Nov. 17, 1964 P. W. DOUGLAS 3,157,390

COMBINATION GAS AND ELECTRIC HEATER FOR A CLOTHES DRIER

Filed April 3, 1961 5 Sheets-Sheet 1

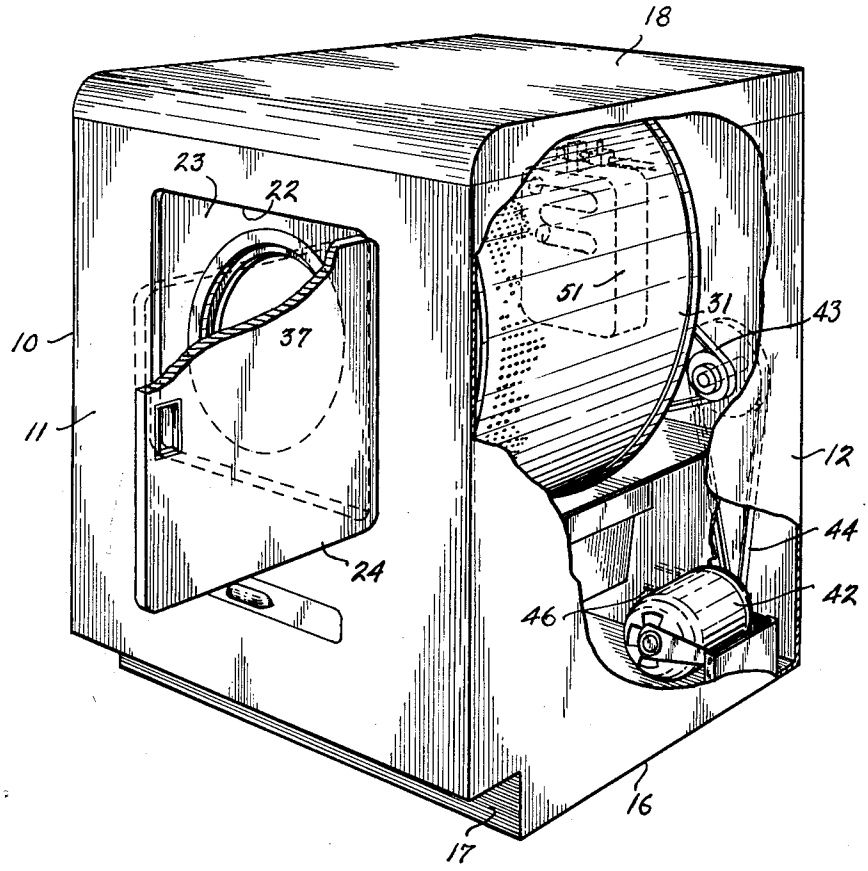


FIG. 1

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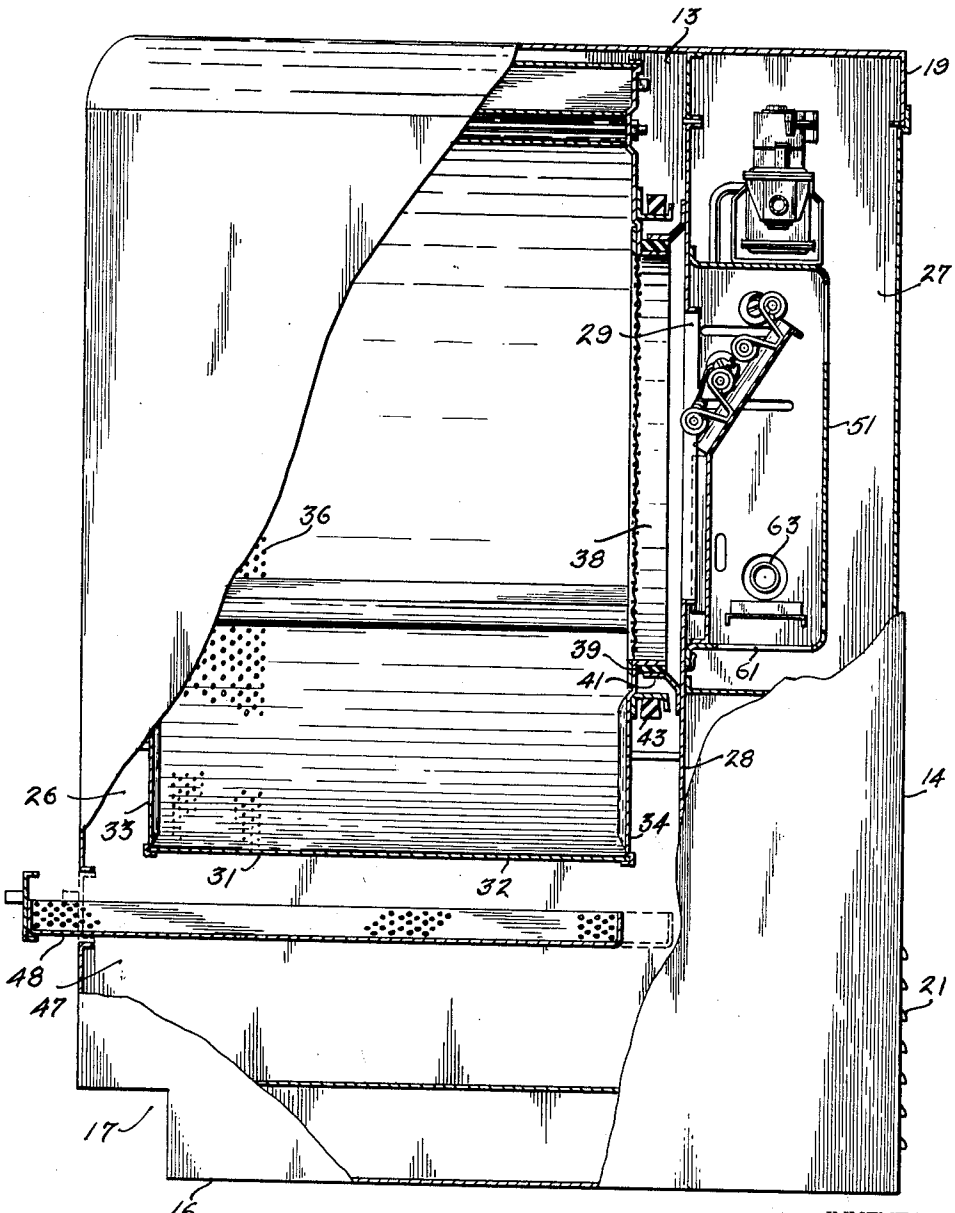


FIG. 2

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COMBINATION GAS AND ELECTRIC HEATER FOR A CLOTHES DRIER

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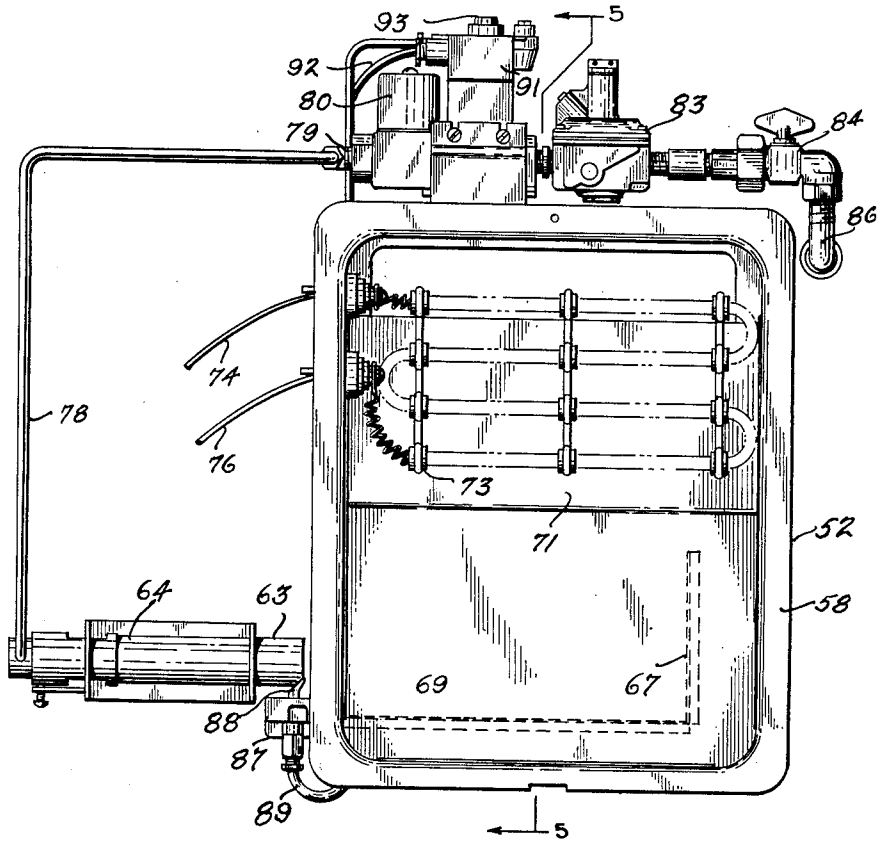


Fig. 3

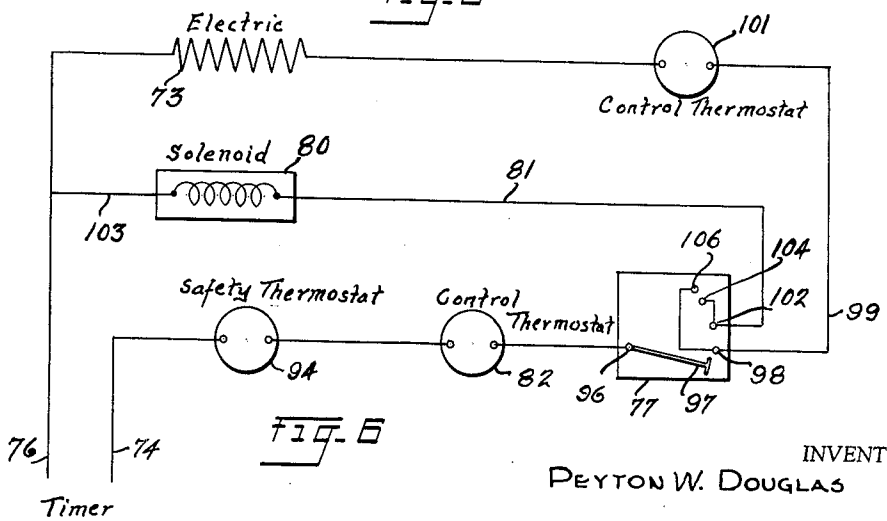


Fig. 6

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COMBINATION GAS AND ELECTRIC HEATER FOR A CLOTHES DRIER

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5 Sheets-Sheet 4

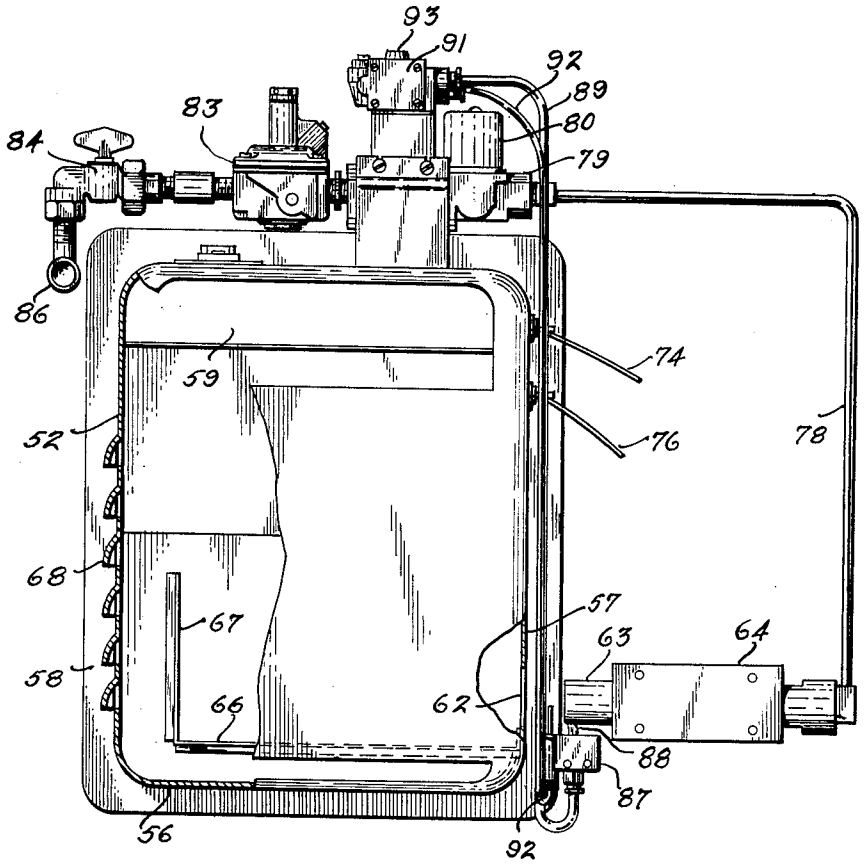


FIG. 4

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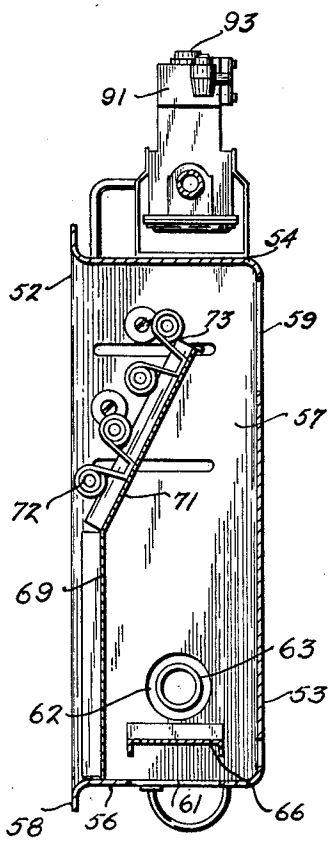


FIG. 5

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COMBINATION GAS AND ELECTRIC HEATER FOR A CLOTHES DRIER

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3 Claims. Cl. 263—33)

This invention relates to improvements in domestic clothes driers of the rotating drum type. More particularly, the invention is directed to means for heating such driers in a manner to enable their use in the drying of all kinds of apparel and fabrics.

Currently available domestic clothes driers of the rotating drum type are purchased by much of the public because of their convenience and reasonable price. In addition to this, many laundry establishments have been set up where those without washing and drying equipment may, for a consideration, rent the use of such equipment. Thus, with the exception of commercial laundries, the general public has access to and makes considerable use of clothes drying machines. This, of course, suggests that these machines are expected to quickly and safely dry any and all kinds of fabrics that any of the many users desire to launder.

Presently, due to the improved treatment of well known fabrics, as well as development of synthetic materials, it is found that wearing apparel or fabrics cannot be washed and dried under conditions or in time periods common to all such apparel or fabrics. With particular reference to driers, it has become evident that they must be provided with heat controls by which to produce several different drying temperatures. This has posed no serious problem when the drying heat is created by an electrical unit operating on a 220 or 230 volt circuit. However, there are many present and potential users of driers to whom such current is not available. A problem, therefore, does exist when only the usual household current is available. This is largely because a heating unit operable on this current either cannot produce adequate heat to dry certain fabrics, or requires a considerable period of time to accomplish the drying. Some driers, of course, incorporate gas heaters but such heaters are limited to providing a set drying temperature since it has been found impractical to install fool-proof expensive valve controls in devices of this nature that are so generally available to and used by the public.

The present invention has for one of its objects the provision of a drier that incorporates such heater equipment as to enable drying all manner of fabrics in a safe and acceptable time period.

Another object of the invention lies in the provision of a drier having multiple heating units that are operable selectively or in combination for the purpose of producing given drying temperatures.

A further and important object of the invention lies in the provision of a drier in which all of the electrically operable parts, including multiple heating units, function on conventional house current through appropriate controls.

A more particular object of the invention lies in the provision of a heating unit in a drier that takes the form of a combined gas burner and electric heater.

A still further and important object of the invention lies in the provision of a control system for operation of a combined gas and electric heater, the system enabling either or both of the heaters being utilized to produce desired drying temperature for any given kind or type of fabric.

Other objects and advantages of the invention will be more fully understood from a consideration of the following specification, taken in conjunction with the accompanying drawings; in which

FIG. 1 is a perspective view of a rotating drum type clothes drier, part of the cabinet being broken away to generally locate the multiple element heating unit embodying the invention;

FIG. 2 is a side elevational view of the drier, parts of the cabinet and drum being broken away to disclose the heating unit and general air circulation within the drier;

FIG. 3 is an enlarged front elevational view of the heating unit and shows the various parts as they would appear from viewing the heater through the rear of the drum;

FIG. 4 is an enlarged rear elevational view of the heating unit;

FIG. 5 is a vertical sectional view of the heating unit, taken substantially as suggested by the line 5—5 of FIG. 3; and

FIG. 6 is a wiring diagram showing the arrangement for selectively or combinedly operating and controlling the gas and electric heater elements.

Referring more particularly to the drawings, the reference numeral 10 is employed to generally designate a clothes drier cabinet in which one form of the invention is embodied. This cabinet may be of sheet material construction and includes a front wall 11, side walls 12 and 13, and rear wall 14. The base portion 16 has a toespace setback 17. A top wall or cover 18 closes the upper end of the cabinet and includes a depending marginal flange or rim 19 that is suitably seated on the upper edges of the vertical walls of the cabinet. Suitable air intake louvers 21 are provided adjacent the lower portion of the cabinet rear wall 14.

The front wall 11 has an opening 22 giving access to the front interior of the cabinet which is presently shown to be framed by a rectangular stepped portion 23. A rectangular door 24, suitably hinged along one vertical edge, is intended to close the entire area defined by the stepped portion 23 as well as the access opening 22. The space within the cabinet is divided into two vertical compartments; namely, a large drum receiving compartment 26 and a rear compartment 27. These compartments are formed by a vertically disposed bulkhead 28 which extends the full height of the cabinet. Midway of its sides, the bulkhead 28 is provided with an opening 29 which, for purposes of operation of the drier shown, is centered with the access opening 22 in the front wall 11.

The large front compartment 26 encloses a cylindrical tumbling drum 31 which includes a peripheral wall 32 and front and rear rear walls 33 and 34, respectively. The wall 32 has perforations 36 which are located forwardly of the drum in much the manner and to an extent suggested in FIG. 2 of the drawings. The front and rear walls 33 and 34 of the drum are provided with central openings 37 and 38, respectively. The front opening 37 is appropriately closed by the cabinet door 24, whereas the rear opening 38 gives air access into the drum through the bulkhead opening 29. A suitable bearing ring 39, framing the circular opening 38 of the drum rear wall, is supported by a correspondingly arranged ring 41 mounted on the bulkhead 28. Similar interfitting bearing rings are provided to mount the forward end of the drum on the cabinet front wall 11. The drum is rotated on these bearings by a motor 42 through a drum belt 43 and motor belt 44.

A belt 46, shown in FIG. 1, connects the motor 42 with and drives a suitable suction fan (not shown) that is mounted at the rear end of a trough 47 which defines the base or bottom of the large front compartment 26. A drawer type lint trap 48 separates the body of the compartment 26 from the trough 47 (see FIG. 2) and enables convenient periodic withdrawal of lint accumu-

lated during operation of the drier. Operation of the fan draws air into the rear compartment 27 through the louvered rear wall 14 of the cabinet, thence into the front compartment 26 by way of a heater 51 and drum 31. The air, after passing through the lint trap 48, exits from the cabinet by way of suitable exhaust ports directly associated with a housing for the fan.

The heater 51, located in the rear compartment 27 and embodying one form of the invention, comprises a housing 52 which includes a rear wall 53, top and bottom walls 54 and 56, respectively, and side walls 57. The forward edges of the top, bottom and side walls are outwardly flanged, as at 58, in a manner to provide a rim to the forward open face of the housing. This rim abuts and is secured to the rear face of the bulkhead and completely surrounds the bulkhead opening 29. The rear wall 53 is provided with one or more openings 59 which permit air within the rear compartment 27 being drawn into the housing 52. An opening 61 is also made in the bottom wall 56 directly above the top wall 69 of an air exhaust compartment. One of the side walls 57 has an aperture 62 with which the nozzle 63 of a gas burner 64 is intended to register, substantially as suggested in FIGS. 3 and 4. Spacedly overlying the bottom wall opening 61 is a horizontally extending baffle plate 66. The end of this plate remote from the burner aperture 62 is flanged upwardly, as at 67, to provide an end baffle. The purpose of the end baffle is to confine the flame of the burner 64 to the interior of the housing and at the same time permit intake of air through louvered vents 68 in one of the side walls 57. Adjacent the forward or open face of the housing, a plate 69 is provided. This plate is attached at its lower edge to the bottom wall 56 and extends upwardly a distance possibly slightly less than half the height of the housing 52. This plate is, of course, permanently secured not only to the bottom wall 56, but also along suitable flanges to the side walls 57 and at its upper end continues in an inwardly inclined baffle plate 71. As shown in FIG. 5, the plate 71 serves to mount the elements 72 of an electric heater 73. The plate 71 serves as a deflector to prevent damage to the heating elements 72 when the gas burner 64 is operated. Suitable electrical leads 74 and 76 connect the heater 73 with a switch 77 and a timing mechanism, may be in series with either lead 74 or 76. The timer is not shown inasmuch as it may be of any acceptable form.

Referring more particularly to FIGS. 3 and 4, it will be noted that the gas burner 64 is provided with a gas inlet tube 78 which in turn is joined to a main shut-off valve 79. This valve is operated by a solenoid 80 which in turn is actuated to turn on the gas by the switch 77 through a line 81 (see FIG. 6). A control thermostat 82 is interposed in the line 74 between the switch 77 and a timer for purposes hereinafter described. A conventional pressure regulator 83 is interposed between the valve 79 and a line extending to a manual shut-off valve 84 which in turn is joined to an intake pipe 86. Since it is contemplated that the drier in which the present invention is shown may be provided with a drying heat from either the gas burner 64 or the electric heater 73, or a combination of both, a gas pilot 87 is provided, the jet 88 thereof being adjacent the burner nozzle 63. The line 89 from the pilot 87 connects with a pilot valve 91. This valve, through a tube 92, is also thermostatically coupled with the pilot 87. To prepare the gas burner for use, a button 93 is depressed and so held until the thermocouple locks the pilot line open, thus enabling lighting the pilot.

Attention is no particularly directed to the wiring diagram of FIG. 6. Herein, electrical leads 74 and 76 are shown as coming from a timer mechanism that is operatively connected with a source of conventional household current. The lead 74 passes through a safety thermostat 94, control thermostat 82 and enters the switch 77 at terminal 96. A switch arm 97 is operable to connect the timer lead 74 with an output terminal 98, from which a lead 99 passes through a control thermostat 101 to heater 73 and returns to the other timer lead 76. In other words, when the switch arm 97 is closed to connect terminals 96 and 98, the electric heater 73 can be energized at such time and to an extent determined by manipulation of the timer from an "off" to a desired "on" period. When a drying temperature has been reached, such as 125°, the control thermostat 101 will break the circuit and thus shut off the heater 73. Should the control thermostat 82 malfunction, or should the heat in the drier, for any other reason, tend to become excessive, the safety thermostat 94 will automatically function to break the circuit when the drier temperature has reached approximately 170°.

Referring now particularly to the circuit involving the gas burner 64, it is to be noted that the switch 77 is provided with another terminal 102. When the switch is operated to connect terminals 96 and 102, current passes from timer lead 74 through thermostats 94 and 82 and line 81 to solenoid 80 that controls operation of the main shut-off valve 79. From the solenoids, a lead 103 joins the other line 76 to the timer. Assuming that the pilot 87 has been lighted, closing the switch 97 as between terminals 96 and 102 will effect opening the main gas valve, and burner 64 will function. Since the solenoid of the gas shut-off valve is in this circuit, it is obvious that when the temperature within the drier reaches approximately 140°, the limit defined by thermostat 82, this circuit will be broken and the solenoid will shut off the gas burner 64. However, should any malfunction occur in the timer or the control thermostat 82, the safety thermostat 94 will function at a maximum drier temperature of 170° to break the circuit and cause the solenoid to shut off the supply of gas to the main burner.

As is well known, an electric heater operating on house current does not satisfactorily effect drying of the average type of clothes because of the fact that the B.t.u. output is relatively low and drying time would extend over an excessively long period. However, many synthetic fabrics or a combination of synthetic fabrics with wool, cotton, or silk cannot be safely dried at anything but a relatively low temperature. Thus, when delicate fabrics, or those subject to damage when exposed to relatively high temperatures, are to be dried, the switch 77 is closed to connect terminals 96 and 98 and the control thermostat 101 in this circuit will shut off the heater 73 at a maximum temperature considered suitable to dry such fabrics even though the timing mechanism may have been set for a period in excess of that required.

As mentioned above, gas burners of the nature usable in a clothes drier are not safely and economically subject to use with a variable supply control, and consequently, a gas burner must either be completely shut off or operating to its full capacity. As proposed, the burner 64 may be designed to provide a gas flame that is either the equal, in B.t.u.'s, of the heater 73 or in excess thereof. In the event the gas burner provides one or more times the B.t.u.'s of the electric heater 73, it will be found that heat therefrom will be entirely adequate in the drying of many clothes or fabrics and, thus, by closing the switch 77 to connect terminals 96 and 102, the gas burner may be used as the sole source of drying heat and will, of course, only function for the period of time for which the timer is set or for a shorter period, should the temperature reach 140°, the setting of the control thermostat 82.

There are instances when clothes or other fabrics that are not susceptible to damage by intense heat could be dried more rapidly if provision were made for such operation. With the present invention, it is possible to operate the switch 77 in a manner to connect terminal 96 with both heating units by means of a pair of terminals 104 and 106. This will, of course, cause both the heater 73 and burner 64 to operate and the heat produced thereby will, in

B.t.u.'s, be the equivalent of the total B.t.u.'s of both heaters. The electric heater 73 will automatically cut out when the set maximum temperature has been reached in the control thermostat 101. Subsequently, when the set maximum temperature of the control thermostat 82 has been reached, the gas burner 64 will be shut off and the clothes or fabrics subjected to the combined heat of these units will be found to have dried in a considerably lesser period of time.

Although applicant has shown and described only one form of a combined gas and electric heater for a rotating drum type clothes drier, it will be understood that structural variations may be made and are contemplated in the use of the invention with other types of driers insofar as such variations are encompassed by the annexed claims.

Having thus set forth my invention, what I claim as new and for which I desire protection by Letters Patent is:

1. In a clothes drier having a cabinet and a bulkhead vertically dividing the interior thereof into a front rotatable drum compartment and a rear heater compartment, an air heating unit in said rear compartment embracing an opening in said bulkhead leading into said front compartment, said unit comprising an enclosure having inlet ports, an electric heater in the upper portion of said enclosure, a gas burner in the lower portion of said enclosure, means in said unit for deflecting heat from said burner around said heater and through said bulkhead opening into said front compartment, manually controlled means connecting said burner and said heater with their respective sources of supply, said means including gas supply means having a solenoid valve and circuitry operating said solenoid valve and said heater, said circuitry including switch means connected with an electrical current supply and operable to selectively and combinedly activate said solenoid valve and said heater, and automatically operated temperature responsive means associated with said burner and said heater for individually terminating their operation when a predetermined temperature has been reached in said front compartment.

2. In a clothes drier having a cabinet and a bulkhead vertically dividing the interior thereof into a front rotatable drum compartment and a rear heater compartment, an air heating unit in said rear compartment embracing an opening in said bulkhead leading into said front compartment, said unit consisting of an enclosure containing a gas burner and an electric heater in superposed relation, gas supply means including a solenoid valve for operating said gas burner, circuitry connected with said gas burner operating solenoid valve and said heater, said circuitry including switch means, connected with a single current supply, operable to selectively and combinedly activate said solenoid valve and said heater, baffle means in said enclosure above said burner operable to deflect heat from said burner around said electric heater and through the opening in said bulkhead, means for circulating air through said unit and said drum compartment and control thermostats in said circuitry for opening the circuits of said solenoid and said heater when a predetermined temperature has been reached in said drier.

3. In a clothes drier having a cabinet and a bulkhead vertically dividing the interior thereof into a front rotatable drum compartment and a rear heater compartment, an air heating unit in said rear heater compartment embracing an opening in said bulkhead leading into said front compartment, said unit consisting of a gas burner and an adjacent electric heater, baffle means between the burner and heater deflecting heat from the burner around said electric heater and into said opening in the bulkhead, gas supply means including a solenoid valve connected with said burner, electrical circuitry connected with said solenoid valve and said heater, said circuitry including multiple position switch means connected with a single current supply operable in one position to energize the electric heater to provide low heating, in a second position to energize the solenoid in the gas supply means to energize the burner and in a third position to energize both the electric heater and the solenoid to provide a combination of heat from both sources, means for circulating air through said unit and said drum compartment and control thermostats in said electrical circuitry for opening the circuits of said heater and said solenoid when a predetermined temperature has been reached in said drier.

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