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IGNITION AND CONTROL MEANS FOR BURNERS

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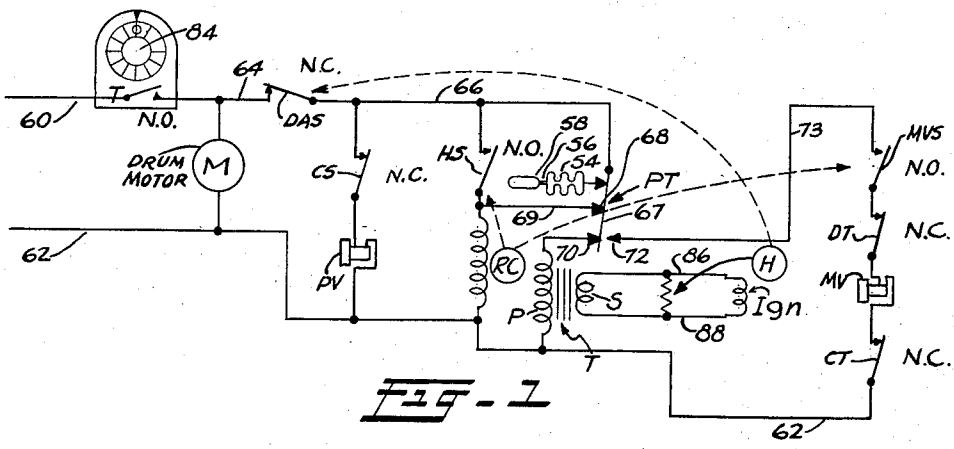


Fig - 1

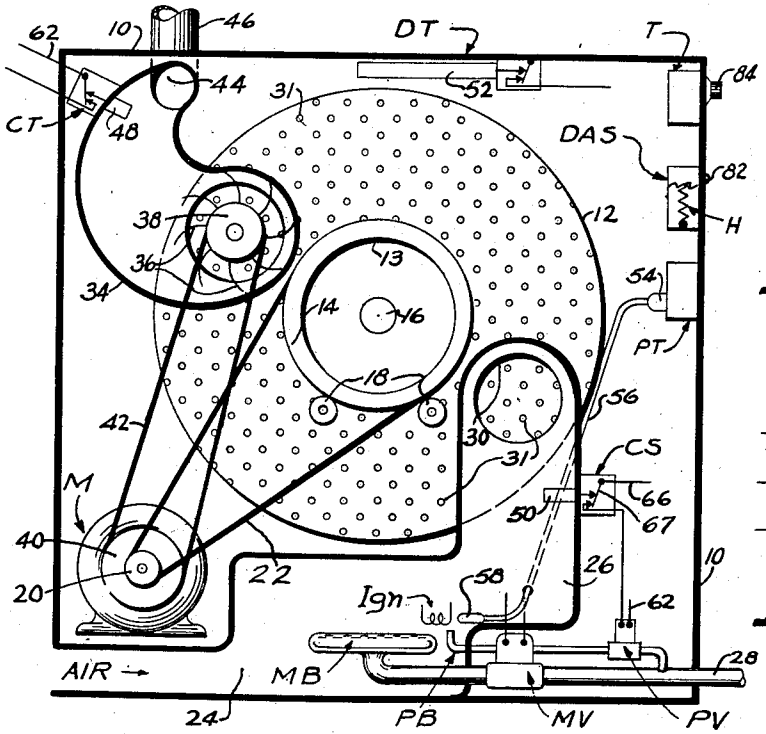


Fig - 2

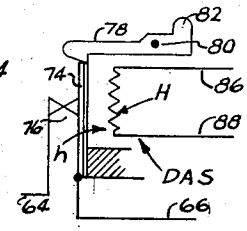


Fig - 3

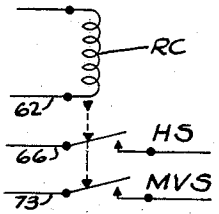


Fig - 4

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IGNITION AND CONTROL MEANS FOR BURNERS

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3 Claims. (Cl. 158—128)

My present invention relates to an ignition and control means for a burner and particularly one whcih is designed for controlling the ignition and a gas burner or the like of a domestic clothes dryer.

One object of the invention is to provide a control means which is entirely automatic in operation to effect ignition of a burner, control the same so as to maintain a substantially constant temperature of the air circulated through the dryer and provide for automatic cut-off of the fuel to the burner in the event of excessive temperatures generated within the clothes dryer, the entire cycle of operation including the energization of a motor for circulating the heated air through the dryer being under initiate the ignition and burner control cycle and teminate the control of a clock timer that can be manually set to initiate the ignition and burner control cycle and terminate the same automatically at the expiration of a predetermined time period for which the timer was set.

Another object is to provide a control means which energizes an ignition coil with electric current so as to cause the same to glow and ignite a pilot flame, a pilot thermostat being responsive thereto for effecting operation of the main valve for supplying fuel to the main burner providing the pilot flame is properly lit and burns for causing operation of the pilot thermostat.

Still another object is to provide a circuit arrangement in which there is a delayed action switch that opens after a time period in the event that the pilot thermostat does not operate due to the pilot flame not burning properly and consequently failing to operate the pilot thermostat whereupon the control system is shut down and may require attention as to the cause for failure before manual resetting for automatic operation can again be accomplished.

A further object is to provide a relay including a main valve switch for preparing the circuit of the main valve for operation upon subsequent response of the pilot thermostat to the pilot flame whereupon the pilot thermostat completes the circuit of the main valve and at the same time discontinues the circuits for the delayed action actuator for the delayed action switch and for the glow coil of the ignition mechanism.

Still a further object is to provide a pilot valve controlled by the timer and delayed action switch and also under control of a combustion thermostat which functions as a high-limit control in the event of excessive heat from the main burner to de-energize the pilot valve and thereby the pilot flame.

An additional object is to provide a control thermostat for the main valve to turn the main burner on and off and thereby maintain a substantially constant temperature in the clothes dryer.

Another additional object is to provide a dome thermostat in the housing of the clothes dryer to act as a high limit safety thermostat to de-energize the main valve in the event of excessive heating within the clothes dryer such as caused by the ignition of lint therein.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, wherein:

Figure 1 is an electro-diagrammatic view of my ignition and control means for burners.

Figure 2 is a diagrammatic view of a domestic clothes dryer together with the burner mechanism thereof and shows the location of the combustion thermostat, dome thermostat, combustion switch and pilot thermostat.

Figure 3 is a detailed diagram of a delayed action switch; and

Figure 4 is a detailed diagram of the relay which I use in connection with my control means.

On the accompanying drawing I have used the reference numeral 10 to indicate a housing of a clothes dryer. The usual drying and tumbling drum 12 is mounted therein and has an opening 13 for the introduction of the clothing to be dried. This opening is usually closed by a suitable door. A pulley 14 on the front end of the drum 12 surrounding the opening 13 rotates on rollers 18 and these rollers in conjunction with a bearing 16 at the back rotatably support the drum 12.

For rotating the drum 12, a motor M is provided and on its shaft is a pulley 20 belted as at 22 to the pulley 14. An air inlet 24 is provided and the air flowing in passes a main burner MB and then flows upwardly through a discharge duct 26 and a discharge opening 30 through perforations 31 into the drum 12 for drying the clothing therein. A gas supply line 28 is illustrated for the main burner MB and a main valve MV of the solenoid type, having an electromagnetic operator, is provided to control the flow of gas or other fuel to the main burner MB. The valve MV is normally closed and is actuated to the open position by energization of its coil.

Diametrically opposite the discharge opening 30 is an intake opening to a blower housing 34. The blower blades are indicated therein at 36 and are driven by a pulley 38 from a pulley 40 on the shaft of the motor M through a belt 42. The discharge opening of the blower housing 34 is indicated at 44 and communicates with a discharge conduit 46 usually led to a chimney or to the outside of the dwelling.

I provide a control thermostat CT having a temperature responsive element 48 located in the blower housing 34. This thermostat is normally closed (indicated N.C. in Figure 1) and is of the on-off type for maintaining a substantially constant temperature of the heated air in the clothes dryer as will hereinafter appear. In the top of the housing 10, I locate a dome thermostat DT having a temperature responsive element 52. The thermostat DT is normally closed and is a high limit thermostat set to open when the temperature surrounding the element 52 becomes excessive or dangerous.

A clock timer T is disclosed and this, of course, may be either spring wound or electric motor driven. It is provided with a control knob 84 by means of which a normally open switch of the timer may be closed and will remain closed for the time period to which the dial of the knob 84 is set.

The control device DAS is a delayed action switch and it is provided with a delayed action actuator in the form of a heater H. Referring to Figure 3, the heater is located adjacent a bimetal element 74 so as to warp it toward the right as indicated by the arrow *h* (indicating heat) when the heater H is energized. Preferably in about 90 seconds the warpage of the bimetal element will open the contacts 76 of the delayed action switch and the bimetal element will be latched in the contact-open position by a latch 78. This latch is pivoted at 80 and has a

projection 82 which may be manually depressed for resetting the delayed action switch.

Below the delayed action switch in Figure 2 is a pilot thermostat PT. The thermostat is responsive to a pilot flame and for this purpose may be provided with a bellows or the like 54 connected by a capillary tube 56 with a temperature responsive bulb 58. The bulb 58 is responsive to the flame from a pilot burner PB and this flame is controlled by a pilot valve PV receiving fuel from the supply pipe 28.

An ignition coil *Ign* is provided adjacent the pilot burner PB to ignite the gas issuing therefrom when the coil glows. The mechanism for energizing and de-energizing the coil will be described later.

The pilot valve PV is controlled by a combustion switch CS having a temperature responsive element 59 located in the discharge duct 26. The combustion switch CS is normally closed and opens upon response to excessive heat generated by the main burner MB whereupon it opens the circuit of the pilot valve PV, thus performing the function of a high-limit control.

Three controls are provided for the main valve MV as shown in Figure 1. One of them is a main valve switch MVS which is normally open. This switch is part of a relay, the electromagnetic operator of which is shown at RC and the details of which are illustrated in Figure 4. The operator RC when energized closes a normally open holding switch HS and the switch MVS.

The other two controls referred to are the control thermostat CT and the dome thermostat DT, both of which are in series with the main valve switch MVS and the main valve MV. This particular (main valve) circuit is also in series with part of a control switch of the pilot thermostat PT which switch consists of a switch blade 67 normally contacting a pair of contacts 68 and 70. When the bulb 58 responds to the flame of the pilot burner PB, however, the switch blade 67 disengages 68 and 70 and engages a contact 72 in the main valve circuit just referred to.

The ignition coil *Ign* and the heater H are supplied with current from wires 86 and 88 connected with the secondary S of a transformer T. The primary thereof is indicated at P and is connected with a supply wire 62 and the contact 70. This contact in turn is normally connected with another supply wire 66 to complete the circuit for the primary P. The current for the wire 66, however, is controlled by the delayed action switch DAS and by the time T, the timer being connected to the main supply wire 60 and the circuit from 60 to 66 being through T, a wire 64 and DAS. The holding switch HS of the relay is connected between the relay coil RC and the wire 66 and thus shunts the switch 67—68 of the pilot thermostat PT. Other significant wires in the circuit are indicated at 69 (between RC and 68) and 73 (between 72 and MVS). The dash line arrows in Figures 1 and 4 indicate that the actuating device RC actuates switches HS and MVS and H actuates DAS.

Practical operation

In the operation of my ignition and control means for burners, when the timer T is set for a time period, the normally open switch of the timer is closed so as to establish a circuit from the wire 64 through the motor M to the wire 62 for the entire timing period. The rest of the circuit is dependent upon the delayed action switch DAS remaining closed to supply current to the wire 66.

The pilot valve PV is energized immediately upon closure of the switch in the timer T so as to supply fuel to the pilot burner PB, the combustion switch CS being closed because it is cold. The pilot fuel is ignited by the coil *Ign* which is energized from 66 through 67 and 70 controlling the primary of the transformer T supplying the current to the coil *Ign*. The heater H is also energized at this time and starts the timing period of the delayed action switch DAS.

The relay coil RC is energized from 66 through 67, 68 and 69 to 62. Therefore the main valve switch MVS closes and the holding switch HS also closes. Once the holding switch is closed, the relay coil circuit remains established even though the ciruit is later broken between 67 and 68 of the pilot thermostat PT.

Proper burning of the pilot flame from PB heats the bulb 58 and thereby operates the pilot thermostat PT so as to break the initial or starting circuit of the relay coil through 67, 68 and 69 (the circuit now being held by the holding switch HS) and to break the circuit of the transformer primary controlled by 67 and 70. De-energization of the transformer de-energizes the ignition coil *Ign* which is no longer needed and de-energizes the heater H so as to prevent the delayed action switch DAS from opening.

Contact of the switch blade 67 with 72 of the thermostat PT establishes the circuit for the main valve MV from wire 73 through MVS, DT and CT to 62. Since MVS is now closed and DT and CT are normally closed, the main valve MV is open and burner operation is therefore established and will continue until such time as the temperature becomes too high for the setting of the control thermostat CT whereupon the main valve circuit is broken at CT and the main valve MV closes for cutting off fuel to the main burner. Thereafter the main burner will be recycled by subsequent closing of the control thermostat CT and the temperature in the clothes dryer will thus be maintained substantially constant throughout the timing period of the timer T.

The heat generated by the burner MB causes the combustion switch CS to open for stopping operation of the pilot burner PB when excessive heat is developed. The bulb 58 keeps the pilot thermostat PT in the operating position, that is, with the blade 67 disengaged from 68 and 70 and engaged with 72 so as to keep the system conditioned for recycling by the control thermostat CT unless, of course, CS opens the circuit of PB to stop the pilot flame and thereby permit PT to close cold.

In the event that the temperature within the housing 10 becomes excessive, it effects opening of the dome thermostat DT for breaking the circuit of the main valve MV and thus provides a safety feature in addition to the control thermostat CT.

In the event of an attempt to start the cycle of operation when the pilot burner PB is not properly lit or there is fuel failure, the bulb 58 will not be heated and accordingly the pilot thermostat PT will remain in the initial position shown in Figure 1. This will maintain the heater H energized which at the end of approximately 90 seconds will effect drop-out of the delayed action switch DAS whereupon the latch 78 becomes operative to retain the bimetal 74 in the switch-open position. Thereupon the trouble must be investigated and remedied before the delayed action switch is reset. On the other hand, the delayed action switch can be reset and another attempt at operation made whereupon the operation will become established if the trouble has already been remedied, whereas if it has not, the delayed action switch will again cut out.

From the foregoing specification it will be obvious that I have provided a means for automatically electrically igniting a gas burner such as one of the type used in a clothes dryer. Ignition and the entire operation are automatic with the exception of turning the circuit on by means of the timer T. After the cycle is started, it will be automatically stopped by the timer at the expiration of the timing period.

If ignition does not occur properly, the operation will be shut down, whereas if it does occur properly, operation will continue under control of the thermostat CT at a substantially constant temperature and under control of the dome thermostat DT for cut-off if dangerously high temperatures are attained within the housing 10.

The pilot valve PV is automatically de-energized by the combustion switch CS on excessive temperature in duct 26 and the ignition coil is de-energized after it is no longer needed. Likewise the heater H of the delayed action switch DAS is de-energized if it is no longer needed, whereas if there is an improper starting operation, it will remain energized and effect lock-out of the system at the delayed action switch.

Some changes may be made in the construction and arrangement of the parts of my method, apparatus and articles without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of method, structure or article, or use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. In a fluid fuel burner control system having main and pilot burners and an electrically operable igniter for the pilot burner, a normally closed main valve and an electrical operator therefor for controlling the supply of fuel to the main burner, an electrically operable pilot valve for controlling the supply of fuel to the pilot burner, a pilot valve circuit including said pilot valve and a combustion responsive switch, opened only in response to an abnormally high temperature at said main burner, and a main valve and ignition control circuit network including said main valve and said igniter, a normally closed delayed opening switch connected in series with and controlling both said pilot circuit and said control circuit network, a first closed cold pilot flame responsive switch connected in series with said normally closed delayed opening switch, a normally open holding switch connected in shunt around said first switch, said main valve and ignition control circuit network comprising two parallel circuit branches; one of said branches including a second closed cold pilot flame responsive switch and said igniter; the other of said branches including a closed hot pilot flame responsive switch, a normally open main valve switch, said main valve operator and a control thermostat adapted to be responsive to the temperature of the air heated by the burner; and an electrical operator for said main valve switch and said holding switch connected in parallel with said main valve and ignition control circuit network and jointly controlled by said holding switch and said first pilot flame responsive switch.

2. In a fluid fuel burner control system having main and pilot burners and an electrically operable igniter for the pilot burner, a normally closed main valve, and an electromagnetic operator therefor for controlling the supply of fuel to the main burner, an electrically operable pilot valve for controlling the supply of fuel to the pilot burner, a pilot valve circuit including said pilot valve and a combustion responsive switch, opened only in response to an abnormally high temperature at said main burner, and a main valve and ignition control circuit network including said main valve and said igniter, a normally closed delay action switch connected in series with both said pilot valve circuit and said control circuit network, a first closed cold pilot flame responsive switch connected in series with said normally closed delayed opening switch, an electromagnetically operated normally open holding switch connected in shunt around said first switch, said main valve and ignition control circuit network comprising two parallel circuit branches; one of said branches including a second closed cold pilot flame responsive switch and said igniter to control ignition of the pilot burner; the other of said branches including a closed hot pilot flame responsive switch, an electromagnetically operated normally open main valve switch, said main valve operator and a control thermostat adapted to be responsive to the temperature of the air heated by the burner; and an electromagnetic operator for said main valve switch and said holding switch connected in parallel with said main valve and ignition control circuit network and jointly controlled by said holding switch and said first pilot flame responsive switch.

3. In a fluid fuel burner control system having main and pilot burners and an electrically operable igniter for the pilot burner, a normally closed main valve, and an electromagnetic operator therefor for controlling the supply of fuel to the main burner, an electrically operable pilot valve for controlling the supply of fuel to the pilot burner, a pilot valve circuit including said pilot valve and a combustion responsive switch, opened only in response to an abnormally high temperature at said main burner, and a main valve and ignition control circuit network including said main valve and said igniter, a normally closed delayed opening switch connected in series with both said pilot valve circuit network and said control circuit, a first closed cold pilot flame responsive switch connected in series with said normally closed delayed opening switch, an electromagnetically operated normally open holding switch connected in shunt around said first switch, said main valve and ignition control circuit network comprising two parallel circuit branches; one of said branches including a second closed cold pilot flame responsive switch and said igniter to control ignition of the pilot burner; the other of said branches including a closed hot pilot flame responsive switch, an electromagnetically operated normally open main valve switch, said main valve operator and a control thermostat adapted to be responsive to the temperature of the air heated by the burner; an electromagnetic operator for said main valve switch and said holding switch connected in parallel with said main valve and ignition control circuit network and jointly controlled by said holding switch and said first pilot flame responsive switch, and a delayed action operator for said delayed action switch connected in parallel with said igniter.

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