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SYSTEM OF CONTROL FOR BURNERS

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2 Claims.

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This invention relates generally to control equipment for governing the cyclic operation of burners of the so-called intermittent type.

The general object is to provide a novel oil burner control system which is simple and inexpensive in construction, which is reliable in operation, which embodies all of the features necessary for safe operation of the burner under all abnormal conditions ordinarily occurring in service use, and which effects automatic recycling of the burner at the time and under the conditions when such recycling may safely occur.

The invention also resides in the novel character of the construction employed for carrying out the foregoing object.

Other objects and advantages of the invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings which shows the improved control system as applied to the control of the liquid fuel burner of a conventional type adapted upon operation of an electric motor to discharge atomized fuel into the combustion chamber within a boiler indicated in dotted outline and having an outlet pipe through which the products of combustion are discharged. While any preferred form of ignition means may be employed, a spark igniter is illustrated and arranged to be rendered operative upon energization of the primary winding of a step-up transformer.

The motor is arranged to be energized through a circuit which extends from a high voltage power source through a conductor, the motor, a normally open switch of an electromagnetic relay, and a conductor having interposed therein a normally closed safety switch and a normally closed switch arranged to be opened in response to an abnormal high pressure or temperature of the boiler fluid. Thus, with the switches and closed as they normally are, the motor will be started and stopped and the supply of fuel to the combustion chamber will be initiated and interrupted in response to energization and deenergization of the magnet.

The safety switch is maintained closed under normal operating conditions and is arranged so to be opened after the lapse of an interval determined by the period during which a suitable slow-acting device remains electrically energized. After being opened, the switch remains in this position until reset manually. The slow-acting device comprises a strip of bimetallic material normally acting as a latch to hold a movable contact of the safety switch in closed position and arranged to warp, when heated by a resistance element, in a direction to release the contact and permit movement thereof away from the fixed contact. After opening of the switch, the motor circuit remains broken until the latch is reset by manual operation of a lever.

The primary winding of the ignition transformer is connected in series with a control switch, and the two are arranged in parallel with the motor so that the spark igniter will be rendered effective when both of the switches and are closed, but may be rendered ineffective by opening of the switch alone. The latter is arranged to be opened upon energization of a second relay. Preferably the switches and are formed by a common stationary contact cooperating with movable contacts and carried respectively by the armatures and of the magnets and.

The energizing circuits for the relays are preferably operated at low voltage under the control of a room thermostat having a switch, and a combustion responsive device. In the present instance, the latter device comprises a thermostat disposed within the flue with its movable end connected through a slip clutch or well known equivalent mechanism (not shown) to an arm carrying a contact which cooperates with two relatively stationary contacts and to form switches and. Stack switches of this character operate to detect predetermined rises and falls in the stack temperature, so that upon heating of the element the switch will be closed, the closed-when-cold switch will be opened, and after the lapse of a predetermined interval the closed-when-hot switch will be closed, slippage of the driving clutch occurring as the stack temperature continues to rise. When the stack temperature falls in response to stopping of the burner, the switch will open, and after the lapse of a predetermined interval, the switch will be again closed. The parts of the stack switch are so constructed and the contacts and so spaced that the interval of time between the opening of the switch and clearing of the switch upon initial cooling of the element is following stopping of the burner is of sufficient duration to enable the combustion chamber to be properly purged of combustible gases. Also the arrangement is such that the interval between the opening of the switch and the closing of the switch is
during starting of the burner is shorter than the interval during which the resistance 17 must be energized and the thermostatic element 16 in switch 12.

The circuit for effecting initial energization of the relay 18 extends from the source of low voltage current such as the secondary of a transformer 35 through a conductor 36, the room thermostat switch 27, a conductor 37, the closed-when-cold stack switch 33, a conductor 38, the holding circuit of the relay 18 by the armature 25 and normally closed when the relay 21 is deenergized, a conductor 39 in which the resistance 17 is interposed, the winding of the relay 18 and the control transformer 37. The conductor 39 is closed when the control transformer 37 is energized and the burner motor to be started. Then when the closed-when-cold stack switch 33 becomes closed as it will after the lapse of the purging interval, the starting circuit will, if the room thermostat is still calling for heat, again be completed and recycling of the control mechanism will occur.

With the arrangement above described, the room thermostat switch cannot be manipulated accidentally in a manner such as to effect momentary operation of the burner or momentary interruption of its operation without the desired purging interval being interposed between any two successive periods of burner operation. Thus, the presence of control effects recycling of the burner 25 automatically in response to the occurrence of any abnormal condition where such recycling is permissible but only after the proper interval for purging the combustion chamber has been allowed. Similarly, the control provides for locking the system against recycling in the event of initial failure of ignition upon starting of the burner motor. Such failure is evidenced by failure of the close-when-cold stack switch 33 to open when the relay 18 is in circuit and energization of the heater 27. The use of the closed-when-cold stack switch 33 to determine which continues the energization of the heater 27 until the relay 18 has warped to a position allowing the safety switch 12 to open.

Advantage is taken of the circuits above described to incorporate in the control system a simple and reliable mechanism for rendering the burner motor power and steam heating systems when the water level in the heater 3 falls below a predetermined safe level.

For this purpose, the primary winding 46 of a transformer 47 is interposed in the low voltage 45 circuits in series with the winding of the motor relay 10. One terminal of the secondary winding 48 is connected to an electrode 49 which may be a pipe communicating with the boiler at the proper level. The other winding terminal 50 is connected to an electrode 51 which is insulated and spaced from the electrode 49 and positioned at the minimum water level to be maintained. The transformer is so constructed that the primary winding 46 will act as a choke in the low voltage supply to the motor relay 10, so that when the electrode 50 is immersed in the boiler water, the impedance of the primary winding will be relatively low. But when the water level falls below the electrode when the burner is operating, the impedance of the primary will be increased to such an extent that the resulting reduction in the voltage applied to the winding of the motor relay will cause this relay to release its armature and permit the switches 27 and 42 to open. In the event that the room thermostat calls for heat following a rise in the water level below the desired point, the relay 10 cannot be energized to the degree necessary to close the motor switch 27, with this arrangement, electrodes of very small size may be used and the necessity of switches or other moving parts subject to deterioration is avoided. I claim as my invention:
1. A control system for a motor operated fuel burner having high voltage motor and ignition circuits, a first relay adapted when energized to close the motor and ignition circuits, a second relay adapted when energized to open said ignition circuit, a first switch constituting a main control, a combustion responsive thermostat having closed-when-hot and closed-when-cold switches, an electrically operable safety switch adapted to render the control system inoperative upon prolonged energization of an operating element, a low voltage circuit for effecting initial energization of said first relay extending through said first switch, said closed-when-cold switch, a normally closed switch which is opened when said second relay is energized, said operating element and the winding of said first relay independently of said closed-when-cold switch including the winding of the relay, said operating element, said normally closed switch, and a normally open switch which is closed when said first relay is energized, and a circuit for energizing said first and second relays in series relation upon the occurrence of combustion including said first switch, said normally open switch, said closed-when-hot switch and the windings of said relays.

2. A control system for a motor operated burner having high voltage motor and ignition circuits, a first relay adapted when energized to close the motor and ignition circuits, a second relay adapted when energized to open said ignition circuit, a main control switch, a combustion responsive thermostat having closed-when-hot and closed-when-cold switches, an electrically heated safety switch adapted to render the control system inoperative upon prolonged heating of a resistance element, means controlled by said control switch and closed-when-cold combustion switch for effecting initial energization of said first relay and said resistance element and maintaining such energization during a burner starting period, and a low voltage circuit including said control switch and said closed-when-hot switch and operating to energize said first and second relays in series relation independently of said resistance element whereby to interrupt said ignition circuit and maintain operation of said burner after successful ignition of the fuel.

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