

Jan. 12, 1937.

P. O. HENDERSON

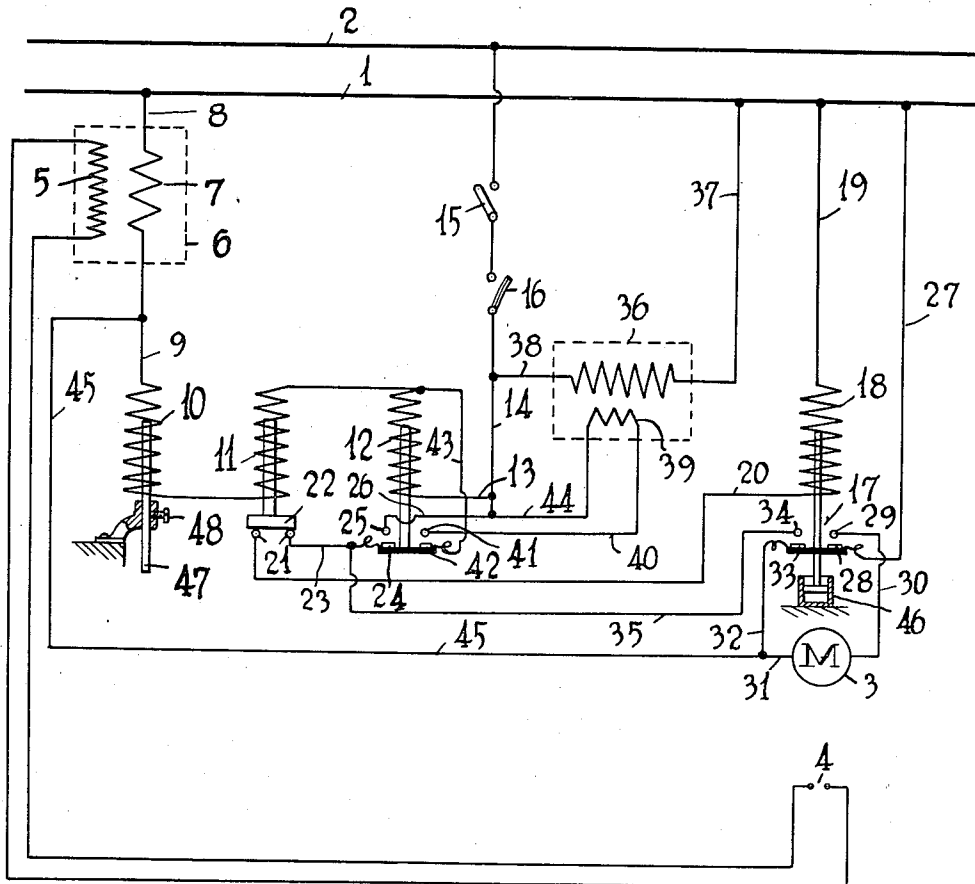
2,067,699

FLUID FUEL BURNER CONTROL SYSTEM

Filed Aug. 11, 1936

2 Sheets-Sheet 1

Fig. 1.



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2 Sheets-Sheet 2

FIG. 2.

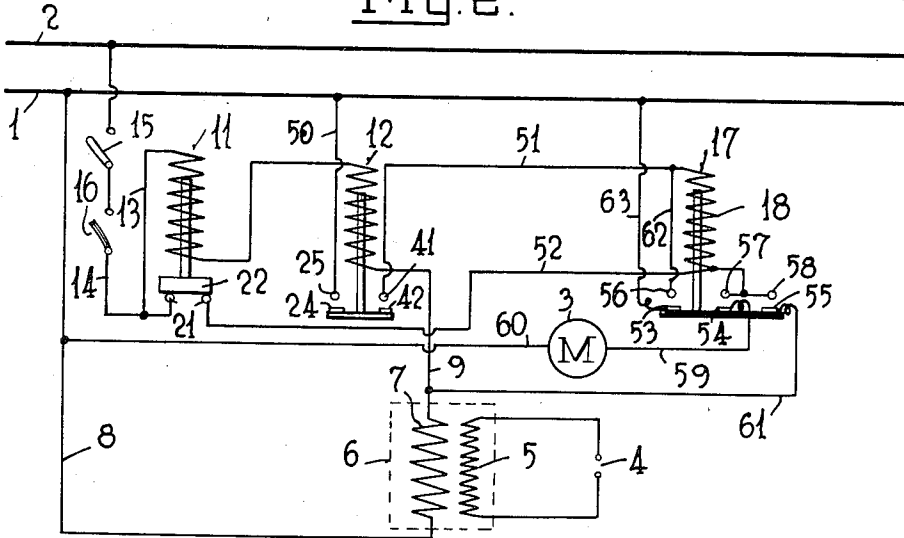
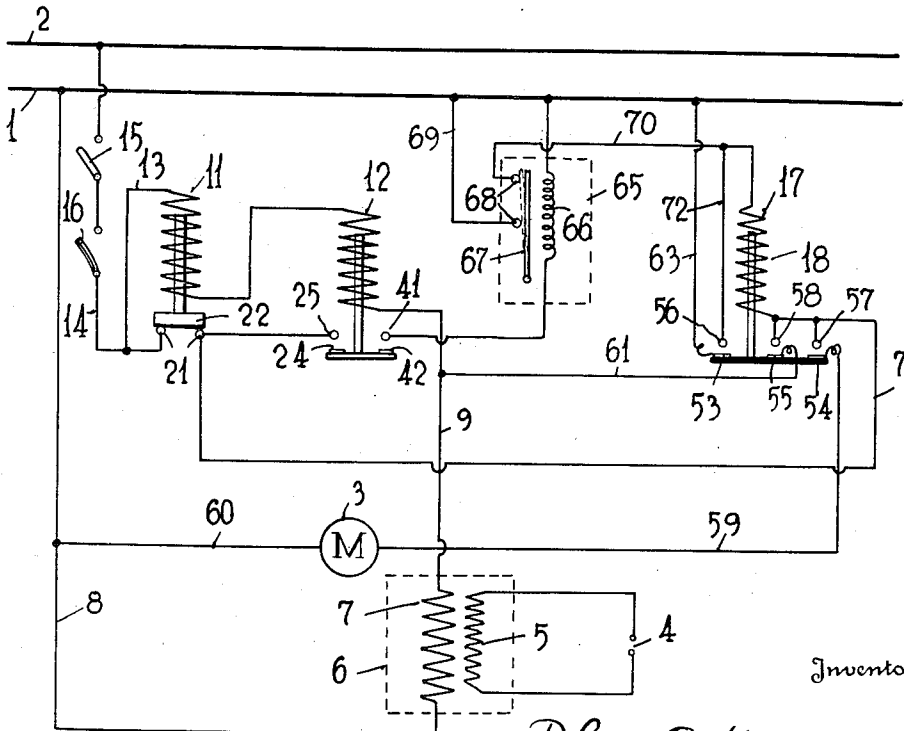


FIG. 3.



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2,067,699

FLUID FUEL BURNER CONTROL SYSTEM

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Application August 11, 1936, Serial No. 95,447

18 Claims. (Cl. 158—28)

This application is a continuation in part of my application Serial No. 71,506, filed March 28, 1936.

My invention relates to control circuits for fluid fuel burners of the type which in normal operation are periodically put into and out of operation by a thermostat or otherwise and in which the fuel is electrically ignited.

A primary object is to correlate the fuel feeding means and the igniting means so that fuel will not be fed until the igniting means is in good operative condition to cause ignition. Stated in another way, an important object of the invention is to provide means for positively preventing the delivery of fuel from the burner whenever, for any reason, maladjustment of the igniting means would result in failure to ignite the fuel at the burner. The invention thus prevents waste of fuel and the occurrence of explosions consequent upon the igniting of an accumulation of unburned fuel in a firebox or the like.

A particular object of a preferred embodiment of the invention is to make the operation of the fuel delivery means dependent on the proper electrical spacing of electrodes forming an ignition spark gap, so that fuel will not be delivered to the burner unless the electrodes are spaced properly, i. e., far enough apart to provide a spark sufficiently hot to ignite the fuel and close enough together to provide a spark which will not be blown out by the blast of fuel or for any other reason fail to ignite the fuel.

At the present time the conventional fluid fuel burner control systems comprise means for delivering fuel to the burner and simultaneously supplying current to the igniter and include some instrumentality, generally thermostatic, for stopping the delivery of fuel if ignition does not take place after a predetermined period, generally ninety seconds, of fuel delivery. In the use of such systems serious explosions sometimes occur when a previously heated firebox becomes loaded with unburned fuel or when an igniter which initially fails to function becomes operative after a brief period of unburned fuel delivery. By my present invention I positively withhold the delivery of fuel to the burner and firebox until the igniter is in condition to cause certain and instant ignition.

I have illustrated the invention as embodied in an oil burner of the type in which a mixture of atomized oil and air is supplied to a burner by a blower or equivalent pump and ignited at the burner by an electric spark which jumps between

spaced electrodes. The invention is predicated upon the fact that for any given type of fuel and supply line voltage a certain predetermined gap value of a particular ignition apparatus is essential to a certainty of ignition.

By "gap value" I mean the distance between the effective ends of the electrodes, i. e., the air gap through which the spark jumps. This gap value is exclusive of deposits on the points of the electrodes through which deposits the current may pass without arcing, and is therefore seen to be not necessarily the same as the mechanical spacing of the points. Of course, in the case of clean points separated by air only, the gap value is identical with the distance between points. In the case of fouled points the gap value is diminished by the thickness of fouling through which the current travels from electrode material to air and from air to electrode material.

The fact that with a given line voltage, ignition transformer, type of fuel, and perhaps other variables of any particular installation and use, a certain predetermined spacing of the ignition electrodes is essential to certainty of ignition may be demonstrated as follows:

Suppose that in the case of a given oil burner installation, operation with a particular grade of fuel and on a 110 volt supply line is found to give unfailingly certain ignition when the spark gap is one-quarter inch. Of course if the gap be reduced to zero, the points become shorted, no spark is produced, and ignition cannot take place. However, if the gap be reduced to a value appreciably less than one-quarter inch, say one-eighth inch, ignition either fails completely or becomes uncertain because such a short gap does not produce the "flaming" arc essential to instant and certain ignition of the presupposed type of oil and, in the case of "constant ignition" systems, because such a short gap is readily bridged and shorted by carbon deposits, dust, droppings of boiler scale and other foreign bodies so that a proper arc may not be maintained at all times during fuel delivery. If the gap be increased to a value appreciably greater than the predetermined one-quarter inch, say three-eighths inch, any of the following contingencies may arise: (1) The arc is apt to become thin and crackling, instead of fat and flaming, and hence incapable of promptly and unfailingly igniting the fuel. (2) A comparatively small drop in the line voltage, particularly common in rural districts, may cause complete failure of the arc. (3) The long thin arc is not stable and is easily blown out by the

blast of air and atomized oil. (4) The high resistance of the wide gap increases the likelihood of the high tension current shorting through the insulation of the electrode lead wires to the furnace casing or some other ground.

In addition to the foregoing objects, it is the general purpose of the invention to increase the safety factor of any fluid fuel burner system with which an embodiment of the invention may be used and to accomplish this and all of its objects and purposes by means comprising simple, inexpensive and durable instrumentalities which will be automatic and fool-proof in operation and which may be readily adjusted to accommodate such variables of any particular installation as the main line voltage, the type of fuel used, etc.

In the accompanying drawing Figures 1, 2, and 3 are diagrammatic illustrations of certain circuits comprising preferred embodiments of the invention.

In the accompanying diagrammatic drawing the invention is shown embodied in certain preferred forms which have been found operative in practice. These embodiments have been selected merely to exemplify the invention, and the following description of the particular exemplifications is not to be regarded as in any way limiting the spirit and principles of the invention to the selected embodiments. On the contrary, the principles of the invention are recognized as of broad application and the appended claims are to be deemed limited in scope only by their express terms and the state of the prior art. Similar reference characters designate identical or equivalent parts in each of the three figures.

Referring now to Fig. 1 of the drawings, reference numerals 1 and 2 designate the main current supply lines for a burner installation operating on fluid fuel, for example oil, which is atomized by any suitable means and fed with a mixture of air to a burner (not shown) by a blower or equivalent pumping means (not shown) driven by an electric motor 3. Main line 2 may be considered the hot wire, and main line 1 the cold or ground wire. Positioned adjacent the burner is a pair of spaced electrodes forming a spark gap 4. As shown, the circuit is arranged for constant ignition, i. e., an arc is formed at gap 4 constantly during operation of the motor 3 to deliver a combustible mixture from the burner.

The ignition gap is supplied by the secondary winding 5 of an ignition transformer 6. This transformer may be of the type adapted to have impressed on its primary winding 7 an electromotive force of 110 volts, and with such input to deliver a high tension difference in potential of 10,000 volts to the gap when the electrodes forming the same are spaced a predetermined distance apart, say one-quarter inch.

The primary winding 7 of ignition transformer 6 is supplied with main line current through the wire 8 connected to the cold wire 1, the circuit being completed through wire 9, a balancing coil 10, the coil of a relatively weighted relay 11, the coil of a relatively sensitive relay 12, the lead wire 13 thereof, and a connection 14 to the hot wire 2. In the connection 14 may be interposed a main switch 15 for rendering the whole system inoperative when desired and a room thermostat or the like 16 for rendering burner operation responsive to temperature requirements.

A motor-controlling relay 17 has its coil 18 connected to the cold wire 1 by conductor 19, and the other terminal 20 of the coil is connected

to one of a pair of contacts 21 which are normally electrically connected by the comparatively weighted core 22 of relay 11. Current passing from one stationary contact 21 through the movable bridge 22 to the other stationary contact 21 is led by a wire 23 to movable contact 24 carried by the core of the relatively sensitive relay 12. The contact 24 cooperates with a stationary contact 25, these contacts being normally spaced by the weight of the core, by a biasing spring or otherwise, but becoming closed when core 12 is suitably energized. A wire 26 connects stationary contact 25 with lead 14 and thus completes the circuit to the hot wire 2.

The circuit to the motor 3 is made through a connection 27 from the cold wire 1 to a contact 28 movable with the core of motor-controlling relay 17. A stationary contact 29 cooperates with contact 28, these contacts becoming engaged when the core moves against gravity or a spring bias consequent upon energization of the coil 18. From contact 29 the current passes through wire 30 to the motor 3 and thence through lead 31 and wire 32 to another contact 33 carried by the core of relay 17 and insulated from the other contact 28 carried by the core. Cooperating with movable contact 33 is a fixed contact 34 against which fixed contact the movable contact 33 closes at the same time that contacts 28 and 29 close. From contact 34 the circuit continues through wire 35 to movable contact 24, heretofore identified, and thence, if contacts 24 and 25 be closed, through them and through wires 26 and 14 to the hot wire 2.

The reference numeral 36 designates a step-down holding transformer having a primary winding connected by wire 37 to the cold wire 1 and by wire 38 to the connection 14 leading to the hot wire 2. The low voltage secondary winding 39 of this transformer is connected by lead 40 to a stationary contact 41 which cooperates with a movable contact 42 carried by the core of sensitive relay 12 and insulated thereon from the other movable contact 24. A wire 43 connects the contact 42 with one terminal of the coil of relay 12. The other terminal 13 of this coil has already been shown to be connected to wire 14, and this wire is tapped by a wire 44 to the other terminal of the secondary winding 39. When contacts 41 and 42 are closed a circuit is completed for delivering the low voltage output of transformer 36 to coil 12.

A branch wire 45 connects that terminal of the primary winding 7 of ignition transformer 6 which is not connected to cold wire 1 to wire 32 which is itself connected to movable contact 33 of relay 17.

Cooperating with the core of relay 17 is a dashpot or equivalent means 46 for retarding slightly the movement of the core to close contacts 33, 34 and 28, 29 for a purpose hereinafter explained.

The numeral 10 designates any suitable loading device, such as an inductively wound coil whose value may be adjusted in any convenient manner, as by varying the depth of insertion of a core 47, the position of the core being fixed as by a set screw 48.

The operation of the system is as follows:

Assuming that the main line voltage is 110 and the switch 15 is closed and the thermostat 16 moves in response to temperature requirements to closed position, the circuit through primary winding 7 of ignition transformer 6 is completed from main line wire 2 through wire 14, wire 13

coil 12, coil 11, coil 10, wire 9, winding 7 and wire 8 connected to main line wire 1. Coils 10, 11 and 12 by their reactance reduce the voltage applied by this circuit to primary winding 7 to a point considerably below 110, the exact value of which voltage may be adjusted through the medium of set screw 48 controlling the insertion of core 47 in coil 10. Ignition transformer secondary winding 5 does not deliver its full voltage, which may be assumed to be 10,000 volts, to gap 4. The parts are adjusted, by selecting appropriate values for the coils 11 and 12, and by adjusting core 47 of coil 10, to make the relatively low high tension voltage thus delivered by secondary winding 5 to gap 4 sufficiently high to produce across gap 4 what may be called a "feeler spark" if the electrodes forming gap 4 are spaced apart some predetermined distance which has been found appropriate to ignite the fuel mixture when the gap is supplied with the full rated delivery of the transformer 6. Let it be assumed that this predetermined setting of the electrodes is one-fourth inch and that the full rated delivery of transformer 6 is 10,000 volts. If the electrodes be set to provide a one-fourth inch gap the feeler spark is produced, and the current which passes through the described circuit including the primary winding 7 and the coils 10, 11 and 12 is sufficient to move the core of the relatively sensitive relay 12 to close contacts 24, 25 and 41, 42, but is not sufficient to move the relatively weighted core 22 of relay 11 to break the connection between contacts 21. The closing of contacts 24 and 25 thus energizes coil 18 of motor-controlling relay 17 by completing a circuit from hot wire 2 through wire 14, wire 26, contacts 25 and 24, wire 23, contacts 21, wire 20, coil 18 and wire 19 connected to cold wire 1. This energization of relay 17 moves the core thereof, relatively slowly because of the action of dashpot 46, to close contacts 33, 34 and 28, 29. The closing of contacts 28, 29 and 33, 34 completes the circuit to the motor through wire 27 connected to cold wire 1, contacts 28, 29, wire 30, the motor 3, wires 31 and 32, contacts 33 and 34, wire 35, contacts 24 and 25, wire 26, and wire 14 connected to hot wire 2. The motor thus becomes supplied with current from the main lines and begins to operate to drive the blower and feed fuel to the burner. Simultaneously with the beginning of motor operation, the closing of contacts 33, 34, essential to completing the motor circuit as just explained, shunts out of the circuit through primary winding 7 of ignition transformer 6 the voltage reducing coils 10, 11, and 12, so that the voltage through primary winding 7 becomes substantially 110, delivering the full rated high tension voltage to the gap 4, 10,000 in the illustration supposed, producing at the gap 4 a hot flaming arc capable of igniting the mixture. The circuit through primary winding 7, after contacts 33, 34 close to shunt out coils 10, 11 and 12, includes wire 8 connected to cold wire 1, the primary winding 7, wire 45, wire 32, contacts 33 and 34, wire 35, contacts 24 and 25, wire 26 and wire 14 connected to the hot wire 2. To hold contacts 24 and 25 in engagement after coil 12 is shunted out of the circuit of primary winding 7, as just described, a low voltage current, is supplied to coil 12 from the secondary winding 39 of holding transformer 36 through lead 40, contacts 41 and 42, wire 43 connected to one end of coil 12 and wire 13 connected to the other end of the coil, which is in turn connected to wire 14 as is also the other lead 44 of secondary winding 39.

It will thus be seen that if the electrodes form-

ing gap 4 are spaced sufficiently to provide a suitable spark when supplied with the full rated output of ignition transformer 6, the motor will be energized and the spark produced to ignite the fuel.

Let it be supposed however that because of deterioration, loosening, or for any other reason the gap 4 has increased somewhat beyond the desired one-fourth inch, so that the spark therein formed when the gap is supplied with the full rated output of the ignition transformer would not be certain to ignite the fuel. The resistance of the widened gap is thus increased to a point where the current which flows through the circuit including primary winding 7 and coils 10, 11 and 12 is insufficient to move the core of coil 12 to close contacts 24 and 25 to energize the motor-controlled relay 17. The motor therefore remains inoperative and no fuel is fed to the burner. Consequently the firebox cannot fill with a combustible mixture which could not be ignited or might not be ignited instantly on issuing from the burner.

Let it be supposed, again, that the electrodes forming gap 4 have become bridged and hence shorted by an accumulation of carbon or other foreign body, or that they have become loosened and have moved into contact with each other, or that they have become so closely spaced that no arc which could be formed across them by the full rated output of the ignition transformer would be certain to produce instant ignition. In such case the resistance of the diminished gap is decreased to a point where the flow of current through the circuit which includes primary winding 7 and the coils 10, 11 and 12 becomes increased to a value which is sufficient to lift the weighted or comparatively heavy core 22 of relay 11. This breaking of contacts 21 opens the circuit to the motor-controlling relay 17 and prevents the flow of current to the motor so that the motor remains inoperative and no fuel is supplied to the burner.

It sometimes happens that the ignition transformer becomes "drowned", i. e., shorted as the result of immersion in water. Such a transformer is incapable of supplying its full rated output to the gap and the arcing thereby produced in the gap might be insufficient to cause instant and certain ignition. If the transformer 6 included in the present invention should thus become shorted the increased current supplied through it to coil 11 would open contacts 21 and prevent the supply of current to the motor in the same manner as the motor is prevented from operating when the electrodes forming gap 4 approach too closely together or become shorted, as has been explained.

It will be observed that when main switch 15 and thermostat 16 become closed current flows through the primary winding 7 of ignition transformer 6. This current continues to flow whether or not the spacing of the electrodes forming gap 4 is appropriate for positive and instant ignition, until such time (generally 90 seconds more or less) as the usual safety controls operate to open the main circuit. These customary controls generally include a thermal time delay switch or the like (not shown) which opens the main circuit upon failure of combustion for a predetermined period. It is such controls which the conventional burner control systems of the prior art rely upon to terminate motor operation and delivery of fuel if after a period of some 90 seconds of such operation and delivery ignition has not yet taken place. It will be noted that I rely on

such instrumentalities only for opening the circuit to the ignition transformer in case ignition does not take place. I do not rely on them to terminate the delivery of fuel after such delivery has continued for a period of time without being ignited. As explained hereinabove, the delivery of unignited fuel from the burner into the firebox is positively prevented by my invention, so that there is no possibility of the firebox filling up with a combustible mixture which may subsequently become ignited by belated sparking at the gap or improvement in the sparking or by heat stored in the firebox or stack by previous burner operation. The dashpot or its equivalent 46 is included as a precaution to prevent the closing of contacts 33, 34 and 28, 29 on the initial surge of a relatively heavy current through coils 11 and 12 (which will of course almost instantly move the relatively light core of coil 12 to close contacts 24, 25) until the heavy current passing through coil 11 has succeeded in moving the relatively heavy core 22 to open contacts 21. In other words, if the gap be shorted or too short, the relatively light core of coil 12 promptly closes its contacts against their cooperating fixed contacts and this closing is followed somewhat later by the movement of the relatively heavy core 22 to open contacts 21. In such case the dashpot or its equivalent 46 prevents the closing of the circuit through the motor 3 during the brief space of time in which contacts 21 remain bridged and contact 24 is engaged with contact 25.

Figs. 2 and 3 illustrate simplified embodiments, and therefore in a sense improvements, of the Fig. 1 device. In Fig. 2 for example the holding transformer 36 and the dashpot or equivalent 46 are eliminated, and the balancing coil 10, which is not shown in Figs. 2 and 3, may be added if desired, or it may be omitted on the assumption that the several coils are fixed at appropriate values.

The analogy of the operation of the Fig. 2 device to that of Fig. 1 is thought to be evident in view of the foregoing description. Briefly, when the main switch and thermostat are closed, current passes from hot wire 2 through coils 11 and 12, primary 7 of the ignition transformer 6, and lead 8 to cold wire 1, producing a feeler spark at gap 4. If the relatively low voltage high tension current induced in secondary 5 is within predetermined desired limits, points 24 and 42, which are in Figs. 2 and 3 electrically connected, close against points 25 and 41 respectively, closing the circuit (which is in parallel to the circuit just described) to motor-controlling relay 17 through lead 50 connected to the cold wire 1, points 25, 24, 42, 41, lead 51, coil 18, lead 52, points 21 bridged by armature 22, and conductor 14 to hot wire 2. This energization of relay 17 closes points 53, 54, and 55 on points 56, 57 and 58 respectively. The circuit to the motor is completed from hot wire 2 through lead 14, points 21, conductor 52, points 57 and 54, motor leads 59 and 60, and lead 8 connected to main wire 1. Simultaneously relays 11 and 12 are shunted out of primary circuit 7, which becomes completed from hot wire 2 through lead 14, points 21, conductor 52, points 58 and 55, lead 61 connected to the primary 7, and lead 8 connecting the primary to cold wire 1, and to maintain motor-controlling relay 17 energized and keep the motor in operation the coil 18 becomes directly connected to the main wires in parallel with the ignition transformer supply circuit through lead 14 connected to hot wire 2, points 21, conductor 52 connected to coil 18, conductor 62, points 56 and 53, and lead 63

connected to cold wire 1. The connections of the transformer supply circuit and the motor-controlling relay 17 being in parallel assures the transformer receiving the full line voltage and increases the intensity of the spark at gap 4 to the maximum possible on the line voltage. I consider this characteristic, common to all the illustrated embodiments, a novel and important feature of the invention.

Operation of the Fig. 2 modification under abnormal conditions of gap value is as has been described for Fig. 1. Too great a spacing of the electrodes results in relay 12 failing to operate, and too small a spacing causes relay 11 to operate, opening points 21.

In Fig. 3 the circuit is modified to include a thermal time delay switch, designated generally 65, to delay operation of the motor-controlling relay 17, thus serving much the same purpose as the dashpot or the like 46 of Fig. 1. In Fig. 3, points 41 and 42 close to energize the thermal element 66, which in a predetermined short period of time warps the heat-responsive element to bridge points 68, thereby connecting coil 18 of motor-controlling relay 17 with main lines 1 and 2, in parallel with the ignition circuit, and shunting out relays 11 and 12. The connections include lead 69 from main wire 1, points 68, conductor 70 connected to coil 18, conductor 71 connecting the coil with points 21, and lead 14 connected to main wire 2. When relays 11 and 12 are shunted out of the transformer supply circuit by the closing of points 55 and 58, as has been described in connection with Fig. 2, thermal element 66 becomes de-energized and the connection between points 68 is soon broken. This, however, does not result in de-energizing relay 17, the coil of which is now connected directly with the main lines, in parallel with the ignition supply circuit, by engagement of points 53 and 56. This connection is through lead 63 connected to wire 1, points 53 and 56, connection 72 to the coil 18, conductor 71 from the coil to points 21, and lead 14 connected to main wire 2.

Abnormal gap values affect the operation of the Fig. 3 device exactly as has been described above for Fig. 2.

It is hardly necessary to explain that when, in operating the system hereinabove described, it is observed that combustion does not begin promptly after the room thermostat closes or after other customary operating controls are actuated, it is to be concluded that the ignition gap is defective and requires attention. The main switch should then be opened and the electrodes examined and cleaned, adjusted or replaced, so that operation may be begun when the switch is again closed.

The specific form of the various instrumentalities shown constitutes no part of the invention broadly considered. These instrumentalities may take any form capable of discharging the functions required of them. It may be desirable, to adapt a particular embodiment of the system to use with a wide range of different installations, to make the action of core 22 of relay 11 adjustable by providing a variable weight, spring bias or the like for the core 22. The adjustment thereby provided cooperates with the adjustability provided by the loading device 10, 47, to accommodate the apparatus to a wide range of optimum gap settings.

I claim:

1. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a circuit for 75

initially supplying a relatively low voltage high tension current to said gap, and means controlled by said circuit and operable only when said low voltage high tension current lies within predetermined limits to start the fuel delivery means and supply a higher voltage high tension current to said gap.

2. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a circuit for supplying a relatively low voltage high tension current to said gap including a relay, a motor driving said fuel delivery means controlled by said relay, and means controlled by said circuit and operable only when said low voltage high tension current lies within predetermined limits to operate said relay to start said motor and supply a higher voltage high tension current to said gap.

3. A fluid fuel burner control device including main line wires, means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a circuit connected to the main line wires for initially supplying therefrom a relatively low voltage high tension current to said gap, and means controlled by said circuit and operable only when said low voltage high tension current lies within predetermined limits to energize said fuel delivery means from the main line wires in parallel with said circuit and to supply a higher voltage high tension current to said gap.

4. A fluid fuel burner control device including main line wires, a fuel delivery means, electrodes forming a spark gap for igniting said fuel, a circuit connected to the main line wires for initially supplying therefrom a relatively low voltage high tension current to said gap, said circuit including a relay, a motor driving said fuel delivery means controlled by said relay, and means controlled by said circuit and operable only when said low voltage high tension current lies within predetermined limits to operate said relay to connect the motor to the main line wires in parallel with said circuit and supply a higher voltage high tension current to said gap.

5. A fluid fuel burner control device including main line wires, a fuel delivery means, electrodes forming a spark gap for igniting said fuel, a circuit connected to the main line wires for initially supplying therefrom a relatively low voltage high tension current to said gap, said circuit including a relay, a motor driving said fuel delivery means controlled by said relay, and means controlled by said circuit and operable only when said low voltage high tension current lies within predetermined limits to operate said relay to connect the motor to the main line wires in parallel with said circuit and shunt said relay out of said circuit, whereby the gap is thereupon supplied with a higher voltage high tension current.

6. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a transformer having a secondary circuit including said gap, a motor for driving the fuel delivery means and a circuit for energizing said motor, relay means comprised of reactance in the transformer circuit and responsive to a predetermined current therein for closing the motor circuit, and means for shunting said relay means out of the transformer circuit when said motor circuit becomes closed.

7. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a transformer

having a secondary circuit including said gap and having a primary circuit, a motor for driving the fuel delivery means and a circuit for energizing said motor, relay means comprised of reactance in the primary circuit and responsive to a predetermined current therein for closing the motor circuit, and means for shunting said relay means out of said primary circuit when said motor circuit becomes closed.

8. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a transformer having a secondary circuit including said gap, a motor for driving the fuel delivery means and a circuit for energizing said motor, relay means comprised of reactance in the transformer circuit, operable only when the current in the secondary circuit lies within predetermined limits, for closing the motor circuit, and relay means for shunting the first relay means out of the transformer circuit, whereby the gap is thereupon supplied with a higher voltage high tension current when the motor circuit becomes closed.

9. A fluid fuel burner control device including main line wires, means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a circuit connected to the main line wires for initially supplying therefrom a relatively low voltage high tension current to said gap, said circuit including relay means comprised of reactance and a transformer in series with a portion of said reactance for supplying said gap, a motor driving said fuel delivery means, and a circuit for energizing said motor connected to the main line wires in parallel with the first named circuit, the relay means being operable, when the high tension current in the transformer circuit supplying said gap lies between predetermined limits, to close the main line circuit to the motor and to shunt said portion of reactance out of the first named circuit, whereby the circuit supplying the gap is thereupon supplied with a higher voltage high tension current.

10. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a transformer supplying said gap, a motor for driving the fuel delivery means and a circuit for energizing said motor, plural reactive relay means in circuit with the transformer, a relay controlling the motor circuit, and a circuit including the motor-controlling relay controlled by said plural relay means, one of said plural relay means being operable, when a current of predetermined value traverses the transformer circuit, to close the motor-controlling relay circuit, and another of said plural relay means being operable, when a current of predetermined greater value traverses the transformer circuit, to open the motor-controlling relay circuit and prevent the flow of current to the motor-controlling relay, and means operable by the motor-controlling relay for shunting said plural relay means out of the transformer circuit when said motor-controlling relay circuit becomes closed.

11. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a transformer having a secondary circuit including said gap and having a primary circuit, a motor for driving the fuel delivery means and a circuit for energizing said motor, plural reactive relay means in the primary circuit and a relay controlling the motor circuit, and a circuit including the motor-controlling relay controlled by said plural relay means,

one of said plural relay means being operable, when a current of predetermined value traverses the primary circuit, to close the motor-controlling relay circuit, and another of said plural relay means being operable, when a current of predetermined greater value traverses the primary circuit, to open the motor-controlling relay circuit and prevent the flow of current to the motor-controlling relay, and means operable by the motor-controlling relay for shunting said plural relay means out of the transformer circuit when said motor-controlling relay circuit becomes closed.

12. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a transformer having a secondary circuit including said gap and having a primary circuit, a motor for driving the fuel delivery means and a circuit for energizing said motor, plural relay means comprised of reactance in the primary circuit and a relay controlling the motor circuit, and a circuit including the motor-controlling relay controlled by said plural relay means, one of said plural relay means being operable, when a current of predetermined value traverses the primary circuit, to close the motor-controlling relay circuit and shunt the plural relay means out of the primary circuit to supply a higher high tension current to said gap, and another of said plural relay means being operable, when a current of predetermined greater value traverses the primary circuit, to open the motor-controlling relay circuit and prevent the flow of current to the motor-controlling relay.

13. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, an ignition transformer having a secondary circuit including said gap and having a primary circuit, a motor for driving the fuel delivery means and a circuit for energizing said motor, a first and second relay comprised of reactance in the primary circuit, a holding transformer having a normally open low voltage secondary circuit in parallel with said second relay, a relay controlling the motor circuit, and a circuit including the motor-controlling relay controlled by said plural relay means, said second relay being operable, when a current of predetermined value traverses the primary circuit, to close the motor-controlling relay circuit, shunt the first and second relays out of the primary circuit to supply a higher high tension current to said gap, and close the secondary circuit of the the holding transformer, and said first relay being operable, when a current of predetermined greater value traverses the primary circuit, to open the motor-controlling relay circuit and prevent the flow of current to the motor-controlling relay.

14. A fluid fuel burner control device including main line wires, means for delivering fuel, a motor driving said means, a circuit including a transformer and a gap for igniting said fuel, parallel connections between the main line wires and the motor and the transformer circuit, plural reactive relays in the transformer circuit, one of said relays being operable, when a current of predetermined value traverses the transformer

circuit, to close the motor circuit, and another of said relay means being operable, when a current of predetermined greater value traverses the transformer circuit, to open the motor circuit and prevent the flow of current to the motor, and means operable on closing of the motor circuit for supplying the transformer directly from said main line wires.

15. A fluid fuel burner control device including main line wires, means for delivering fuel, a motor driving said means, a transformer having spaced electrodes in its secondary circuit forming a gap for igniting said fuel and having a primary circuit, parallel connections between the main line wires and the motor and the primary circuit, plural reactive relays in said primary circuit, one of said relays being operable, when a current of predetermined value traverses the secondary circuit, to close the motor circuit, and another of said relay means being operable, when a current of predetermined greater value traverses the secondary circuit, to open the motor circuit and prevent the flow of current to the motor, and means operable on closing of the motor circuit for supplying the transformer directly from said main line wires.

16. A fluid fuel burner control device including main line wires, means for delivering fuel, a motor driving said means, electrodes forming a spark gap for igniting said fuel, a circuit connected to the main line wires for initially supplying therefrom a relatively low voltage high tension current to said gap, a thermal relay having its thermal element connected to the main line wires in series with the first named circuit, a motor-controlling relay controlled by the thermal relay and adapted to be connected thereby with the main line wires in parallel with said circuit, and means in said circuit, operable only when said low voltage high tension current lies within predetermined limits, for energizing said thermal element to start the motor, and for supplying a higher voltage high tension current to said gap.

17. A fluid fuel burner control device including means for delivering fuel, a motor driving said means, electrodes forming a spark gap for igniting said fuel, a circuit for initially supplying a relatively low voltage high tension current to said gap, and means controlling the motor circuit, including a delayed action relay controlled by said circuit and operable only when said low voltage high tension current lies within predetermined limits, to energize said delayed action relay to start the motor, and for supplying a higher voltage high tension current to said gap.

18. A fluid fuel burner control device including means for delivering fuel, electrodes forming a spark gap for igniting said fuel, a circuit having reactance for initially supplying a relatively low voltage high tension current to said gap, and means controlled by said circuit and operable only when said low voltage high tension current lies within predetermined limits to render said fuel delivery means operative, shunt at least a portion of said reactance out of said circuit and supply a higher voltage high tension current to said gap.

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