Jan. 21, 1958 E. SOFFER 2,820,623

CLOTHES DRIER

Filed April 20, 1956 4 Sheets-Sheet 1

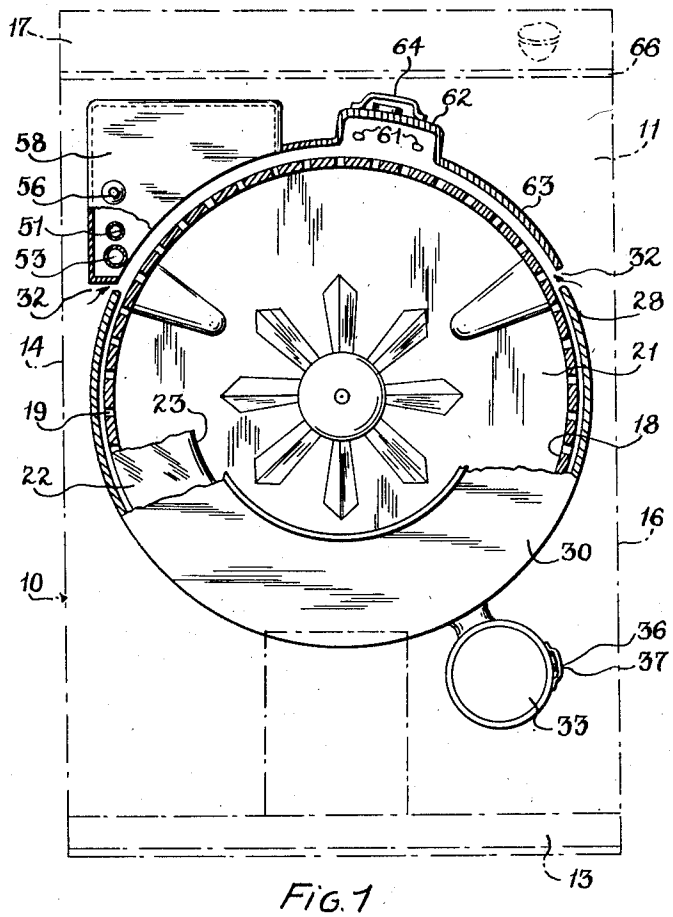

FIG. 1

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CLOTHES DRIER

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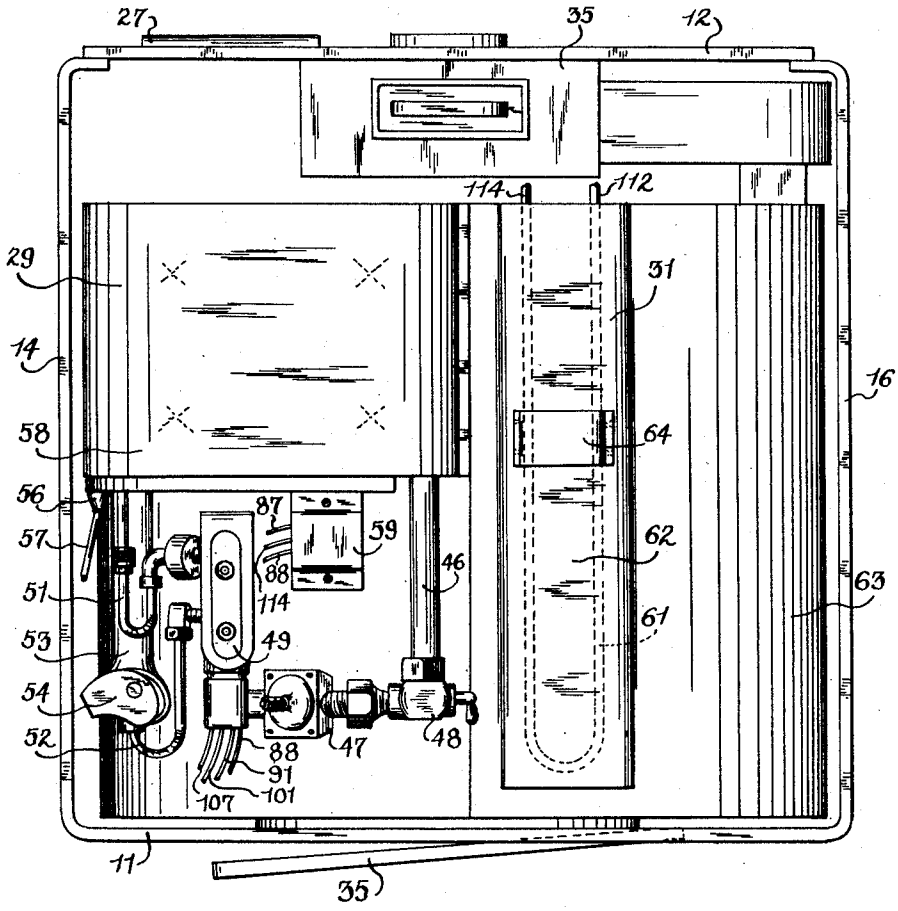

FIG. 2

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CLOTHES DRIER

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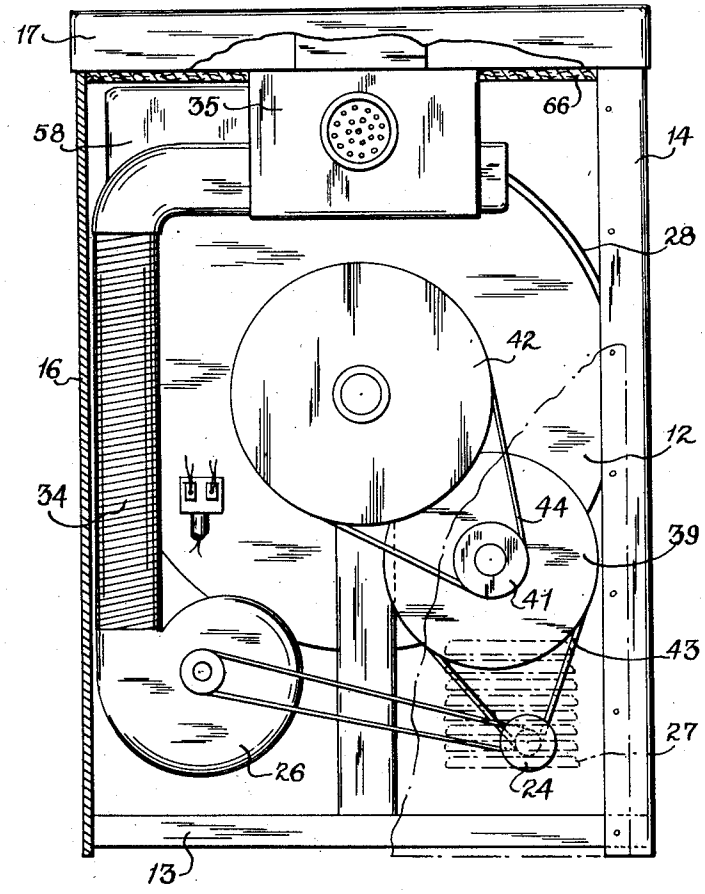

Fig. 3

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CLOTHES DRIER

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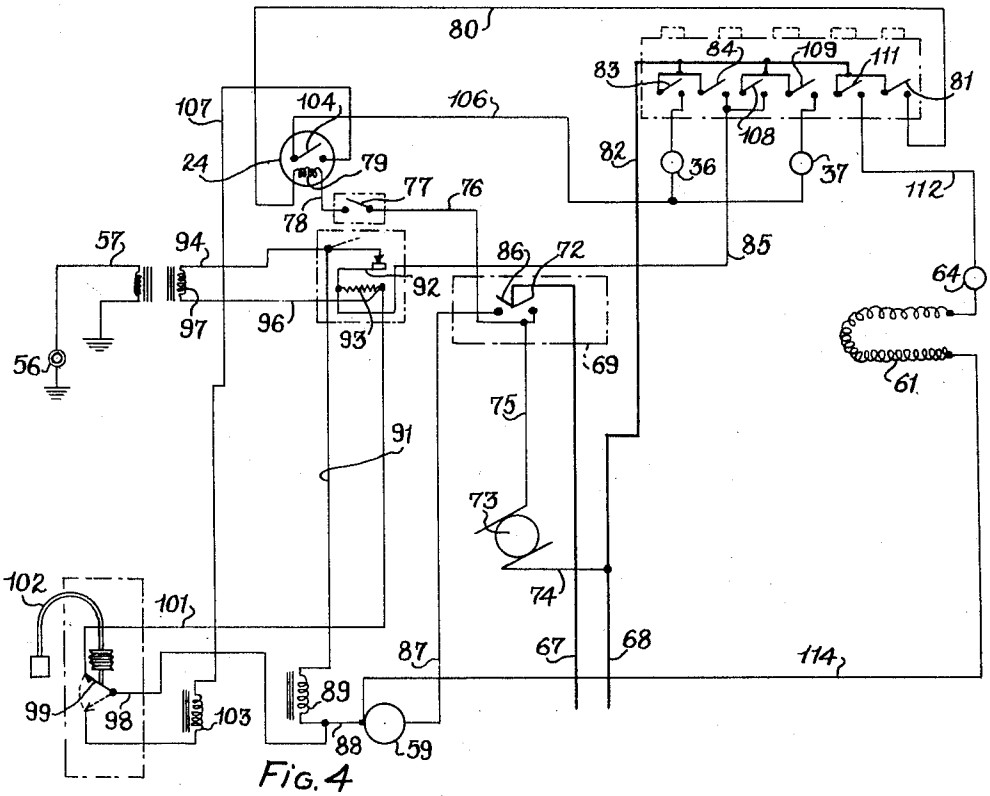

Fig. 4

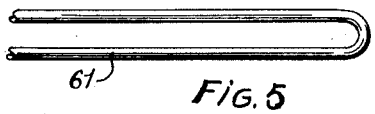

Fig. 5

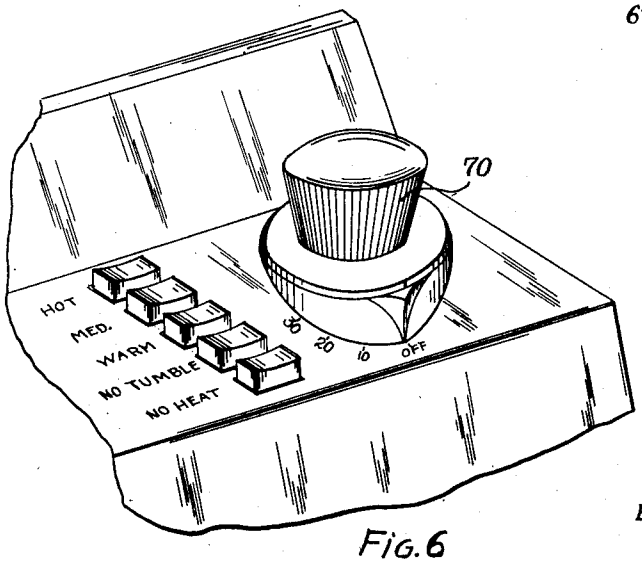

Fig. 6

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CLOTHES DRIER

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Application April 20, 1956, Serial No. 579,691

1 Claim. (Cl. 263—33)

This invention relates to clothes dryers, and more particularly to a clothes dryer wherein the circulating air can be selectively heated by gas or electrical means through a common control.

I am aware that it is well known to provide gas heating means for clothes dryers wherein air is heated by a gas flame prior to circulating the air through the clothes containing drum. In many localities it is considerably more economical to operate a clothes dryer with gas rather than electricity as the heating means. Also I am aware that different heat ranges are provided on gas type clothes dryers such as "hot," "medium" and "warm." Due to the practical difficulty and cost of controlling the heat range by varying the rate of gas supply by valve means it is common practice to supply gas at a relatively constant rate and use thermostatic means to cut off the gas supply at different temperatures. In other words, the air is heated at substantially the same rate for all desired conditions and the thermostatic means is usually responsive to the temperature of air exhausted from the clothes drum since it is impractical to have the thermostatic means responsive to temperature within the revolving drum.

This arrangement, particularly when a "warm" drying temperature is desired, is objectionable in several respects. First, the exhaust air temperature does not accurately correspond to drum temperature. Second, thermostats for clothes dryers which can be procured at reasonable cost usually have a tolerance of about plus or minus ten degrees as to cut off temperature. Due to the temperature drop of air passing from the drum to the exhaust tube in which the thermostatic means is usually disposed and the permissible range of thermostat cut off temperature the drum temperature of a conventional gas dryer cannot be accurately controlled. This can frequently result in damage to articles being dried, particularly delicate articles such as those made of nylon or similar synthetic fabrics, which should be dried at relatively low temperature. It is usual practice to subject articles being dried to a predetermined drying period controlled by a timer and in the case of delicate articles having a desirable drying temperature such as 90° F. if the gas supply is not cut off until the exhaust air temperature reaches 100° F. the articles in the drum may be subjected to a substantially higher temperature. If the high rate gas supply is intermittently supplied during the drying period the drum may be subjected to relatively high heat for a substantial time during which the exhaust air temperature is increasing to a point where the thermostat will cut off the gas supply. In the case of certain delicate fabrics or articles it is desirable to effect drying without tumbling but this cannot be done in a conventional gas type dryer without danger of burning or damaging the articles.

I have developed an arrangement whereby the above mentioned disadvantages of a conventional gas type clothes dryer, particularly when employed for drying delicate articles, may be overcome. According to the invention, I provide a clothes dryer adapted to operate as a generally conventional gas type dryer wherein the clothes

are tumbled for predetermined periods while being subjected to heated air flow and wherein the gas heat may be cut off at different air temperatures. Additionally I provide low temperature electrical heating means wherein delicate articles can be subjected to a low drying temperature without tumbling and without air circulation. Further, the dryer is adapted to tumble articles without heating the air whereby the articles will be dried by circulating air at room temperature.

It is a primary object of the invention to provide an improved clothes dryer adapted through common control means to selectively operate as a generally conventional gas type dryer and as a low temperature electrical type dryer when drying delicate articles.

Another object of the invention is to provide a clothes dryer of the above type wherein delicate articles can be safely dried without tumbling and without air circulation.

Another object of the invention is to provide a clothes dryer of the above type which is relatively economical of manufacture.

Other objects of the invention and the invention itself will become increasingly apparent from a consideration of the following description and drawings wherein:

Figure 1 is a front elevational view, partially in section, illustrating a clothes dryer embodying the invention.

Figure 2 is a top plan view of the dryer with the cover removed.

Figure 3 is a rear elevational view of the dryer with the rear wall partially cut away.

Figure 4 is a wiring diagram for the dryer illustrated in Figure 1.

Figure 5 shows a preferred type of electrical heating element I may use and

Figure 6 is a fragmentary view of the dryer control panel.

Referring now to the drawings and particularly Figures 1, 2 and 3 I have indicated generally at **10** a box form cabinet comprising a front wall **11**, a rear wall **12**, a base **13**, side walls **14** and **16**, and a top cover **17**. Rotatably mounted in a conventional manner within cabinet **10** is a drum **18** having a perforated cylindrical wall **19**, a disc form rear wall **21**, and a front wall **22** formed with a circular opening **23** for transferring articles to and from the drum. An electric motor **24** is adapted to rotate drum **18** and actuate a fan or blower **26**. The cabinet lower rear wall is perforated or formed with louvers as indicated at **27** whereby air externally of the cabinet may be drawn into the cabinet and caused to travel upwardly between the cabinet and a generally cylindrical housing **28** encasing a major portion of drum **18** in spaced relation. Housing **28** is formed with a front wall **30** having a central opening aligned with drum opening **23** and adapted to be closed by a pivoted door **35**. The air then traverses a gas flame heating unit **29**, an electrical heating unit **31**, and is drawn into drum **18** through ports **32**.

The heated air after passing through drum **18** exhausts into a tube **33** connected to blower **26** and is discharged from the blower through a conduit **34** to atmosphere, preferably through a lint trap **35**. Thermostats responsive to the temperature of air in tube **33** are indicated at **36** and **37**.

Concurrently with operation of blower **26** motor **24** through a suitable reducing drive such as pulleys **39**, **41** and **42** and belts **43** and **44** rotates drum **18** at relatively slow speed such as 50 R. P. M.

The apparatus illustrated in Figures 1, 2 and 4 for providing a gas flame for heating the air is well known and will only be briefly described herein. I have illustrated a conventional arrangement wherein a pilot burner is automatically ignited by creating a spark when it is desired to use the burner but it is understood that a con-

ventional arrangement wherein the pilot burner is manually ignited and burns continuously during periods of use and non-use of the dryer is equally adaptable. Referring to Figure 2 I have indicated at 46 a line or pipe connected to a gas supply source and flow from pipe 46 to a pressure regulator 47 is controlled by a manually operable valve 48. Gas flows from regulator 47 to a solenoid operated gas valve 49 and from valve 49 the gas can flow, preferably through filters, to a pilot burner line 51 and a main burner line 52. The gas flows from line 52 into a main burner tube 53 provided with an adjustable plate 54 for regulating the flow of air into the tube. A spark plug 56 for igniting the pilot burner is adapted to be energized by a high voltage line 57. The pilot and main burners extend into a stove 58 comprising a sheet metal housing of inverted generally box form. Also the spark plug 56 extends into the stove with the spark terminals disposed adjacent the pilot burner tip. I preferably provide a safety thermostat 59 for limiting the maximum temperature generated in the stove and adapted to cut off the gas supply when a predetermined temperature is reached.

A generally U-shaped electrical heating element 61 is housed in an elongate raised portion 62 of a generally arcuate sheet metal plate 63 which extends from stove 58 to adjacent drum housing 28. In effect the substantially three-quarter cylindrical wrap around housing 28, the stove 58 and the plate 63 form the complete enclosure for drum 18 with elongate air entry ports 32 between housing 28 and the stove 58 and plate 63. I also provide a thermostat 64 for limiting the temperature generated by the heating element 61 and to prevent the cabinet cover 17 from becoming unduly hot. As further precaution against excess heat being transmitted to cover 17 I dispose a pad 66 of insulating material, such as fibre glass, between the top surface of stove 58 and plate 63 and the under surface of the cover.

Referring now to the wiring diagram, Figure 4, I have indicated power leads 67 and 68 which extend from a power source such as a 115 volt A. C. supply. A conventional electric timer, generally indicated at 69 and adapted to actuate switches 72 and 86 is operable by a slow speed motor 73. One side of timer motor 73 is connected to power lead 68 by a line 74 and the other side is adapted to be connected to the other power lead 67 through a line 75 and switch 72. Switch 72 is adapted to be manually closed by rotation of knob 70 (Figure 6) and is adapted to be opened by the timer at the completion of the drying cycle. Closing of switch 72 is also adapted to energize the main motor 24 through a line 76, a door operable switch 77, a line 78 extending to the windings 79 of main motor 24, a line 80 extending to a push button operable switch 81, and a line 82 extending to the other power lead 68.

Assuming it is desired to dry clothes or articles at a "hot" temperature such as 190° F. The articles are loaded into drum 18 and cabinet door 35 is closed which effects closing of switch 77. The push button marked "Hot" is depressed which closes switch 81 and two additional switches indicated at 83 and 84. Upon turning knob 70 clockwise to desired time position switches 72 and 86 are closed which energizes timer motor 73 and main motor 24. Closing of switch 86 connects a line 87 with power lead 67. Current then flows through safety thermostat 59 and a lead 88 to the coil 89 of the pilot burner solenoid associated with gas control valve 49. From coil 89 current flows by a line 91 to a warp switch 92 adapted to be opened by heat from a resistance 93. Leads 94 and 96 extend to the primary coil 97 of a transformer adapted to generate high voltage such as 3000 volts in the secondary coil connected to spark plug 56 by lead 57. The warp switch is connected to line 85. Current also flows from line 88 through line 98 to the terminal of an automatic switch 99 which upon start of the drying cycle has its arm connected to line 101 extending to resistance 93. It will now be apparent that when the aforementioned switches are all closed current will flow through coil 89 opening the pilot valve, high voltage current will be supplied to the spark plug 56 igniting the pilot valve, and after a short period the warp switch will open. Heat from the pilot burner vaporizes liquid in a tube 102 causing a bellows or the like to throw the arm of switch 99 from the full line to the dotted line position thereby breaking the circuit to coil 97 and rendering the spark plug 56 inoperative. The switch movement also places coil 103 of the main burner solenoid in circuit with line 98. The main burner then opens and is ignited from the pilot burner. It is apparent that the main burner will not be opened unless the burner is ignited.

The main motor 24 is provided with centrifugally operable switch 104 which has one terminal connected with push button switch 83 through a line 106 having thermostat 36 in series therewith. The other switch terminal is connected to the solenoid coil 103 of the main burner by a line 107. When the main motor 24 is running at normal speed centrifugal switch 104 is closed but upon the cabinet door 35 being opened for any reason switch 77 opens cutting off current to the motor windings and resultantly opening switch 104 which cuts off the current to solenoid coil 103 and shuts off the gas supply to the main burner. Thermostat 36 disposed in tube 33 is set to open at a temperature such as 190° F. and shut off the main burner valve and to close when the temperature drops a predetermined amount. Safety thermostat 59 is adapted to open at a somewhat higher temperature such as 250° F. and close at a reduced temperature such as 230° F. After a predetermined drying period the timer opens switch 86 shutting off the gas supply but switch 72 remains closed for a short period to continue tumbling the clothes and circulating air to cool the clothes before removal. The timer then opens switch 72 de-energizing the main and timer motors.

When a "medium" drying temperature is desired the push button marked "Medium" is depressed closing switch 81 and switches indicated at 108 and 109. One terminal of switch 108 is connected to line 85 and closing of switch 109 places thermostat 37 in series with line 106 whereby heat is supplied as previously described but thermostat 37, also disposed in tube 33, is set to limit the temperature to a value such as 150° F.

When a "warm" drying temperature is desired depressing the push button closes switch 81 and a switch 111. One terminal of switch 111 is connected to line 82 and the other terminal to a line 112 which has a thermostat 64 in series therewith and extends to electric heating element 61. A line 114 connects the heating element with line 87 through safety thermostat 59. Closing of switch 81 starts the timer and main motor as previously described and closing of switch 111 completes a circuit through the heating element 61. Thermostat 64 is responsive to the temperature of the air in the raised portion 62 of plate 63 and I have found that if the thermostat is set to limit this temperature to a value such as 300° F. that the air temperature in drum 18 will be limited to a temperature such as 100° F. Since switches 83 and 84 remain open the gas heating unit 29 is inoperative.

It is understood that a mechanical clock type timer can be substituted for electric timer 69 whereby when knob 70 (Figure 6) is rotated clockwise to a desired time position switch 72 will be closed starting the main motor 24. Rotation of the knob 70 imparts energy to the timer spring to rotate the timer in a reverse direction and effect opening of switch 86 and subsequent opening of switch 72 as previously described.

It will be noted that whether gas heat or electric heat is desired the rotation of knob 70 clockwise from "off" position effects operation of the main motor and resultantly the drum and blower. Operation of the push buttons conditions the circuits for use of either gas or elec-

tric heating means and switch **81** is closed in both cases if drum rotation and air circulation is desired.

In the event it is desired to dry clothes at low or warm temperature without tumbling a push button marked "No Tumble" is depressed which closes switch **111** and rotation of knob **70** to the desired time position closes switch **86** completing the circuit through heating element **81**. Rotation of knob **70** also closes switch **72** but since switch **81** remains open only the timer motor **73** is energized and there is no drum rotation or air circulation. It has been found that certain synthetic fabrics have a tendency to shrink if they are tumbled while heated air is circulated therethrough and best results are obtained if fabrics of this type are subjected to relatively low temperature such as 90° F. while in static position.

Other types of synthetic fabrics can only be safely dried at room temperature but to accelerate drying the articles are tumbled while air at room temperature is circulated through the drum. In this case a push button marked "No Heat" is depressed which closes switch **81** energizing the main and timer motors after knob **70** is rotated to a desired time position.

For convenience I have illustrated certain switches as operable by push buttons but it is understood that a single control element movable along different contacts would be equally adaptable for completing the circuits described.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

What I claim is as follows:

The combination with a clothes drier of the type having a rotatable drum adapted to contain articles to be dried, means for circulating air through the drum including a blower, a timer adapted to control drum rotation and blower operation, and a gas supply adapted to be ignited for heating the air, of electrical means for heating the air, a control circuit for selectively heating the air by gas flame and the electrical means, said control circuit comprising a plurality of manually operable switches each adapted to condition a different circuit including a thermostatic switch for energization by the timer, each thermostatic switch being adapted to open its associated circuit responsive to a pre-determined high temperature of heated air and to close said circuit upon a drop in heated air temperature to a pre-determined value, the timer being manually operable to energize a conditioned circuit and start the blower, energization of each different circuit being adapted to effect heating of air to a different temperature controlled by the associated thermostatic switch in the energized circuit, and the timer being adapted to automatically open an energized heating circuit after a pre-determined time interval and to stop blower operation.

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