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CONTROL SYSTEM FOR GAS BURNERS

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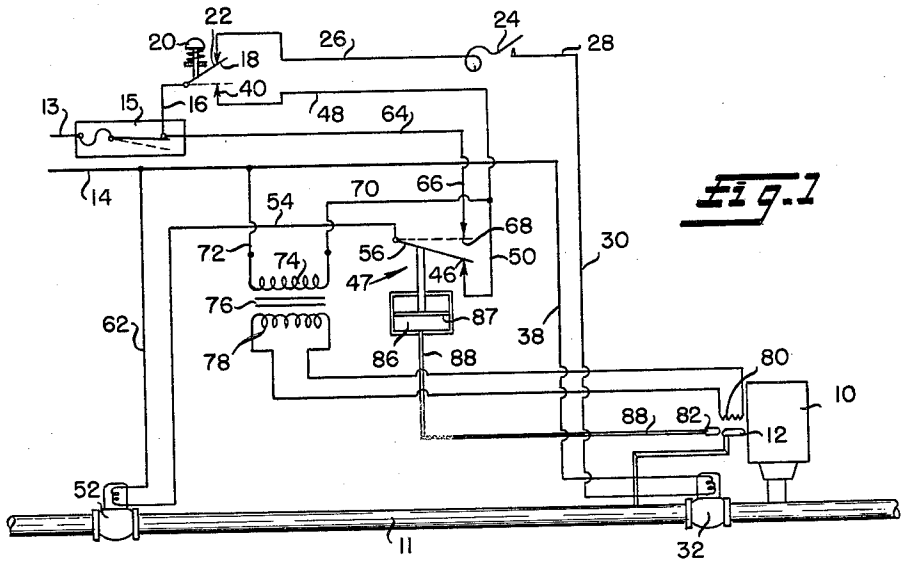


Fig. 1

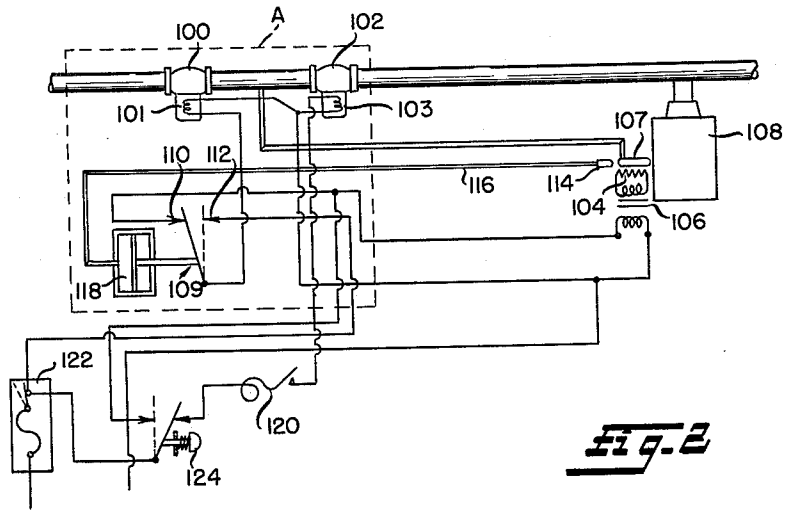


Fig. 2

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CONTROL SYSTEM FOR GAS BURNERS

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This invention relates to control systems for gas burners and more particularly to remotely and manually controlled electric ignition systems for gas burners having fail-safe operation. This invention is particularly suitable for the control of infra-red gas burners of the type disclosed in Patent No. 2,775,294.

In conventional gas burner installations it is often the practice to provide for automatic recycling in the event of pilot light outage. In such systems in the event the pilot light goes out for one reason or another, the system is equipped to automatically relight the pilot burner. Since most current day automatic recycling devices are reasonably efficient, such automatic recycling will suffice in most situations.

It is often the case, however, that the gas burner may be used under circumstances in which the escape of even minimal quantities of gas may be hazardous and in which reliance upon the normal efficiency of the automatic recycling device to relight the pilot light may therefore present an undue risk. If, under such circumstances, the pilot light was not re-established upon operation of the automatic recycling device, dangerous quantities of gas could escape to create precisely the safety hazard which the automatic recycling device was designed to preclude. Thus for many applications conventional automatic recycling systems are not acceptable.

Systems having 100% shutoff in the event of pilot burner outage have been heretofore suggested. For example, a system having this general type of operation is shown in United States Patent No. 2,812,806, which describes an electrically controlled igniter system for gas burners. A system such as is there disclosed, however, has several limitations, no doubt the most significant of which is the large time lag between pilot light outage and the closing of the pilot burner valve. This time lag results not only from the delay between outage and the switching of a flame detector switch from its hot to its cold contact, but also from the delay between said switching action and the opening of a warp switch as a result of the overheating of a heater coil. The latter delay may add 3 to 5 minutes to the former, throughout which time gas seepage will continue to occur.

Another significant limitation of such prior systems is that after pilot light outage, or in the event the pilot light fails to ignite in the first instance, the operator of the system must wait until the heater coil actuating the warp switch cools to permit reclosing of said switch before another attempt may be made to ignite the pilot burner.

It is accordingly a primary object of the present invention to provide a gas burner control system having 100% shutoff in the event of pilot light outage and which reduces the quantity of gas escaping after such outage occurs to a minimum.

It is another object of the present invention to provide an electric ignition system for infra-red gas burners which is manually and remotely controlled and in which all flow of fuel gas through the system will cease within a minimum period after outage of the pilot light occurs.

It is still another object of the present invention to provide an electric ignition system for gas burners having solenoid-operated pilot and main burner valves in series in a single gas line, the pilot valve being closed upon outage of the pilot light to interrupt the flow of gas to both burners.

It is a further object of the present invention to provide an electric ignition system for gas burners in which all flow of fuel gas through both pilot and main burner valves will cease immediately after a flame detector switch is cooled by pilot flame outage.

It is yet another object of the invention to provide an electric ignition system for gas burners in which the pilot burner valve will be closed shortly following outage of the pilot and wherein said pilot burner valve may be immediately reopened manually to permit flow of gas to said pilot burner.

It is still a further object of the present invention to provide an electric ignition system for gas burners in which the ignition coil for the pilot is cut out of the circuit after the pilot is ignited.

It is another object of the present invention to provide an electric ignition system having 100% shutoff operation and in which the opening of the pilot and main burner valves is manually and remotely effected by a single switch, said switch opening the pilot burner valve in a first position and the main burner valve in a second position.

These and other objects of the present invention will become more fully apparent by reference to the appended claims and as the following detailed description proceeds in reference to the accompanying drawings wherein:

FIGURE 1 is a schematic diagram of a circuit incorporating the novel ignition system of the present invention; and

FIGURE 2 is an alternative embodiment of the system shown in FIGURE 1.

As shown in FIGURE 1, the novel ignition system of the present invention is herein illustrated as applied to the control of one or more infra-red gas burners **10** of the type disclosed in United States Patent 2,755,294 to which gas is supplied through a conduit **11**. The burner **10** is normally ignited by a pilot burner **12** also connected to the main supply conduit **11**. The electrical system is connected to a source of power by means of conductors **13** and **14**. Conductor **13** is connected to a normally closed fused line switch **15**, which serves as the junction of two circuits arranged in parallel.

The first circuit leading from switch **15** comprises a conductor **16** which is connected to contact arm **18** of a single pole double throw switch **20**. Contact arm **18** is normally spring-biased into the solid-line position shown in FIGURE 1, into engagement with contact **22** which, in turn, is connected to thermostat **24** by means of conductor **26**. Thermostat **24** will be in its closed position whenever there is a need for operation of the main burner **10**. Connected to thermostat **24** by means of conductors **28** and **30** is a main burner solenoid valve **32** of conventional construction having a valve element in the main gas conduit **11** upstream of main burner **10**. The valve element closes the conduit except when its solenoid is energized. Solenoid valve **32** is connected to the source of power supply by conductor **38**.

When contact arm **18** of switch **20** is depressed into the dotted line position shown in FIGURE 1, it will engage contact **40** which is connected to a cold contact **46** of a flame detector switch **47** by means of conductors **48** and **50**. A circuit is normally established between cold contact **46** and solenoid valve **52** by means of conductor **54** and contact arm **56** which, in its normal solid-line position shown in FIGURE 1, is in engagement with said cold contact **46**. Solenoid valve **52** which is conventional has a movable armature which is operative to open a valve (not shown) in gas conduit **11** upstream of the pilot burner **12**. Solenoid valve **52** is connected to lead **14** by conductor **62**.

The other of the parallel circuits having its junction at fused line switch **15** comprises conductors **64** and **66**, the

latter of which is connected to a hot contact 68 of flame detector switch 47. A circuit will be closed between hot contact 68 and conductor 54 when contact arm 56 is moved into the dotted line position shown in FIGURE 1 when flame detector switch 47 is operative as described more fully below.

Connected in parallel across conductors 50 and 14 by means of conductors 70 and 72 is the primary coil 74 of a transformer 76. Transformer 76 has a secondary coil 78 wired in series with an ignition coil 80 which is positioned adjacent pilot burner 12.

Flame detector switch 47 is of conventional construction and essentially comprises a liquid filled bulb 82 which is sensitive to the heat of the flame of the pilot burner 12 and which is connected to a chamber 86 by means of a capillary tube 88. Chamber 86 is suitably provided with a diaphragm member 87 which is effective when urged upwardly by the pressure of vaporized liquid from bulb 82 to exert a force which causes contact arm 56 to snap from engagement with cold contact 46 into engagement with hot contact 68.

Assuming that the pilot flame in pilot burner 12 has been extinguished for one reason or another, solenoid valves 32 and 52 will be closed and flow of gas to the pilot as well as the main burner will be completely shutoff. The relighting of the pilot burner is effected by depressing switch 20 to move contact arm 18 into engagement with contact 40. With switch 20 in its depressed position, current will flow through solenoid 52 through conductors 13, 16, 48, 50, cold contact 46, contact arm 56, conductors 54, 62 and 14. The energization of solenoid 52 will open the valve in gas conduit 11 upstream of the pilot burner 12, permitting flow of gas to the pilot burner. Since valve 32 is not energized, no gas will be supplied to the main burner 10. At the same time, since current will also flow to transformer 76 through conductors 70 and 72 which are connected in parallel across conductors 14 and 50, ignition coil 80 will be energized to ignite the gas in the adjacent pilot burner 12. The pilot flame will heat bulb 82 and snap contact arm 56 into engagement with hot contact 68.

At this point, a warning light or other suitable signal device which is connected to the circuit in a conventional manner, will advise the operator of the switching of contact arm 56 from the cold to the hot position and the operator will permit spring-biased switch 20 to return to its normal position with contact arm 18 in engagement with contact 22. Since conductors 50 and 70 are no longer in the circuit, the flow of power to transformer 76 will be interrupted, thus shutting off the ignition coil 80. Solenoid 52 will remain energized, however, through the circuit formed by conductors 13, 64, 66, hot contact 68, contact arm 56 and conductors 54, 62 and 14. With switch 20 in its normal position, power will be supplied to main burner solenoid 32 (assuming that thermostat 24 is closed) through conductors 26, 28, 30, 38 and 14, thus opening its associated valve upstream of main burner 10 and permitting ignition of the main burner by means of the pilot light in a conventional manner.

If main burner 10 is ignited and the pilot burner 12 is extinguished for any reason, the pilot will usually be immediately reignited by the flame of the main burner. In the event it is not so reignited, however, or in the event the pilot light is extinguished at a time when the flame of the main burner is also extinguished, contact arm 56 will eventually snap back into engagement with cold contact 46 which, in turn, will open the circuit furnishing power to solenoid 52, closing the valve in gas conduit 11 upstream of pilot burner 12. Since valve 52 is upstream of main burner 10, gas flow to both pilot burner and the main burner will be interrupted and the result will be 100% cut-off of all gas flow.

In the event that the pilot light is not ignited in the first instance, the signal indicating the switching of contact arm 56 from its cold to its hot position will not operate, which will serve as a sufficient warning to the operator to permit switch 20 to return to its normal position to interrupt the gas flow through the pilot burner 12.

The operation of the ignition system shown in FIGURE 2 is identical to that described above and shown in FIGURE 1 except that the pilot and main burner valves are located in a single valve housing, as shown by the dotted enclosure A in FIGURE 2. In the circuit shown in FIGURE 2, the upstream valve is designated by the numeral 100 and its associated solenoid by 101, the main burner valve by 102 and its associated solenoid by 103, the ignition coil by 104, the transformer by 106, the pilot burner by 107, the main burner by 108, the flame detector switch by 109, cold contact by 110, hot contact by 112, liquid-filled bulb by 114, capillary by 116, diaphragm chamber by 118, thermostat by 120, fused line switch by 122, and the single pole double throw switch by 124.

As will be obvious from the description set forth above, the ignition systems of the present invention provide truly effective means for absolutely safe operation of gas burners while providing for remote manual control. In the event of any outage of the pilot light without immediate reignition of the pilot burner, the flow of gas to the main burner and to the pilot burner will be cut off with minimal delay and the hazard created by escaping gas reduced to a minimum.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A control system for a gas burner comprising: a pilot burner; a main burner; conduit means for supplying gas to said pilot burner and said main burner, said main burner being located downstream of said pilot burner; a normally closed solenoid pilot burner valve located upstream of said pilot burner, a normally closed solenoid main burner valve located between said pilot burner and said main burner whereby said pilot burner valve must be open for gas to flow to said pilot burner and whereby both said valves must be open for gas to flow to said main burner; a manually operable switch having a normally open contact and a normally closed contact; an igniter for said pilot burner in series with said normally open contact, a flame detector switch having hot and cold contacts, and means to close said hot contact when said pilot burner is ignited and to close said cold contact when said pilot burner is out, a first electrical circuit series connecting a power source, said pilot valve solenoid, said cold contact and said normally open contact, a second electrical circuit series-connecting said power source, said pilot valve solenoid, said hot contact and bypassing said manually operable switch and a third electrical circuit series-connecting said main burner solenoid, said normally closed contact and said power source whereby when said manually operable switch is moved to close said normally open contact, said pilot burner valve will be opened, said main burner valve will be closed, said igniter will be in operation, said flame switch being operable to maintain said pilot burner valve open after said burner is ignited by completing said second circuit through said hot contact, said main burner valve being opened when said manually operable switch is released to close said normally closed contact, said flame detector switch being operative to break said second circuit and close said pilot burner valve upon outage of said pilot burner to thereby discontinue the flow of gas to both burners.

2. An ignition and control system for a gas burner

comprising a pilot burner, a main burner, a gas conduit connected to supply gas to said pilot burner and said main burner, said main burner being located downstream of said pilot burner, a normally closed first solenoid valve located in said conduit upstream of said pilot burner and said main burner, a normally closed second solenoid valve located in said conduit between said pilot burner and said main burner whereby said first solenoid valve must be opened for gas to flow to said pilot burner and where both said valves must be opened for gas to flow to said main burner, ignition means for igniting the gas issuing from said pilot burner, a manually operable switch having a normally closed contact in series with a power source and the solenoid of said second valve and a normally open contact in series with said power source and the solenoid of said first valve and said ignition means whereby when said normally open contact is manually closed the flow of gas is established to said pilot burner

and said ignition means is energized and when said normally closed contact is thereafter closed a flow of gas is established to said main burner, a temperature sensitive switch having a contact in parallel with said normally open contact, temperature sensitive means for closing said contact when said pilot burner is in operation and for opening said contact when said pilot burner is out of operation to thereby close said first valve in the event the gas in the pilot burner fails to be ignited or is ignited and is extinguished prior to the ignition of the gas from the main burner, the closing of said first valve discontinuing the flow to said pilot burner and said main burner.

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