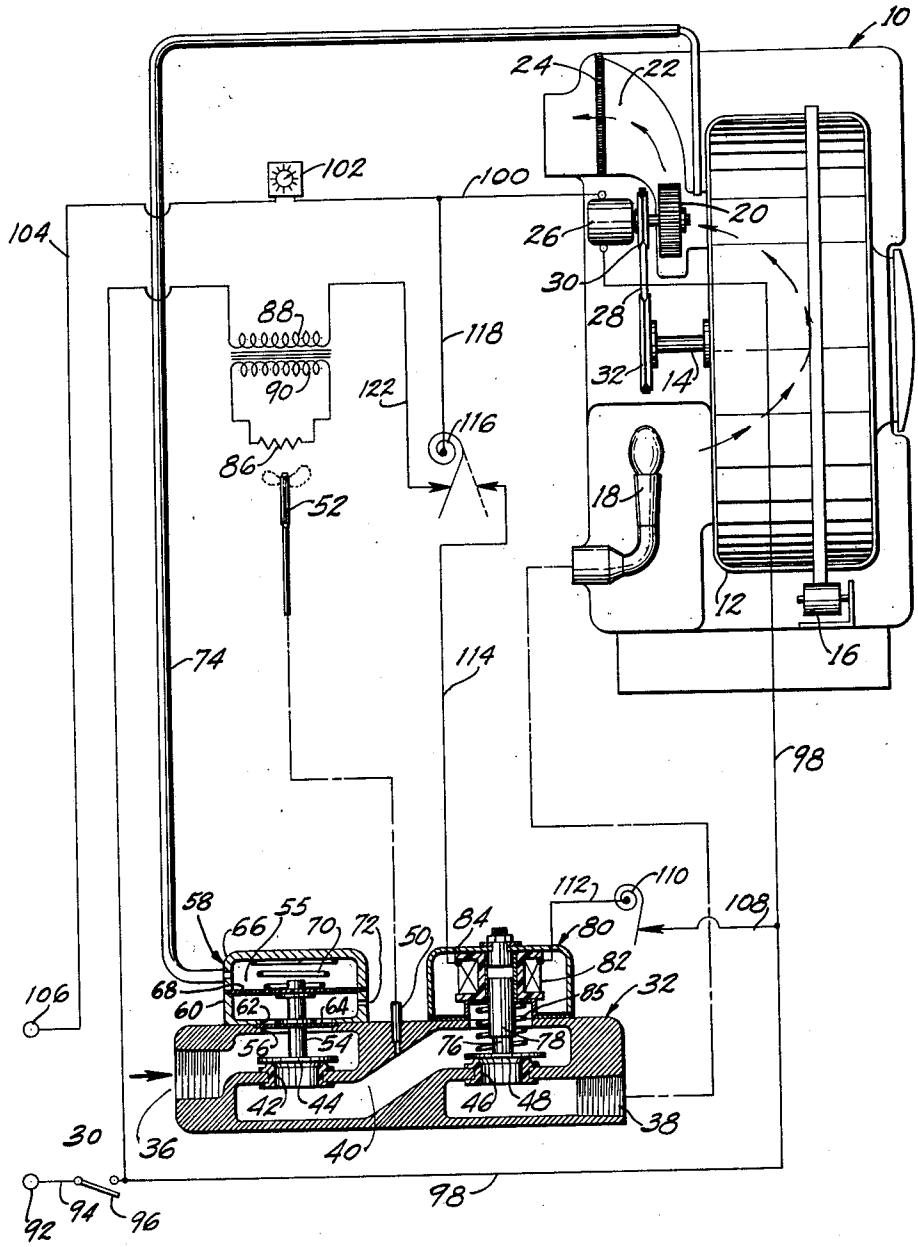
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BURNER CONTROL FOR CLOTHES DRYERS

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BURNER CONTROL FOR CLOTHES DRYERS

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This invention relates to burner control systems for gas-fired clothes dryers and particularly concerns a fuel flow control device incorporating novel fuel cut-off means.

It is an object of the invention to provide an automatic fuel flow control device for clothes dryer burners which is operative to permit the flow of fuel to the dryer burner only under conditions in which the dryer heat-circulating means is operative.

A further object is to provide a fuel flow control device for a clothes dryer gas burner comprising a pair of series arranged, normally closed valves in a single valve body for controlling the flow therethrough, the anterior valve being operative to permit the flow of fuel through the valve body only when the dryer heat-circulating means is operative and the posterior valve being operative to permit the flow of fuel through the valve body only when the anterior valve is open and when the dryer thermostat is calling for heat.

A further object is to provide a fuel flow control device of the above character in which the normally closed anterior valve is operated pneumatically and opens in response to a pressure change incident to the operation of the dryer circulating means, and in which the normally closed posterior valve is electromagnetically operated and opens upon completion of an energizing circuit controlled by a pilot flame-detecting switch which closes in response to a pilot flame supported by fuel passing the anterior valve when it is open and by a series arranged thermostatic switch which cycles open and closed to maintain a preselected dryer temperature.

Further objects and advantages will appear from the following description when read in connection with the accompanying drawing.

In the drawing, the single figure of the drawing is a schematic illustration of a fuel flow control device constructed in accordance with the present invention shown in connection with a clothes dryer.

Referring to the drawing, numeral 10 generally indicates a gas-fired clothes dryer having a drying drum 12 mounted for rotation on a shaft 14 and rollers 16, a gas burner 18, and an air circulating blower 20. Heated air and the products of combustion from burner 18 are drawn into the clothing drum 12 at one point, through the drum and out of the drum at another point, and then forced outwardly from the dryer casing through an exhaust passageway 22 by the blower 20 as indicated by arrows. A lint trap or filter 24 is usually provided at the outlet of passage 22 so that the pressure in passage 22 is somewhat above atmospheric when the blower 20 is operating. The rear wall of the drum 12 is suitably perforated to permit circulation therethrough. The blower 20 is driven directly by an electric motor 26 and the drum 12 is driven by motor 26 through a belt 28 passing over pulleys 30 and 32. Frequently, however, the arrangement is such that both the blower and drum are driven by motor 26 through V-belts.

Fuel is supplied to burner 18 from a suitable source through a fuel supply line 30 and the flow of fuel to the burner 18 is controlled by the fuel flow control device which is generally indicated at 32. The device 32 consists of a body member 34 having an inlet passage 36, an outlet passage 38, and an intermediate connecting passage 40. The inlet passage 36 and intermediate passage 40 are separated by a partition having a port therethrough provided with a valve seat 42 with which a disc valve 44 cooperates, and the intermediate passage 40 and outlet passage 38 are separated by a partition having a port therethrough provided with a valve seat 46 with which a disc valve 48 cooperates. A fuel supply line 50 communicating with the intermediate passageway 40 at a point between valves 44 and 48 supplies fuel to a pilot burner 52.

Valve 44 is provided with a stem 54 passing upwardly through an opening 56 in the top of body member 34 and into a pneumatic operator generally indicated at 58. The operator 58 comprises an open end casing 60 having a bottom wall suitably attached to the valve body 34. The casing 60 has an opening 62 in the bottom wall thereof concentric with and of substantially the same diameter as the opening 56 in the body member and these openings are of substantially the same diameter as disc valve 44. A flexible diaphragm 64 clamped at its periphery between the casing 60 and body member 34 and being connected at its center to the valve stem 54 which passes therethrough provides a closure for openings 56 and 60 and permits axial movement of valve stem 54. The casing 60 has a domed-top, cover member 66 closing its upper open end and an operating diaphragm 68 of suitable flexibility is clamped at its periphery between the cover 66 and the upper end of casing 60, whereby an expansible chamber 55 is formed in cover 66. The upper end of valve stem 54 is attached to the center of diaphragm 68. A compression spring 70 in the cover 66 acting through valve stem 54 biases valve 44 in a closed position on seat 42. An atmospheric vent 72 is provided in casing 60.

A suitable flexible tube 74 extending from the expansible chamber 55 to a point on the intake or low pressure side of blower 20 in the exhaust passage 22 of the clothes dryer provides a communication between these two spaces whereby the pressure in chamber 55 varies with that in exhaust passage 22 at that point.

Valve 48 is provided with a stem 76 connected to the lower end of the reciprocating magnetic plunger 78 of an electromagnetic actuator, generally indicated at 80, which is suitably mounted on the body member 34. The actuator 80 further includes a winding 82 and a casing 84 of magnetic material. A compression spring 85 biases the valve 48 in a closed position when winding 82 is de-energized, and when winding 82 is energized, plunger 78 is attracted upward thereby opening valve 48.

A resistance coil-type igniter comprising a resistance coil 86 and a step-down transformer having a primary winding 88 and a secondary winding 90 is provided for igniting the pilot burner 52.

A circuit for the energization and control of the drum and blower driving motor 26 is provided and this circuit may be traced as follows: starting at a power source terminal 92, through lead 94, a starting switch 96, a lead 98, the motor 26, a lead 100, a time switch 102, and a lead 104 to a second power terminal 106.

A circuit for the energization and control of the electromagnetic valve actuator 80 is provided and may be traced as follows: starting at power source terminal 92, through lead 94, starting switch 96, a lead 98, a lead 108, a thermostatic switch 110 responsive to the temperature of the dryer, a lead 112, the actuator winding 82, a lead 114, a pilot flame switch 116, a lead 118 to lead 100, through time switch 102, and thence to terminal 106.

A circuit for the energization and control of the pilot igniter is provided and may be traced as follows: from power source terminal 92, through lead 94, starting switch 96, a lead 120, the primary winding 88 of the igniter transformer, a lead 122, pilot flame switch 116,

lead 118 to lead 100, through time switch 102 and lead 104 to power source terminal 106.

The pilot flame switch 116 is a double-throw switch having a cold (solid line) position in the absence of pilot flame in which it completes the described pilot igniter circuit at that point and having a hot (dotted line) position in the presence of pilot flame which effects the breaking of the igniter circuit at that point and the completion at that point of the described circuit for energization of the electromagnetic valve actuator 80. The thermostatic switch 110 is responsive to the temperature at some preselected point in the dryer and functions to effect the opening and closing of the valve 48 to cycle the operation of burner 18 in accordance with heat requirements to maintain a predetermined temperature at a preselected point in the dryer.

Operation

In the drawing, valves 44 and 48 of the fuel flow control device 32 are shown in a closed position, the pilot flame switch 116 and thermostat 110 in a cold position, and the starting switch 96 in an open position. When it is desired to dry a load of clothing the timer 102 is set to close the circuit at that point for the drying period required and starting switch 96 is closed. The closing of these switches effects the energization of the motor 26 which drives the drum 12 and the blower 20 and effects the energization of igniter coil 86. When the blower 20 reaches its normal speed the pressure in exhaust passage 22 decreases on the low pressure side of blower 20 sufficiently to effect a pressure drop in expansible chamber 55, by reason of communicating tube 74, which will flex diaphragm 68 upward against spring 70 and open operatively connected valve 44. When valve 44 opens fuel flows to pilot burner 52 and is there ignited by igniter coil 86. Pilot flame switch 116 now responds to the presence of pilot flame and moves from its solid to dotted line position, thereby breaking the igniter circuit and completing the described circuit for electromagnetic actuator 80. Energization of actuator 80 effects the opening of valve 48 and fuel now flows to the main burner 18 where it is ignited by pilot burner 52. When sufficient heat has been supplied to attain the desired dryer temperature, thermostatic switch 110 opens de-energizing actuator 80 and valve 48 closes. The thermostatic switch thereafter cycles the burner 18 on and off until the timer 102 terminates the drying period. The downward force caused by supply line pressure acting on the upper side of valve 44 when closed is counterbalanced by a substantially equal force acting upward on the lower diaphragm 64 so that the force to be overcome in opening valve 44 is substantially that of the closing spring 70.

A first advantage of employing a pneumatic actuator for actuation of valve 44 over the usual electromagnetic actuator is its lower cost. A second advantage is that the usual centrifugal motor switch, which is provided to insure that the blower is up to speed and that adequate circulation is established before main burner valve 48 opens, may be dispensed with. A third advantage is that the usual broken-belt switch may be dispensed with. The broken-belt switch is provided in clothes dryers in which the blower as well as the drying drum is driven through a belt instead of directly driven as illustrated. A fourth advantage is the provision of a safety fuel cut-off means which functions to cut off the fuel at valve 44 in event the exhaust duct 22 becomes clogged so as to prevent adequate circulation. In FIG. 2, the conduit 74*a* communicates with the duct 22 on the intake side of blower 20 so that diaphragm 68 is drawn upward to open valve 44 so long as the pressure on the intake side of blower 20 remains sufficiently below atmospheric. As the usual lint trap 24 becomes filled, the pressure in exhaust passage 22 builds up until a point is reached wherein the pressure on the intake side exceeds that which will hold valve 44 open.

The foregoing description and accompanying drawings are intended to be illustrative and not limiting, the scope of the invention being set forth in the appended claims.

I claim:

1. In a clothes dryer, a drying drum, means including said drying drum defining an air flow passageway having an inlet portion leading to said drum and an outlet portion leading from said drum, a burner in said inlet portion and a lint trap in said outlet portion, a blower in said outlet portion between said drum and said lint trap and operative to induce air heated by said burner to flow through said drum and exhaust through said outlet portion, said blower having a low pressure side, a fuel conduit leading to said burner, a normally closed valve in said conduit, a pneumatic actuator operatively connected to said valve and operative in response to a drop in pressure below atmospheric to open said valve, and conduit means connecting said actuator with said outlet portion of said passageway at a point adjacent said blower and on the low pressure side thereof.

2. In a clothes dryer, a drying drum, means including said drying drum defining an air flow passageway having an inlet portion leading to said drum and an outlet portion leading therefrom, a main burner in said inlet portion and a lint trap in said outlet portion, a blower in said outlet portion between said drum and said lint trap and operative to induce air heated by said main burner to flow through said drum and exhaust through said outlet portion, said blower having a low pressure side, a main fuel conduit leading to said main burner, two normally closed series arranged valves in said main fuel conduit, a pilot burner, a pilot fuel conduit communicating with said main fuel conduit at a point between said valves and leading therefrom to said pilot burner, a pneumatic actuator operatively connected to the anterior one of said valves and operative in response to a pressure drop below atmospheric to open said valve, conduit means connecting said actuator with the outlet portion of said passageway adjacent to and on the low pressure side of said blower, an electrically operated actuator operatively connected to the posterior one of said valves and which when energized opens said valve, an energizing circuit for said actuator, a normally open flame responsive switch in said circuit arranged to be impinged by pilot flame and responsive to the existence of pilot burner flame to close, and a thermostatic switch in said circuit in series relationship with said flame responsive switch, said thermostatic switch being responsive to dryer temperature and operative to effect the opening and closing of said posterior valve in accordance with requirements to maintain a predetermined dryer temperature.

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