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IGNITION SYSTEM

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UNITED STATES PATENT OFFICE.

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IGNITION SYSTEM.

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To all whom it may concern:

Be it known that I, OTTO A. KNOPP, a citizen of the United States, and a resident of the city of Oakland, in the county of Alameda and State of California, have invented a new and useful Ignition System, of which the following is a specification.

This invention relates to an electrical system for controlling the operation of liquid or gaseous fuel burners, and more particularly to a scheme whereby the ignition of the fuel, as well as the admission thereof to the burner, may be safely effected.

It is now well-known to utilize an electric system for temporarily producing the heat necessary to ignite the fuel, whereby heat or light is created. Gaseous or liquid fuel consuming devices of this character are quite often installed for example for the heating of residences, in which the turn of a switch or the pressure on a button is utilized to initiate the controlling function. The control for setting the burner into operation involves two distinct features—one, that of turning on the fuel, and another, that of producing a spark or a high temperature at the burner. There is a likelihood that the ignition takes place before all of the air is expelled from the burner and replaced by the fuel mixture. This may result, in the case of gaseous fuel especially, in the production of an explosive mixture in the fuel pipe passages, with a consequent explosion and improper burning of the fuel. It is one of the objects of my invention to prevent such occurrences, by automatically providing a slight lag in the time between the turning on of the gas and its ignition.

It is another object of my invention to utilize in such a system, a double-throw switch of the usual wall push button type, for lighting the burner as well as for stopping its operation. This type of switch has two stable contact making positions, which would cause the current to flow continually even after the desired controlling function of the system is accomplished. It is another object of my invention to ensure that the current will cease to flow as soon as this control is effected, whereby a material saving in the expenditure of electrical energy is effected, this energy being utilized only for brief periods at the time the control system is operated.

In many instances, the igniting function is performed by a wire heated by the passage of an electric current. To ignite the fuel, it is essential to place the heated wire in proximity to the fuel outlet; yet after the flames are once started, this proximity exposes the wire to a destructive heat which is highly detrimental to the life of the wire. Especially is this the case where as is usual, the wire is of filamentary form and fashioned from specially alloyed resistance wire, making the replacement not only difficult but expensive. It is still another object of my invention to provide a scheme whereby the igniting wire is moved out of the region of high heat after the burner is ignited. Preferably this action is performed automatically, in a manner to be described hereinafter. Of course this feature of my invention, involving bodily movement of the igniting device, is also applicable to other forms of ignition, such as by sparks or the like.

My invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full those forms of the invention which I have selected for illustration in the drawings accompanying and forming part of the present invention. Although I have shown in the drawings but a few embodiments of my invention, I do not desire to be limited thereto, since the invention as expressed in the claims may be embodied in other forms also.

Referring to the drawings:

Figure 1 is a schematic wiring diagram of a control system embodying my invention;

Fig. 2 is a diagram of a modified form of the invention, in which a lag is introduced in the interval between the opening of the valve to permit the flow of fuel, and the ignition; and

Fig. 3 is a detail showing the construction of certain of the contacts, in a less diagrammatic manner.

In the embodiment of Fig. 1, a fuel burner 11 is shown, which is arranged to be supplied with gas or liquid fuel through a conduit 12. To ignite the fuel at the burner 11, I preferably utilize a filamentary resistance wire 13 in the form of a coil, heated to incandescence by the passage of an elec-

tric current therethrough. The control of the flow of fuel may be accomplished by the aid of a valve 14 in conduit 12, operated by a rod 15. This stem or rod is so arranged that upon lifting it to open position, it stays in that position of its own accord, and until it is pushed downwardly to closed position. This effect is usually obtained by the provision of well-known expedients forming in themselves no part of my invention, such as a friction sleeve in which the rod 15 is disposed.

The electrical system whereby the flow of fuel is controlled, as well as the flow of current to wire 13, will now be described. In the condition shown, the burner 11 is inoperative. To start the burner into operation, the double-throw switch 16 (which is shown diagrammatically as the wall push button type) is operated by pushing on lower button 17. This causes engagement of contacts 18 and 19. A circuit is now completed, as follows: from contact 19, to wire 20, bar 21, wire 13, bar 22, spring contact 23, wire 24, coil 25, secondary 26 of a transformer 27, wire 28, to contact 18. The transformer 27 has a primary winding 29 which may be connected to any convenient source of electrical energy. This transformer serves the purpose of stepping down the voltage to the proper operating value, and may if desired be dispensed with, if batteries are used or if the apparatus is altered in design to take the available supply. The flow of current through the coil 25 causes core 30, attached to rod 15, to be pulled in a direction shown by arrow 31, and the valve 14 opens. At the same time, the flow of current in wire 13 causes it to become hot and to ignite the fuel issuing from the burner 11.

It is one of the features of my invention that the circuit just traced is interrupted after the controlling function is completed, and there is no waste of electrical energy, and furthermore the wire 13 does not deteriorate so rapidly as when energization would be continual. These results I accomplish by making the free ends of bars 21 and 22, which support coil 13, automatically movable away from spring contact 23, in response to the heat developed near the burner 11. For this purpose, the bars 21 and 22 are made from bimetallic material, whereby when heated, they take the position shown in dotted lines. The heat of the burner is sufficient to accomplish this movement, the strips 21 and 22 remaining in the dotted line position while the burner 11 is in operation. It is furthermore evident that in case wire 13 is broken, the fuel valve 14 cannot be opened, as the operating solenoid 25 cannot be energized.

The construction used for strips 21 and 22 is shown most clearly in Fig. 3, where it is

seen that they are anchored at the top to the posts 32 placed side by side.

Not only does the movement of strips 21 and 22 to the dotted line position stop the flow of current as described, but it also performs another important function, that of removing the heated wire 13 out of the region of intense heat. It is thus assured that this wire will not be unnecessarily exposed to the destructive temperatures generated near the burner tip. Renewals need be less frequent. The strips 21 and 22 are of course exposed only to the radiated heat, and occupy positions comparatively remote from the burner 11.

While this burner is in operation, the strips 21 and 22 stay in the dotted line position. To shut down the burner, the push button 33 is operated, causing engagement between contacts 34 and 35. The following circuit is then energized: from contact 35, to connection 36, contact springs 37 and 38 (which are pressed together by insulation piece 51 on the strip 21 while it occupies the dotted line position), connection 39, coil 40, secondary winding 26, switch 16, back to contact 34. The winding 40 actuates the core 41 fastened to stem 15 to urge valve 14 to closed position, in a direction shown by arrow 42. As soon as the valve 14 closes, the burner 11 is extinguished, strips 21 and 22 cool, and reassume the full line position. This has the effect of permitting spring contacts 37 and 38 to separate, and thereby of deenergizing the circuit just traced. The valve however stays closed, as has been mentioned heretofore, until coil 25 is energized. The movement of strips 21 and 22 to the full-line position thus insures against loss of electrical energy, places the igniting device 13 into operative position, and also places the circuit into condition for reignition, at contact 23. To ignite the fuel at burner 11, the push button 17 is operated, with the result that has already been described.

When the fuel used is gaseous, it is advantageous to delay ignition at the burner for a short period after valve 14 is opened, so as to prevent explosions or burning of the fuel in conduit 12. To provide this time lag, the wire 13 may be so designed that a small but appreciable time must elapse for it to attain an igniting temperature. This thermal lag may be readily secured by providing sufficient mass for the wire 13 in conjunction with the proper choice of material.

In many instances, however, it is inexpedient to design the igniting device with this idea in mind, and special means must be provided if a time lag be desired. One such means is illustrated in the modification of Fig. 2. In this figure the operation to render the burner 11 inactive is substantially identical to the operation of Fig. 1, and

involves a circuit control at contacts 37, 38 by the strips 21 and 22. However, the operation to make the burner active is different. When button 17 is operated, a circuit is completed as follows: contact 19, connection 43, a conductor 44, contact arm 45, coil 25, secondary winding 26, connection 28, back to contact 18. Energization of coil 25 causes valve 14 to open. Conductor 44 is so chosen that it becomes appreciably heated by the current flowing through it, and expands in a short time to permit contact 46 carried by lever 45 to engage another contact 47. This short interval may be varied very readily, as by adjusting the screw 48 which carries the contact 47; this has the effect of varying the amount of expansion of conductor 44 to close the contacts. These contacts in turn control the circuit for the heated wire 13, which circuit may be traced as follows: contact 19, conductor 43, conductor 44, arm 45, contacts 46 and 47, connection 49, spring contact 23, strip 22, wire 13, strip 21, conductor 50, secondary winding 26, conductor 28, back to contact 18. After ignition takes place, the strips 21 and 22 are flexed to the dotted line position, carrying wire 13 out of the hot region, as well as breaking its circuit between spring 23 and strip 22, and placing the springs 37 and 38 into contact.

In the present instance the well-known property of heat lag in a conductor such as 44 is made use of to introduce the time lag, the expansion thereof taking an appreciable time after the current flow in it is established. It is of course evident that similar effects could be produced in other ways, not necessary at this point to set forth. The burner 11 of course may represent the source of heat for any purpose, such as the generation of steam, for industrial application, or for heating residences.

I claim:

In combination, a burner, a pair of circuits arranged to be selectively energized and respectively to permit the flow of fuel to the burner, and to prevent said flow, an electrically energized means for igniting the fuel at the burner tip, a support for said igniting means, movable to carry said means out of the hot region near the burner in response to an increase in temperature, and circuit controlling devices operated by the movement of said support to control the said pair of circuits, whereby after completion of their function they become inactive.

In testimony whereof, I have hereunto set my hand.

OTTO A. KNOPP.