

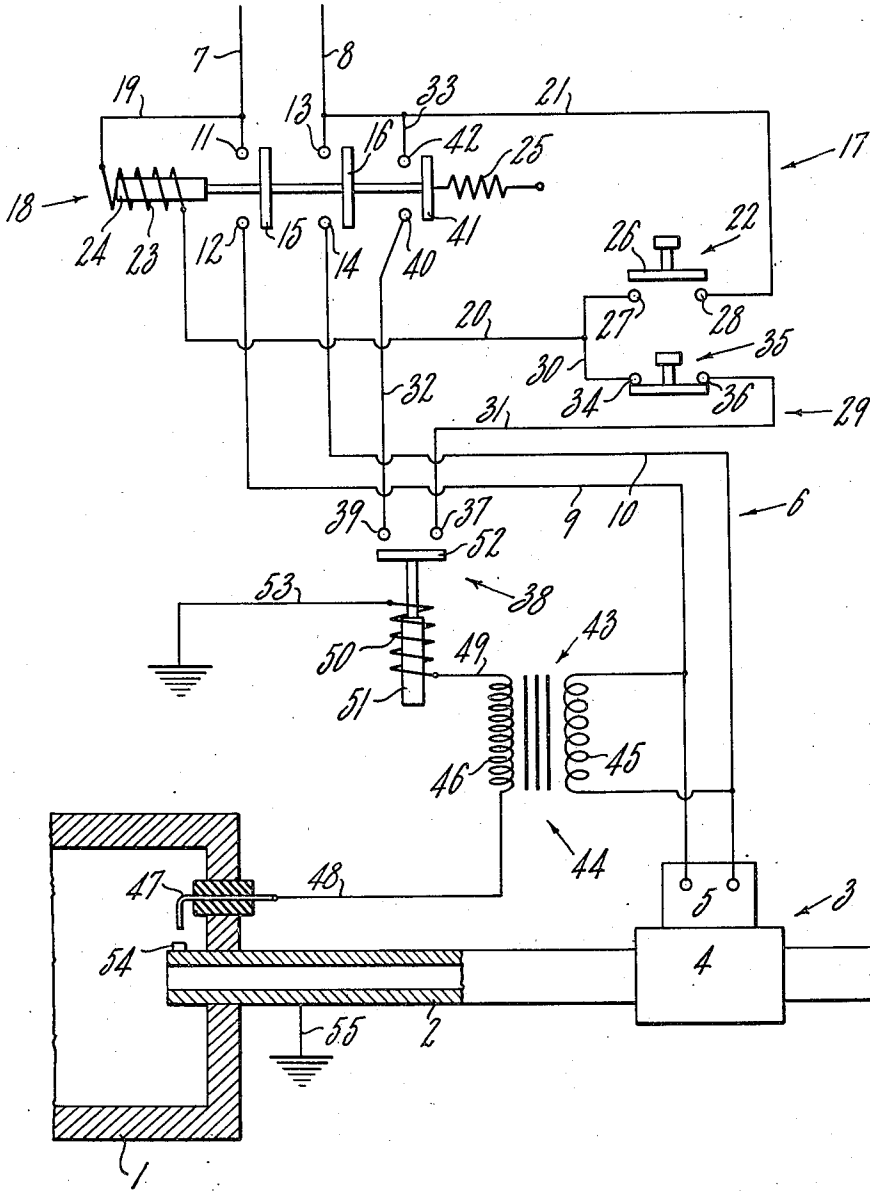
July 30, 1940.

E. G. LOWREY

2,209,410

ELECTRIC CIRCUIT FOR BURNERS

Filed Jan. 18, 1939



INVENTOR.

EDWARD G. LOWREY

BY *Gourley & Budlong*
ATTORNEY.

ATTORNEY.

UNITED STATES PATENT OFFICE

2,209,410

ELECTRIC CIRCUIT FOR BURNERS

Edward G. Lowrey, Bristol, R. I., assignor to
United States Rubber Company, New York,
N. Y., a corporation of New Jersey

Application January 18, 1939, Serial No. 251,489

2 Claims. (Cl. 158—28)

This invention relates to electric ignition systems for burners using gaseous or atomized liquid fuel. More particularly it relates to ignition systems using an ignition spark and provided with a safety control system to insure the safe operation thereof.

In burners using gaseous or liquid fuels, it has heretofore been found desirable to employ electric spark ignition systems in which the ignition spark was substantially continuous while the burner was in operation to insure burning of the injected fuel at all times during the operation of the burner. In the use of such continuous spark systems many difficulties and dangers, for example, flooding and the accumulation of explosive mixtures resulting from the flame becoming extinguished and the furnace filled with unburnt gaseous fuel, were eliminated. However, such systems were found to be troublesome as failure in the spark discharge, either when it was attempted to start the operation of the burner or while the burner was in operation, sometimes occurred and at such times the difficulties and dangers mentioned above were liable to result.

In order to reduce the possible occurrence of such conditions, my invention provides a safety system which regulates and controls the admission of fuel to the combustion chamber and at the same time provides an electric spark for ignition purposes. A motor-operated valve controls the fuel injection for the furnace and a substantially continuous spark discharge within the furnace insures the burning of all injected vapor or gases even though the supply thereof might, for some reason, be interrupted long enough to extinguish the flame. The continuing spark ignites the mixture as soon as more of the mixture is again injected thus preventing the accumulation of unburnt fuel. The spark discharge system is provided with a safety device in the form of a control relay which operates only while the ignition system operates with the result that when the operation of the system ceases, for any reason whatsoever, the safety control relay immediately and automatically becomes inoperative and thereby terminates the flow of current to the motor-operated valve and to the entire burner system.

In this embodiment of my invention, I employ a transformer of conventional construction provided with a high voltage secondary winding to energize the ignition circuit and to provide the necessary potential for the spark discharge device. The safety control relay is placed in series

with the secondary winding of the transformer and the spark discharge device with the result that an interruption of operation of the ignition circuit is immediately and automatically effective to terminate the operation of the relay and consequently the entire burner system.

It will be apparent that a relay inserted into any circuit of the burner system other than the ignition circuit, as a safety control for the entire system, would not operate as desired. It would fail to terminate the operation of the entire system. A system so equipped would continue to operate even though a failure might occur in the ignition circuit. At such times, dangerous and objectionable conditions are liable to occur.

My invention tends to overcome such dangers and objections, because by placing the safety control device in the ignition circuit any failure in this circuit, as well as in any other circuit of the burner system, will effect an immediate and positive termination of operation of the entire burner system.

It will be apparent that I have produced a combination and arrangement that is simple and economical in construction and at the same time positive and instantaneously responsive in operation. It will also be apparent that my invention is highly desirable for use with either oil burners or gas burners and that when so used with either it operates equally well without requiring alterations or additions thereto.

This invention will be readily understood from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawing.

The drawing shows diagrammatically a combustion chamber and ignition system employing my invention.

A furnace or combustion chamber is indicated in the drawing by the numeral 1, and has extended into it a fuel burner conduit 2 which is in direct communication with a motor-operated fuel valve assembly generally indicated by the numeral 3. This valve assembly is composed of a valve proper 4 including a return spring and an operating motor 5 and is of such construction that fuel can pass therethrough only when the motor 5 is operative to hold the valve open. When the motor ceases to operate it is returned to closed position by the return spring. The particular details of this motor-operated valve and return spring form no part of this invention and accordingly are only herein diagrammatically shown.

The electric supply circuit generally indicated

by the numeral 6 comprises conductors 7, 8, 9 and 10. The conductors 7 and 8 extend from contact points 11 and 13 of a magnetic starter (hereinafter to be more completely described) to some external source of alternating electric power, while the conductors 9 and 10 serve to connect the contact points 12 and 14 of the magnetic starter with the terminals of the electric motor 5. The terminals 11 and 12 are arranged to form a pair of magnetic starter contact points while the terminals 13 and 14 form a second pair of similar contact points. The supply circuit is interrupted between these pairs of contact points and movable contact bars 15 and 16 are arranged adjacent thereto to bridge the gaps so formed and thereby connect the electric motor 5 to the source of power for operating purposes.

A starting circuit is generally indicated by the reference numeral 17 and comprises a holding coil 23, a starting switch 22 and conductors 19, 20 and 21. One end of the coil 23 is connected by means of the conductor 19 to the magnetic starter terminal 11 while the other end is connected by the conductor 20 to the switch 22. The conductor 21 extends from the magnetic starter terminal 13 to the other side of the switch 22 thereby completing the supply circuit.

The magnetic starter, generally indicated by the reference numeral 18, is composed of the said holding coil 23 and an armature 24 which is connected to and directly controls the position of the contact bars 15 and 16 and is biased to an inoperative position by a tension spring 25. The starting switch 22 is of any conventional type provided with a connecting bar 26 engaging contact points 27 and 28, when manually held closed. It should be understood that while a manually operable starter switch has been shown in this embodiment that any type of conventional switch, such as one controlled by some external power means, might readily be employed in this circuit without departing from the spirit of this invention.

The holding circuit 29 comprises conductors 30, 31, 32 and 33. The conductor 30 extends from the starting circuit conductor 20 to a terminal 34 of the stop switch 35. A second terminal 36 of the stop switch is in turn connected by means of the conductor 31 to a contact point 37 of the safety relay 38. The opposite contact point 39 of this relay is, in turn, connected by the conductor 32 to a contact point 40 of the magnetic starter 18. Complementary contact point 42 of the magnetic starter is connected by the conductor 33 to the starting circuit conductor 21. The contact blade 41 is carried by the armature 24 of the starter 18 and is provided to close the gap between the said contact points 40 and 42 when completing the holding circuit.

A transformer circuit is provided for supplying to the burner a high tension spark for ignition purposes. This circuit is indicated generally by the reference character 43 and is composed of a step-up or high voltage transformer 44 having a relatively low tension primary coil 45 and a relatively high tension secondary coil 46. The terminals of the primary coil 45 are connected to the supply circuit conductors 9 and 10, respectively. One of the secondary coil terminals is connected directly to the electrode 47 of a spark gap located within the combustion chamber by a conductor 48 while the other terminal 49 of the secondary coil is connected to one terminal of the high voltage safety relay coil 50. The safety relay

is of such construction that it is directly and easily influenced by the high voltage potential created in the ignition circuit by the secondary coil 46. The relay is equipped with an armature 51 which carries at its end the contact blade 52. The opposite terminal 53 of the relay coil 50 is, in turn, connected to the ground. The relay is arranged so that the high voltage coil 50 is well insulated from the contact points 37 and 39 and the contact blade 52 to prevent any electric leakage from the ignition circuit to the holding circuit. The fuel conduit 2, in this particular disclosure, is composed of a metallic substance so as to serve as an electric conductor and carries at its inner end a member 54 constituting the other electrode of the spark gap which is located in the combustion chamber and serves to ignite the gaseous or atomized liquid fuel injected therein. A portion of the fuel conduit 2 outside of the furnace is connected by a conductor 55 to the ground and serves to complete the ignition or high potential circuit.

The operation of this electric ignition control system is such that when it is desired to operate the burner, the starting switch 22 is actuated by an attendant or by some external control means, the details of which form no part of this invention, thereby closing the circuit between the contacts 27 and 28 and a current is caused to flow in the starting circuit and in the holding coil 23 of the magnetic starter. This energizing of the coil 23 moves the armature 24 and biases the spring 25 with the result that the contact blades 15, 16 and 41 are brought, respectively, into contact with the contact points 11—12, 13—14 and 40—42. When the blades 15 and 16 have completed or closed the supply circuit the electric motor 5 and the fuel valve 4 are caused to operate and admit a gaseous or a liquid fuel to the furnace 1. At the same time the ignition circuit has been energized and a high voltage spark caused to pass between the electrodes 47 and 54 and the contact blade 52 of the safety relay 38 has been moved to an operative position in contact with the contact points 37 and 39. As the holding circuit 29 has been closed between the contact points 40 and 42 by the action of the magnetic starter and has also been closed between the terminals 37 and 39 of the safety relay, the holding circuit operates and continues to energize the coil 23. The result of this condition is that the holding coil continues to maintain the system operative even after the starting switch 22 has been released, this switch being of a conventional type and remaining open except at the time it is being operated by an attendant.

Should any interruption or failure in the ignition circuit occur and thereby cause an interruption of the spark passing between the electrodes 47 and 54, a similar interruption will be caused in the holding circuit 29 by the lack of current in the coil 50 and movement of the relay armature 51 and blade 52 away from the contacts 37 and 39. This movement of the armature and blade is caused by gravity, or some conventional spring means not shown, and occurs immediately and interrupts the current passing through the holding circuit and the holding coil 23 of the magnetic starter. When the current ceases in the coil 23, the spring 25 is free to move the contact blades 15, 16 and 41 away from their respective associated contact points and the operation of the entire system is completely terminated. The motor-operated fuel valve accordingly ceases to function and the flow of fuel

through the supply conduit 2 is immediately stopped.

Should it be desired to terminate the operation of the entire system at any time and for any purpose whatsoever, it is only necessary to operate the stop switch 35 momentarily. This interrupts the flow of current in the holding circuit and holding coil and accordingly releases the armature 24 and blades 15, 16 and 41 to the influence of the spring 25. The results obtained thereby are the same as those obtained when the safety relay automatically interrupts the current in the holding circuit thereby terminating operation of the entire system.

It will be readily understood that this system employs a safety control circuit which prevents a continued flow of fuel to the furnace or combustion chamber when the electric spark has ceased to pass between the electrodes 47 and 54. It is very important that this action be positive and complete in operation so that injurious or dangerous conditions will not be created by the continued flow of unburnt fuel to the furnace.

By the insertion of a safety relay in the secondary circuit of the transformer 44, it is possible to obtain more immediate and directly responsive safety conditions than have heretofore been available by other ignition systems already in use with gaseous fuel burners. An interruption of the secondary circuit interrupting the ignition spark will also interrupt the energizing of the safety relay and cause the entire system to stop operating immediately. If the safety relay had been inserted in the primary circuit of the transformer rather than the secondary circuit for safety control purposes, the results obtained would not be as satisfactory since the entire system would continue to operate even though a failure might have occurred in the ignition circuit. Such an objectionable condition has been entirely eliminated in my invention wherein this relay is located in the high tension circuit and a complete control of the entire system, rather than a partial control thereof, is effected.

It will be readily apparent that while it may be found advantageous to form the burner fuel conduit 2 of metallic or current conducting material, it may be made of other substances more resistant to high and varying temperatures of the combustion chamber. In such cases instead of the burner conduit 2 serving as a part of the high voltage secondary circuit, the electrode 54 may be connected directly to the end of an independent conductor which is in direct connection with the ground. In such an arrangement it is only necessary to position the spark gap formed between electrodes 47 and 54 near the point of injection of the fuel and to insulate these electrodes thermally and electrically in any manner well known in the art.

Although the invention has been disclosed in

connection with the specific details of a preferred embodiment thereof, it must be understood that such details are not intended to be limitative to the invention except in so far as set forth in the accompanying claims.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. The combination with a fuel burner, of a motor-operated fuel valve and an electric ignition means operatively associated with said burner, a transformer having a primary and a secondary winding for energizing said ignition means, a source of electrical energy, a supply circuit connected to said primary winding and said motor-operated valve, a magnetic starter comprising an actuating coil for connecting said source with said supply circuit, a starting circuit and switch connected to said source for momentarily energizing said starter coil to close said supply circuit, a holding circuit including a switch closed by the starter for maintaining said starter coil energized and said supply circuit closed, safety relay means comprising a contact blade for completing said holding circuit and an actuating winding for holding said blade in circuit-closing position when energized, said actuating winding being connected in series with said ignition means and said secondary winding so as to form an ignition circuit, said relay means being responsive to the interruption of current in said ignition circuit to open said holding circuit and deenergize said starter coil, and a stop switch operatively associated with said holding circuit to terminate the operation thereof, whereby upon failure of current in the ignition circuit the burner and supply circuit are disconnected from said source of energy.

2. The combination with a burner, of a motor-operated fuel valve and an electric spark ignition means for said burner, a supply circuit for said motor-operated valve, a magnetic starter operative when energized to connect said supply circuit with a source of power, said starter having a normally open starting circuit and a holding circuit including a switch closed by the starter, a switch for momentarily closing said starting circuit, a safety control relay operable when energized to close said holding circuit, a transformer having its primary winding operatively connected with said supply circuit and its secondary winding adapted to energize said spark ignition means and said relay, said secondary winding, control relay and ignition means being connected in series and arranged so that an interruption of current through said ignition means is operable to interrupt the current in and the operation of said control relay and thereby terminate the operation of said holding circuit and said magnetic starter.

EDWARD G. LOWREY.