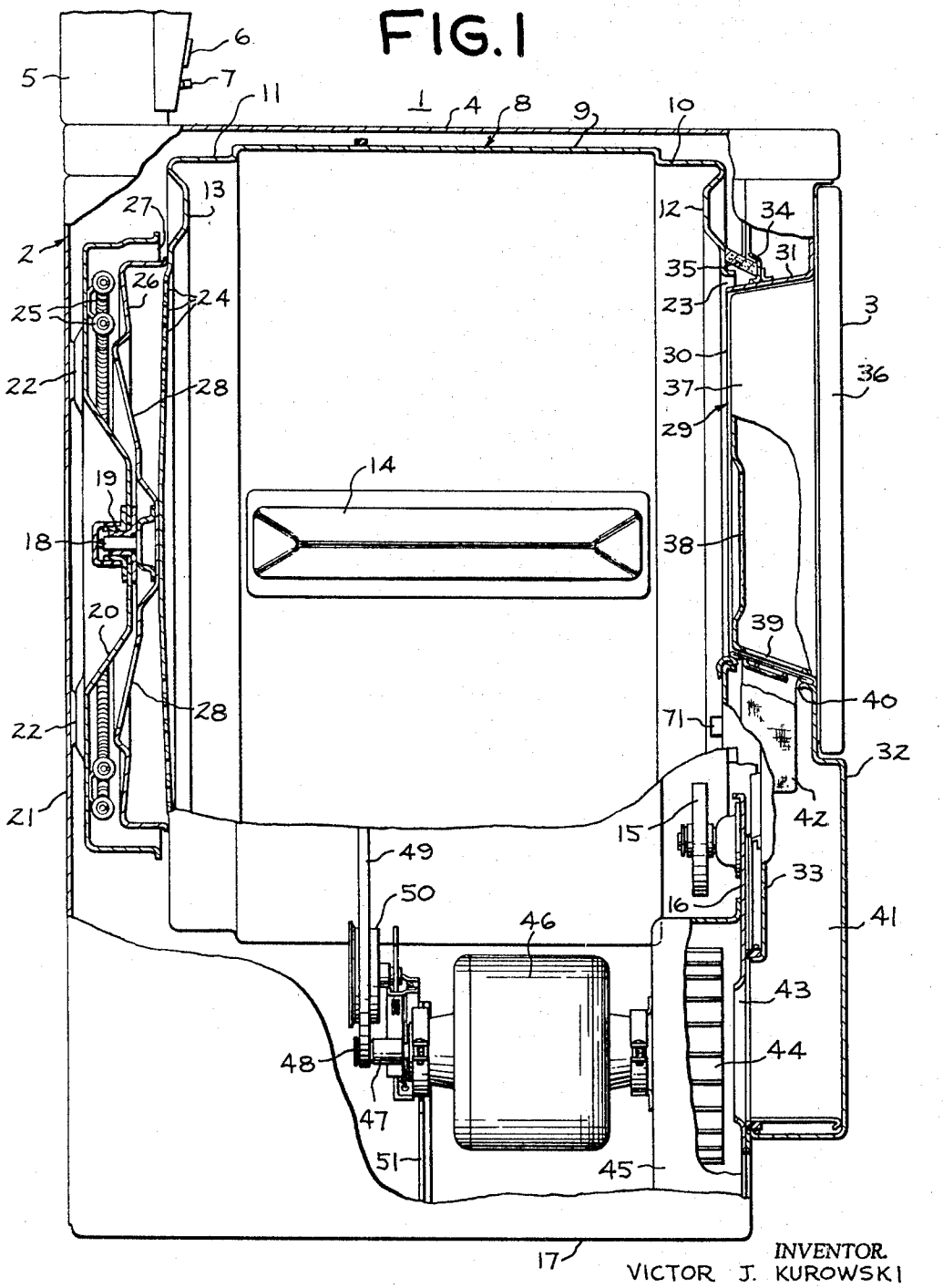
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DRYER CONTROL

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FIG. 1



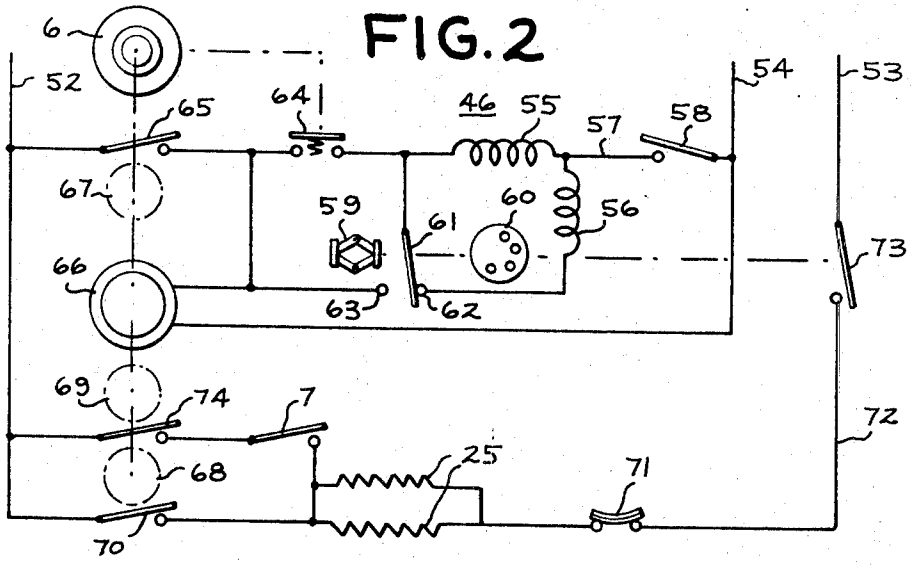

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DRYER CONTROL

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FIG. 2



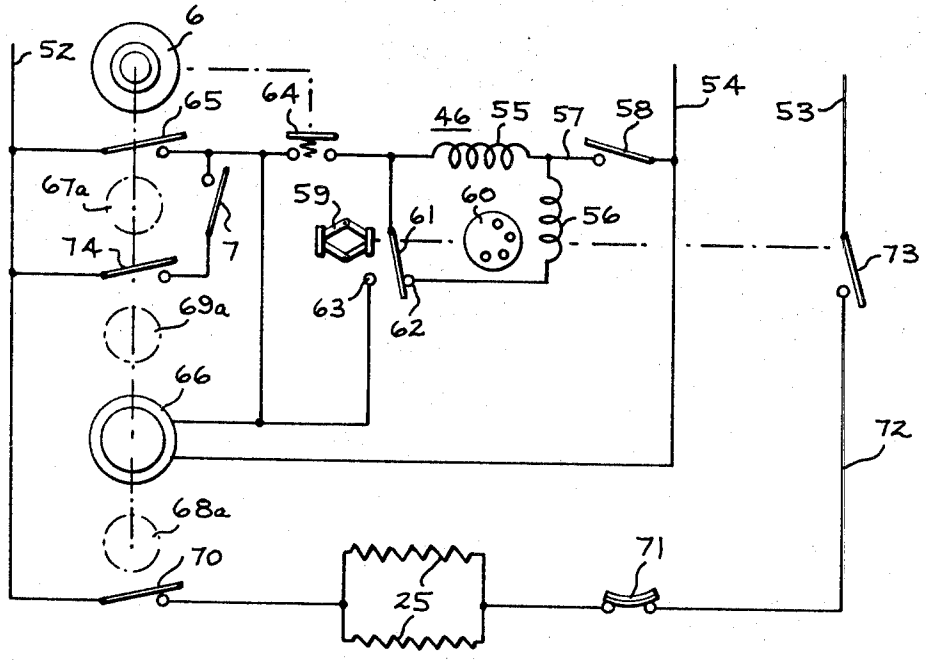




FIG. 3

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3,381,389

# DRYER CONTROL

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4 Claims. (Cl. 34—45)

## ABSTRACT OF THE DISCLOSURE

A clothes dryer control includes a heat switch, normally effective when operated, to de-energize the heater after a first period of operation and a power switch normally effective when operated to de-energize the power means after a second, longer period of operation to provide a sequence of operation including a heated drying period followed by a non-heated cool-down period. A series connection of a manual switch and an optional switch is connected in parallel with one of the heat and power switches. The optional switch is operated after a period of operation longer than the period associated with the switch in parallel with it, so that the length of cool-down operation may be varied by varying the manual switch between open and closed positions.

### *Background of the invention*

With the advent of so-called permanent press fabrics, it became desirable for automatic clothes dryers to have two drying cycles for each general type of fabrics. This is because fabrics which have been treated so as to be in the permanent press category need a drying cycle with a longer cool-down operation than similar material which has not been so treated. Most types of fabrics normally dried in automatic clothes dryers are now available in both the regular and permanent press form. Thus it is desirable that each drying operation be coupled with a long and with a short cool down.

Automatic dryer controls normally include a group of generally circular cam surfaces, placed in juxtaposition and driven by a timer motor to operate the various control switches of the dryer. With the switch arrangements of prior dryers, it was necessary to use entirely different circumferential portions of the cam surfaces to control the machine for regular and for permanent press cycles of operation. This caused larger and more complicated control arrangements with attendant complicated user control setting procedures.

An object of the present invention is to provide a simplified control which selectively will provide different lengths of cool down operation.

Another object of this invention is to provide such a control in which the same general circumferential portion of the associated cams may be used regardless of the length of the selected cool down operation.

### *Summary of the invention*

In accordance with one embodiment of this invention there is provided a fabric dryer including a container for receiving fabrics to be dried, power means for tumbling the fabrics in the container and heating means arranged to heat the fabrics in the container. A circuit is provided to connect the operative elements of a dryer to a source of electrical power. The circuit includes a heat switch, normally effective when operated to de-energize the heating means; a power switch, normally effective when operated to de-energize the power means; and a series connection of a manual switch and an optional switch connected in parallel with either the heat or the power switch. Sequence control means are included and operatively connected to the heat, power and optional



switches. The sequence control means operates the heat switch after a first period of dryer operation; the power switch after a second, longer period of dryer operation; and the optional switch after a third period of dryer operation, longer than the period of operation associated with the switch connected in parallel with the optional switch. This provides a heated drying operation followed by a non-heated cool down operation with the length of the cool down operation being varied by the setting of the manual switch.

### *Brief description of the drawings*

FIGURE 1 is a side elevational view of a clothes dryer which may incorporate the improved dryer control arrangement of this invention, the view being partly broken away and partly sectionalized for purposes of illustration;

FIGURE 2 is a simplified, schematic electrical circuit diagram of a control circuit incorporating one embodiment of this invention; and

FIGURE 3 is a simplified, schematic electrical circuit diagram incorporating another embodiment of this invention.

### *Description of the preferred embodiments*

Referring now to FIGURE 1, there is shown therein a typical fabric drying machine **1** in which my improved control may be used. Dryer **1** is provided with a cabinet **2** having a front door **3** to provide access to the interior of the cabinet for loading and unloading fabrics such as clothes. Provided on the top wall **4** of cabinet **2** is a control panel **5** which includes suitable manual controls such as dial **6** and switch **7**.

Within cabinet **2**, there is provided a clothes receiving container or drum **8** mounted for rotation on a substantially horizontal axis to tumble fabrics contained therein. Drum **8** is substantially cylindrical in shape, having a first, central, cylindrical outer wall portion **9**, second and third outer, cylindrical wall portions **10** and **11**, located adjacent the ends 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 entire outer shell of the drum is imperforate. On the interior surface of the central portion **9** there are provided a plurality of clothes tumbling ribs **14** so that clothes are lifted up when the drum rotates and then tumble back down to the bottom of the drum.

The drum is rotatably supported within outer housing **2** by two idler wheels, one of which is shown at **15**. These wheels are rotatably secured at the top of a member **16** which extends up from base **17** of the machine. Wheels **15** are disposed beneath the drum in contact with the portion **10** thereof so as to support portion **10** on each side to provide a stable support.

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

In order to provide for the flow of a stream of drying air through the clothes drum, the drum is provided with a central aperture **23** in its front wall **12** and with an opening in the form of a plurality of perforations **24** in its rear wall **13**; the perforations in the present case being formed to extend around the rear wall in an annulus baffle member **20** also supports heating means such as electric heating elements **25** which are appropriately insulated from

the baffle member and are annular in shape so as to be generally coextensive with the perforations 24 in drum 8. A 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 inlet 27 is, in effect, formed by baffles 20 and 26. In this manner a passage is formed for air to enter annular inlet 27, pass over the heating elements 25, and then pass through openings 28 formed in baffle 26 and the perforations 24 to the interior of drum 8.

The front opening 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 of member 33 of an exhaust duct which is formed by the cooperation of member 33 with the front wall 32 of the cabinet, and an annular 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 the drum opening 23 and the edge of the bulkhead 29 so that there is no rubbing between the drum 8 and the bulkhead during rotation of the drum. In order to prevent any substantial air leakage through opening 23 between the interior and the exterior of the dryer, a suitable ring seal 35, preferably formed of felt-like material, is secured to flange 34 in sealing relation with the exterior surface of drum wall 12.

Front opening 23, in addition to serving as part of the flow path through the drum also serves as a means whereby fabrics 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 open, fabrics may be inserted into or removed from the drum through door frame 31. The door includes an outer flat imperforate section 36 and inwardly extending, hollow section 37 mounted on the flat outer section. Hollow section 37 extends into the door frame 31 when the door is closed and the door surface 30, which comprises part of the combination bulkhead 29, is actually the inner wall of the hollow section.

The air outlet from the drum is provided by a perforated opening 38 in the inner wall 30 of hollow door section 37. The bottom wall section of door 3 and the adjacent wall of door frame 31 are provided with aligned openings 39 and 40, providing the entrance to the exhaust duct 41, formed by the cooperation of member 33 with front wall 32. A lint trap 42, which may comprise a fine mesh bag, preferably positioned in the exhaust duct 41 at opening 40, the bag being supported by the door frame 31.

Duct 41 leads downwardly to an opening 43 formed in the member 16 which supports wheels 15. Opening 43 constitutes an inlet to a blower member 44, contained within a housing 45 and directly driven by an electric motor 46. Opening 43 connects duct 41 to blower 44 so that the blower may draw air in over heaters 25, through the drum, and then through the door 3 and the duct 41, 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 has a shaft 47 with a small pulley 48 formed thereon. 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 fabrics therein. In order to provide proper tensioning of the belt 49, there is provided a suitable idler assembly 50 secured on the same support 51 which supports one end of the motor. Thus, the air is pulled through the drum and, at the same time, the fabrics in the drum are tumbled. When the air is heated by heating elements 25, 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 machine. At the conclusion of such a heated drying operation, deenergization of the heating elements 25 while energization of motor 46 is continued will cause unheated air to be drawn through the drum as the fabrics are tumbled therein to provide a non-heated cool down operation.

The operation of dryer 1 may be controlled by the new and improved control system shown in schematic form 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 52 and 53 and a neutral conductor 54. For domestic use, conductors 52 and 53 normally will be connected across a 220 volt power supply, with 110 volts appearing between the neutral conductor 54 and each of the supply conductors, and with the neutral conductor being at ground potential. The power means or motor 46 is connected between the conductors 52 and 54 and is a single phase, induction-type motor having a main winding 55 and a start winding 56, both connected at a common end to a conductor 57 which, in turn, is connected through a door switch 58 to conductor 54. The door switch is of the type which is closed when door 3 is closed and is open when the door is open.

The start winding 56 is connected in parallel with main winding 55 under the control of a speed responsive device, such as that shown at 59. The speed responsive device is connected to the rotor 60 of the motor 46 (as shown schematically in FIGURE 2). The speed responsive device controls a switch 61 which is engageable with either a contact 62 or a contact 63, being engaged with contact 62 when the machine is at rest and moving into engagement with contact 63 as the motor comes up to speed. It really can be seen that engagement with contacts 62 connects the start winding 56 in parallel with main winding 55, while movement of switch 61 away from this position opens the start winding. Thus, as rotor 60 comes up to speed, the start winding becomes deenergized and the motor thereafter runs on the main winding alone.

The starting of the motor is provided for by a manually operable switch 64 which may, for instance, in the structure of FIGURE 1, be moved to its closed-position by pushing in on dial 6. Switch 64 connects the motor to the supply conductor 52 through power switch 65. Switch 64 is normally biased to the open position shown; however, when dial 6 is pushed in manually, and provided that switch 65 is closed, energization of the motor is provided. Within less than a second then, under normal circumstances, the motor comes up to speed so that switch 61 engages contact 63. As a result of this movement of the centrifugally responsive switch 61, the main winding 55 of motor 46 continues to be energized by a bypass around switch 64 when dial 6 is released and switch 64 opens.

A timer motor 66 controls a cam 67 which, in turn, controls power switch 65. The timer motor also controls two other cams 68 and 69. The timer motor 66 and cams 67, 68 and 69 are interconnected with the dial 6 so that the cams may be preset by rotation of dial 6 to set a desired sequence of operation and then controlled by timer motor 66 to provide that sequence. When operation of the machine is desired dial 6 is rotated until cam 67 causes power switch 65 to close. The machine operation is terminated, as will be seen herebelow, when cam 67 has been rotated sufficiently by the timer motor 66 to open switch 65, thus breaking the circuit to both main motor 46 and timer motor 66.

An energizing circuit is completed for heating elements 25 through a circuit running from conductor 52 through a heat switch 70 controlled by cam 68 to heating elements 25, and then through a safety thermostat 71 to a conductor 72 leading back through a switch 73 to conductor 53. The safety thermostat 71 may be positioned on the front stationary bulkhead of the dryer, as shown in FIGURE 1, to sense the temperature of

the air exiting from the machine and any clothes which physically contact the thermostat so that it will be effective to interrupt the energization of heating elements **25** in the event the temperature rises to an excessive level. The switch **73** also is connected to the centrifugal responsive device **59** so that the switch **73** is open when motor **46** is at rest or rotating below operational speed and closes as the motor comes up to operational speed. Thus, the heating means cannot be energized unless the motor is rotating at operational speed.

An optional switch **74**, controlled by cam **69**, is connected in series with manual switch **7** and this series connection is connected in the control circuit in parallel with heat switch **70**. This provides a bypass around heat switch **70** from conductor **52** to heating elements **25**, when manual switch **7** is closed.

The cams **67**, **68** and **69** are rotated concurrently by the timer motor **66**, and in fact, may be three juxtaposition surfaces on a single cam stack. The arrangement of parts which has been described thus far provides a new and improved control for the dryer wherein generally the same circumferential portion of the cams may be utilized to provide a normal drying cycle as well as a permanent press drying cycle.

For the permanent press drying cycle the manual switch **7** is placed in its open position, dial **6** is rotated to provide the required amount of timer motor run time for the particular clothes load in the machine and the dial **6** is then pushed in, closing switch **64**. The rotation of dial **6** has caused cams **67**, **68** and **69** to close switches **65**, **70** and **74** respectively and, assuming door **3** is closed to close switch **58**, motor **46** will begin to rotate and quickly come up to speed. This causes switch **61** to move from contact **62** to contact **63**, so that the motor **46** continues to run after dial **6** is released. The rotation of the motor at operational speed also causes switch **73** to close so that heating elements **25** are energized, under the additional control of thermostat **71**, to maintain a predetermined temperature within the dryer.

This mode of operation continues with timer motor **66** causing the cams **67**, **68** and **69** to rotate for a period of time sufficient to provide the desired heated period of drying operation. At the conclusion of that period, cam **68** causes switch **70** to open and, since manual switch **7** is open the heating elements will be de-energized. Timer motor **66** and main motor **46** continue to run to provide a non-heated period of cool down operation. At the end of this period of operation, cam **69** causes switch **74** to open; however, since switch **7** already is open, this has no effect on the operation of the machine. When timer motor **66** rotates the cams sufficiently for cam **67** to open switch **65** the timer motor and the main motor are de-energized and the de-energization of the main motor causes switch **73** to open so that the circuit is effectively completely disconnected from the source of electrical energy.

To provide a normal drying cycle manual switch **7** is closed however; the dryer is otherwise set for operation in the same manner as previously described. With manual switch **7** closed, cam **68** opening switch **70** at the end of the first period of operation will have no effect on the operation of the dryer, because the circuit is completed from conductor **52**, through switches **74** and **7** to heating elements **25**. The cycle or period of heated drying operation will continue until cam **69** causes switch **74** to open, at which time the heater **25** will be de-energized. Subsequently cam **67** will open switch **65** to completely de-energize the machine, at the end of the non-heated cool down period.

One typical configuration for the cam **66**, **68** and **69** would be such as to have cam **68** open switch **70** ten minutes before cam **67** opens switch **65** and to have cam **69** open switch **74** three minutes before cam **67** opens switch **65**. Thus, with switch **7** open, there will be a ten minute cool down operation, and, with switch **7** closed, there will be a three minute cool down operation.

With the simple straight time controls schematically illustrated in FIGURE 2, the dial **6** then may be provided with two scales, one labeled permanent press and the other labeled regular, for example, and when switch **7** is closed to provide the short cool down the dial would be rotated to the appropriate position using the regular scale while, when manual switch **7** is to be left open for a long cool down permanent press operation, dial **6** would be rotated to the appropriate setting on the scale labeled permanent press. It will be obvious that the only difference between these scales will be that the time for the permanent press scale is measured from when cam **68** opens switch **70** while the time on the regular scale is measured from when cam **69** opens switch **74**.

FIGURE 3 schematically illustrates a slightly different circuit, incorporating another embodiment of my invention. Basically, the circuit is the same as that of FIGURE 2 and the same numerals have been used to identify parts which are the same. The difference resides in the cam and switch arrangement. The heat switch **70** is controlled by a cam **68***a*, the power switch **65** is controlled by a cam **67***a* and the optional switch **74** is controlled by a cam **69***a*. Additionally, the series connection of the optional switch **74** and manual switch **7** is connected in parallel with the power switch **65** rather than the heat switch **70**.

With the circuit shown in FIGURE 3, the cam **68***a* will cause switch **70** to be opened after a first predetermined period of operation determined by rotation of dial **6**. At the end of a second longer predetermined period cam **67***a* will open power switch **65** and at the end of a third, even longer, period of operation cam **69***a* will open switch **74**. By way of example cam **67***a* may be set to open switch **65** three minutes after cam **68***a* opens switch **70** and cam **69***a* may be set to open switch **74** ten minutes after switch **70** is opened. With switch **7** open this will provide a regular drying cycle with a three minute cool down and, with switch **7** closed, it will provide a permanent press cycle with a ten minute cool down. Thus, it will be seen that, in a manner similar to the circuit of FIGURE 2, substantially the same circumferential portions of the cams **67***a*, **68***a* and **69***a* may be utilized to provide both regular drying cycles of operation and permanent press cycles of operation.

While a simplified basic circuit has been described for purposes of illustration and ease of understanding, it will be realized that various modifications and additions may be made thereto without departing from the scope of the invention.

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

What is claimed as new and desired to be secured by Letters Patent of the United States is:

**1.** A fabric dryer including:

(a) a container for receiving fabrics to be dried;

(b) power means for tumbling fabrics in said container;

(c) heating means arranged to heat fabrics in said container;

(d) a circuit for connecting the operative elements of said dryer to a source of electric power;

(e) said circuit including a heat switch, normally effective when operated to de-energize said heating means,

(f) said circuit also including a power switch, normally effective when operated to de-energize said power means;

(g) said circuit further including a series connection of a manual switch and an optional switch connected in parallel with one of said heat and power switches;

(h) sequence control means operatively connected to said heat, power and optional switches, said sequence control means operating said heat switch after a first period of dryer operation, said power switch after a second longer period of dryer operation, and said optional switch after a third period of dryer operation, longer than the period of operation associated with the switch connected in parallel with said optional switch, thereby to provide a heated drying operation followed by a non-heated cool down operation, the length of the cool down operation being varied by the setting of said manual switch.

**2.** A fabric dryer including:

(a) a container for receiving fabrics to be dried;

(b) power means for tumbling fabrics in said container;

(c) heating means arranged to heat fabrics in said container;

(d) a circuit for connecting the operative elements of said dryer to a source of electric power, including sequence control means to cause said dryer automatically to proceed through a sequence of operation;

(e) a heat switch connected in said circuit in series with heating means and controlled by said sequence control means normally to de-energize said heating means after a first predetermined period of operation;

(f) a power switch connected in said circuit in series with said power means and controlled by said sequence control means normally to de-energize said power means after a second, longer predetermined period of operation so that said dryer performs a



heated drying operation followed by a non-heated cool down operation; and

(g) a series connection of a manual switch and an optional switch connected in said control circuit in parallel with one of said heat and power switches;

(h) said sequence control means being effective to control said optional switch after a third predetermined period of operation, longer than the period of operation associated with said one of said heat and power switches, whereby the length of said non-heated cool down operation selectively may be varied by the opening and closing said manual switch.

**3.** The dryer as set forth in claim **2** wherein said series connection is connected in parallel with said heat switch whereby the period of operation of said power means is independent of said manual switch and the period of operation of said heating means is varied by the setting of said manual switch.

**4.** The dryer as set forth in claim **2** wherein said series connection is connected in parallel with said power switch whereby the period of operation of said heating means is independent of said manual switch and the period of operation of said power means is varied by the setting of said manual switch.

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