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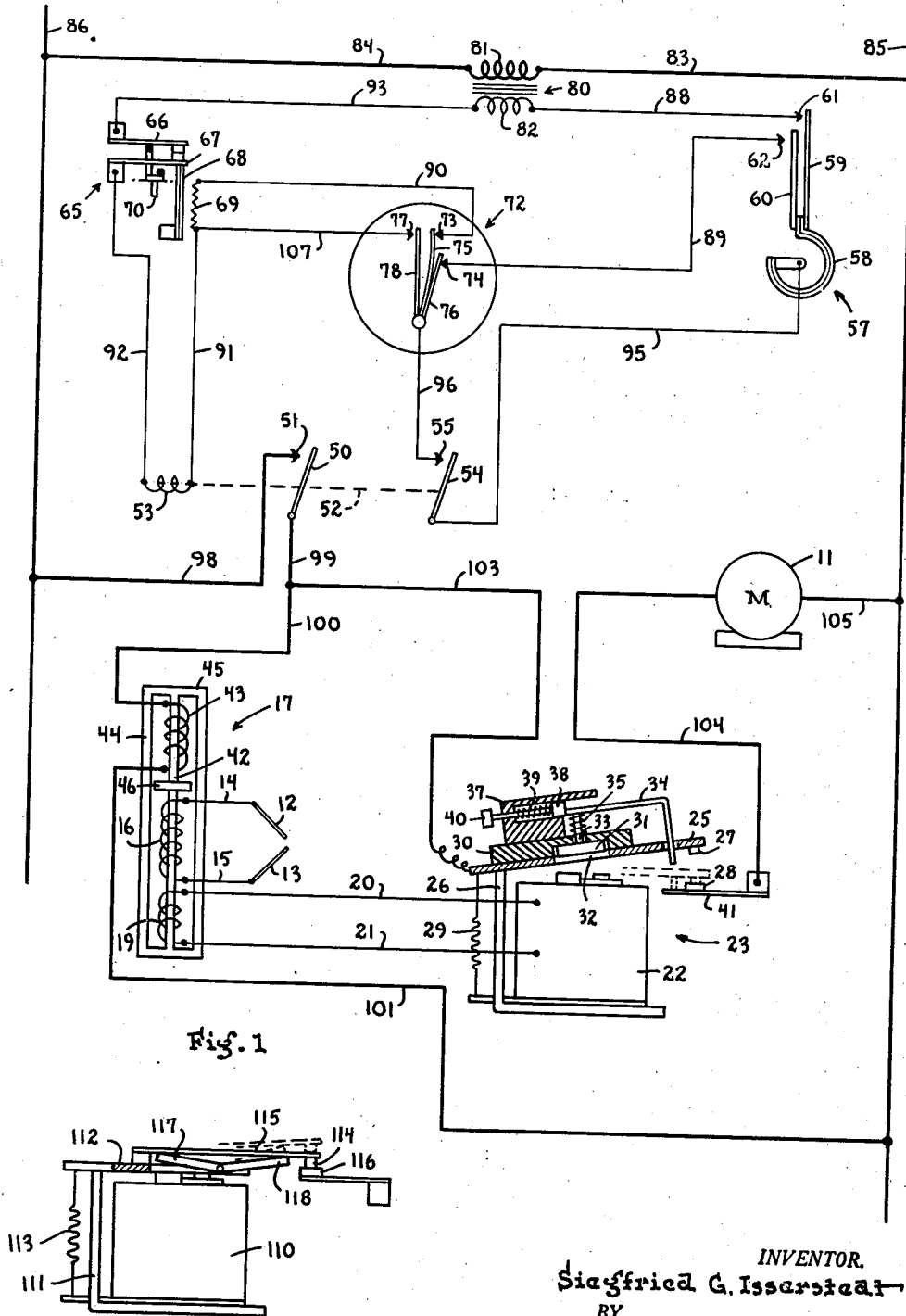


Fig. 1

Fig. 2

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SPARK CHECK ARRANGEMENT

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The present invention is directed to an automatic control system for fluid fuel burners in which the fuel is ignited by means of an electric spark. The present invention is an improvement over the type of system shown in the patent to Koerner 2,143,076.

The system covered in Koerner is a system which will check the spark gap for igniting the fuel at the burner so that if the gap is too small so as to cause a substantial short circuit, or if this gap is so wide as to not produce the proper spark, it will be impossible to energize the burner motor. Various different modifications are shown but in each modification it is necessary to utilize two separate relays, one responding to a substantial short circuit in the spark gap circuit and the other responding to a very low value of current in the spark gap circuit due to the electrodes being too widely spaced. The two relays are controlled in each case by means of a leakage transformer which also feeds power to the high voltage spark gap circuit.

One of the main objects of the present invention is to accomplish the same results as are accomplished by Koerner with the use of a single relay which will close the switch to the burner motor if the current flow through the relay is within a predetermined range, but which will maintain this switch in open position if the current flow through the relay is either above or below this predetermined range.

An additional object of the invention is to design a double armature relay which will operate to attract one of its armatures when the current flow therethrough is within a predetermined range for the purpose of closing a switch, and which will energize a second armature when the current flow through the relay exceeds a predetermined high value, the second armature operating to open the switch.

A further object of the invention is to provide means for locking the burner motor switch in open position in the event it has been opened as a result of the spark electrodes being spaced too widely apart. The purpose of this is to prevent the burner motor from being intermittently energized and deenergized in the event the spark should appear and disappear between the electrodes.

A further object of the invention is to design an electromagnet relay in which a main armature will move a movable contact into engagement with a stationary contact when it is attracted, and an auxiliary armature which will move the movable contact out of engagement with

the stationary contact when it is attracted due to an increase in the flow of current through the relay above a predetermined high value.

A still further object of the invention is to design a relay of the above type in which the auxiliary armature moves the stationary contact out of engagement with the movable contact when the auxiliary armature is attracted due to a predetermined high flow of current through the relay.

A still further object of the invention is to provide the relay with a trip which is released by the auxiliary armature to prevent this armature from returning to its original position and reclosing the switch.

These and other objects will readily become apparent as the following specification is read in the light of the accompanying drawing in which:

Figure 1 is a more or less diagrammatic representation of a system incorporating the various features of my invention, and

Figure 2 is a view of a slightly modified form of relay which may be substituted for the relay shown in Figure 1.

The control system shown in Figure 1 is adapted to control electrically the delivery of a fluid fuel to a burner, and to provide electrical means for igniting the fuel so delivered. It will be understood that many different types of fluid fuel may be used and that many different types of electrical means may be used for controlling the delivery of fuel. However, for the purposes of illustration the electrical means for controlling the delivery of fuel is illustrated as the usual burner motor 11. A pair of electrodes 12 and 13 are connected by means of conductors 14 and 15 to a high voltage secondary winding 16 of a leakage type transformer indicated generally at 17. When this high voltage circuit is energized, a spark will jump between the electrodes 12 and 13 for igniting the fuel delivered to the burner by the burner motor 11.

The transformer 17 is provided with an auxiliary secondary winding 19 which is connected by means of the conductors 20 and 21 to a relay winding 22 of the relay indicated generally at 23. The relay 23 is provided with an armature 25 which is pivotally mounted upon a bracket 26. The armature 25 carries a movable contact 27 which is adapted to cooperate with the stationary contact 28. A biasing spring 29 biases the armature 25 to its unattracted position in which the contact 27 is out of engagement with the contact 28, but when the relay coil 22 is sufficiently energized the armature 25 is attracted; thus caus-

ing it to move downwardly and close the switch 27, 28.

The armature 25 carries a block of insulating material, such as Bakelite, indicated at 30. A second armature 31 is carried by the armature 25 in a chamber formed by a cut-away portion in the bottom of the insulating member 30 which registers with an opening through the armature 25 as indicated at 32. The armature 31 is provided with a stem which extends upwardly through an opening in the insulating member 30 and connects to an L shaped operating member 34. The armature 31, stem 33 and operating member 34 are all suitably connected together as a unit. A biasing spring 35 seats at its lower end on the insulating member 30 and at its upper end against the L shaped operating member 34 to bias the operating member and armature 31 to its unattracted position as shown in Figure 1.

A second block of insulating material 37 is carried on the upper surface of the insulating member 30 and is hollowed out to form a cylinder which slidably receives a trip mechanism 38. A biasing spring 39 within the cylinder biases the trip member 38 toward the right as seen in Figure 1 and its engagement with the end of the operating member 34 restrains this trip member from further movement. It will be understood that if the armature 31 is attracted it will move downwardly carrying the operating member 34 with it, and the operating member 34 will then release the trip member 38 for movement to the right. The trip member 38 will then be immediately above the operating member 34 and will therefore lock the armature 31 in its energized position and prevent its return to unattracted position. The armature 31 then must remain in this position until the trip member 38 is pulled back to its original position by means of the knob 40, at which time the biasing spring 35 will be operative to raise the armature 31 to its unattracted position to return the parts to the position shown in Figure 1.

If the current flow through the relay coil 22 is gradually increased from zero to a certain value, the relay will attract the armature 25 and cause it to move to the position shown in dotted lines in the drawing in which the contacts 27 and 28 will be in engagement. If the current flow through the coil 22 is then increased further to a predetermined high value, the armature 31 will be attracted to pull the operating member 34 downwardly. The operating member 34 will engage the resilient blade 41 on which the stationary contact 28 is mounted and will cause this blade to move downwardly and separate the contact 28 from contact 27. At the same time the trip member 38 will be released and the armature 31 will be locked in its lower position so that even though the relay 22 were deenergized and then energized again it would be inoperative to close the switch 27, 28 due to the fact that the operating member 34 would be in its lowered position and would push the resilient blade 41 downwardly and thus prevent the movable contact 27 from engaging the stationary contact 28. Therefore, before the switch 27, 28 can again be closed it is necessary to pull the trip member 38 to the left by means of the knob 40 to permit the biasing spring 35 to return the armature 31 to its unattracted position.

Referring now to the transformer 17, it will be seen that this transformer consists of a center leg 42 on which a primary winding 43 as well as the two secondary windings 16 and 19 are wound,

The center leg 42 is connected with the two side legs 44 and 45 which provide for a normal low reluctance path for the magnetic flux produced by the primary winding 43. The transformer 17 has a leakage path which includes the cross leg 46 which is connected to the center leg 42 but which is separated from the two side legs 44 and 45 by an air gap. Normally therefore, the flux will flow through the center leg 43 and then through the side legs 44 and 45. As long as the two electrodes 12 and 13 are properly spaced so as to produce a spark between them, a normal amount of current will flow through the secondary winding 16. The current induced in the secondary winding 16 will set up magnetic flux which will tend to oppose the normal flow of magnetic flux produced by the primary winding 43 through the center leg 42. However, as long as the flow of current in the secondary winding 16 is normal, sufficient current will be induced in the secondary winding 19 to produce a normal flow of current through the relay winding 22 with the result that the armature 25 will be moved to its attracted position to close the contact 27, 28. The flow of current through the relay winding 22 will at this time be insufficient to attract the second armature 31, with the result that the switch 27, 28 will remain closed.

If the electrodes 12 and 13 are spaced too close together and do not produce a spark then the circuit in which they are located will be effectively short circuited with the result that an abnormally large current will flow through the secondary winding 16. This will produce a very large amount of flux which bucks the flux produced by the primary winding 43. Under these conditions the major portion of the flux will pass through the leakage path 46 and only a small current will be induced in the secondary winding 19 and therefore the flow of current through the relay 22 is so slight that the relay is unable to pull in the armature 25 with the result that the switch 27, 28 will remain open.

If the two electrodes 12 and 13 are so widely spaced that they do not produce the proper spark, then the current flow through the secondary winding 16 will be very small and as a result a much larger flux will flow through the center leg 42 and induce an abnormally large current in the secondary winding 19. This abnormally large current flow through the relay coil 22 will not only attract the armature 25 but will also attract the second armature 31 which, as explained above, will cause the operating member 34 to engage the resilient blade 41 and move the contact 28 out of engagement with the contact 27.

It will therefore be seen that the switch 27, 28 will be closed by the relay winding 22 only when the electrodes 12 and 13 are spaced so as to produce a proper spark and cause a normal current flow through the secondary winding 16 which causes a normal current to be induced in the secondary winding 19 and fed to the relay winding 22. If the current flow through the relay winding 22 should be either lower or higher than the normal range of current values, then either the armature 25 will not be pulled in, or both the armature 25 and the armature 31 will be pulled in. In either case the switch 27, 28 will be opened.

The energization of the primary winding 43 of the transformer 17 is under the control of a switch formed by the relay arm 50 and stationary contact 51, the relay arm 50 being operated by

means of the armature, indicated by the dotted line 52, of an electromagnetic relay having a relay winding 53. The armature 52 additionally controls the relay arm 54. When the relay winding 53 is energized, the armature is attracted to move the relay arms 50 and 54 into engagement with their stationary contacts 51 and 55, and when the relay winding 53 is deenergized these relay arms move out of engagement with their stationary contacts.

The energization of the relay winding 53 may be controlled manually or it may be placed under the control of any one of a number of different types of condition responsive devices. For purposes of illustration however, this relay has been shown as being under the control of a thermostat indicated generally at 57 which comprises a bimetallic element 58 which is fixed at one end and which carries at its free end a pair of contact blades 59 and 60 which cooperate with the stationary contacts 61 and 62, respectively. The arrangement is such that on a decrease in temperature the resilient contact blade 59 is first brought into engagement with its stationary contact 61 and then at a slightly lower temperature the contact blade 60 is brought into engagement with its stationary contact 62.

This system is provided with the usual time switch which is commonly known as a safety switch and which is indicated generally at 65. It is composed of a pair of resilient contact blades 66 and 67 which are biased to open position and which are latched in closed position by the free end of a thermal blade 68. The thermal blade 68 is adapted to be heated by means of the electric heater 69 and when so heated warps toward the right and after a predetermined time interval releases the resilient contact blade 67 for movement downwardly to open circuit position. The safety switch then remains in this position until it is manually reset by the reset button 70. The reset button 70 provides what is known as a trip free reset, that is it maintains the contact blades 66 and 67 in open circuit position during the resetting operation so that the safety switch cannot be closed until the button 70 is released and then not unless the thermal blade 68 has cooled off and returned to a position where it can engage the contact blade 67 and latch the switch in its closed position.

A combustion responsive device indicated generally at 72 is provided for responding to the presence or absence of combustion at the burner. This device has a pair of cold contacts 73 and 74 which are engaged by the contact blades 75 and 76 in the absence of combustion at the burner, and a hot contact 77 which is engaged by the switch blade 78 when combustion is present at the burner. The switching action of this device overlaps on heating but not on cooling. That is, on heating the contact blade 78 engages the stationary contact 77 before the contact blade 75 leaves the stationary contact 73, but on cooling the contact blade 78 first separates from stationary contact 77 and then the contact blade 75 engages the stationary contact 73. Also the arrangement is such that the contact blade 75 does not engage its stationary contact 74 until after the contact blade 75 has moved into engagement with the stationary contact 73. Such devices are old and well known and may be purchased on the open market and a further description thereof is not believed necessary.

The electrical power for the control system is provided from a transformer 80 having a pri-

mary winding 81 and a secondary winding 82, the primary winding 81 being connected by means of conductors 83 and 84 to the line wire 85 and the line wire 86.

Operation

The various elements of the control system are shown in Figure 1 in the positions which they will occupy when the room thermostat 57 is satisfied and therefore holding the two contact blades 59 and 60 out of engagement with their respective stationary contacts 61 and 62. The relay winding 53 will therefore be deenergized and the relay arms 54 and 50 will be in open circuit position. The primary winding 43 of the transformer 17 will be deenergized and the relay 23 and burner motor 11 will also be deenergized. There will therefore be no combustion present at the burner and the combustion responsive device 72 will be in its cold position in which the contact blade 75 will be in engagement with contact 73 and the contact blade 76 will be in engagement with the contact 74.

The temperature in the space in which the thermostat 57 is located will therefore begin to decrease and the bimetallic element 58 will contract and cause the switch blade 59 to engage the stationary contact 61. This action will not result in the establishment of any circuit at this time due to the fact that the relay arm 54 is out of engagement with its stationary contact 55. Upon a further decrease in temperature, the bimetallic element 58 will cause the switch blade 60 to engage its stationary contact 62. This will result in the energization of relay winding 53 by means of a circuit extending from one side of the secondary winding 82 through conductor 88, contact 61, switch blades 59 and 60, contact 62, conductor 89, contact 74, switch blades 76 and 75, contact 73, conductor 90, electric heater 69, conductor 91, relay winding 53, conductor 92, safety switch blades 67 and 66, and conductor 93 back to the other side of the secondary winding 82.

Closure of this circuit will cause the relay winding 53 to attract the armature 52 which will in turn move the relay arms 50 and 54 to closed circuit position. Engagement of the relay arm 54 with its contact 55 will establish a holding circuit for the relay winding 53 which extends from one side of the secondary winding 82 through conductor 88, contact 61, contact blade 59, bimetallic element 58, conductor 95, relay arm 54, contact 55, conductor 96, contact blade 75, contact 73, conductor 90, electric heating element 69, conductor 91, relay winding 53, conductor 92, safety switch blades 67 and 66, and conductor 93 back to the other side of the secondary winding 82. It will be noted that this holding circuit for the relay winding 53 is independent of the switch blades 60 and 76. It will be noted also that both the original energizing circuit for the relay winding 53 as well as the holding circuit includes the electric heating element 69 which starts heating the bimetallic blade 68, so that after a predetermined period of time this blade will warp toward the right and open the safety switch 66, 67 which will terminate the supply of electric power to the entire system.

The energization of the relay winding 53 will also cause movement of the relay arm 50 to closed circuit position which will cause energization of the primary winding 43 of the transformer 17 by means of a circuit extending from line wire 86 through conductor 98, contact 51, relay arm 50,

conductors 99 and 100, primary winding 43 and conductor 101 back to the other line wire 85. The energization of the primary winding 43 causes current to be induced in both of the secondary windings 16 and 19 and, as set forth above, the amount of current induced in the secondary winding 19 depends upon the amount of current which flows through the secondary winding 16, and this in turn depends upon the spacing of the spark electrodes 12 and 13.

It might be pointed out at this time that the control circuit for the burner motor 11 extends from the line wire 86 through conductor 98, contact 51, relay arm 50, conductors 99 and 103, relay armature 25, movable contact 27, stationary contact 28, resilient contact blade 41, conductor 104, burner motor 11, conductor 105, back to the other line wire 85. It will therefore be seen that as long as the switch 27, 28 operated by the relay 23 was in open circuit position the burner motor 11 is deenergized.

Let it be assumed first that the primary winding 43 of the transformer 17 has just been energized as a result of the call for heat by the thermostat 57 and that at this time there is a substantial short circuit between the electrodes 12 and 13 with the result that they do not produce a proper spark for igniting fuel at the burner. Under these circumstances, an abnormally large current will flow in the circuit including the secondary winding 16 and the counterflux generated thereby will cause most of the flux produced by the primary winding 43 to flow through the leakage path 46 with the result that only a very small current will be induced in the secondary winding 19. This small current flow through the relay coil 22 will be insufficient to produce a magnetic force great enough to attract the armature 25 and the switch 27, 28 will therefore remain in open circuit position and the burner motor 11 will remain deenergized. Therefore, when the electrodes 12 and 13 are inoperative to produce a spark for igniting the fuel due to their being substantially short circuited the burner motor 11 will not be energized and no fuel will be delivered to the burner. Combustion will not be produced and therefore the combustion responsive device 72 will remain in its cold position in which the contact blade 75 will remain in engagement with its cold contact 73. The thermostat 57 will still be calling for heat and therefore the relay winding 53 and the electric heater 69 will remain energized. After a predetermined period of time the bimetallic blade 68 will have heated sufficiently to open the safety switch 66, 68 which will terminate the supply of power to the system. The system will then remain locked out until the safety switch 66, 67 is manually reset, and before this is done it is assumed that the difficulty which prevented combustion will have been corrected.

Let it be assumed now that the space between the electrodes 12 and 13 is proper and that a proper spark is produced. Under these circumstances a normal current will flow through the secondary winding 16 and likewise a normal current will be induced in the secondary winding 19. Under these conditions the relay coil 22 will move the armature 25 to its attracted position and the burner motor switch 27, 28 will be closed and the burner motor energized through the circuits traced above. Under normal conditions combustion will be established and the combustion responsive device 72 will cause the switch blade 78 to engage its hot contact 79 before the

blade 75 disengages the cold contact 73. This will cause a holding circuit for the relay winding 53 to be established, this holding circuit extending from one side of the secondary winding 82 through conductor 88, contact 61, switch blade 59, bimetallic element 58, conductor 95, relay arm 54, contact 55, conductor 96, switch blade 78, hot contact 77, conductors 107 and 91, relay winding 53, conductor 92, safety switch blades 67 and 66, and conductor 93 back to the other side of the secondary winding 82. It will be seen that the establishment of this circuit effectively short-circuits the electric heating element 69 and that therefore this element will be deenergized even before the combustion responsive device 72 causes the switch blade 75 to separate from the cold contact 73. The relay winding 53 will therefore remain energized as well as the primary winding 43 of the transformer 17 and the relay winding 22. The burner motor switch 27, 28 therefore remains closed. This is the running condition of the system.

If the electrodes 12 and 13 should be spaced properly to form the proper spark and the burner motor 27, 28 therefore closed but for some other reason combustion should not be established then the combustion responsive device 72 would not cause the switch blade 78 to engage the hot contact 72 and therefore the electrical heating element 69 would remain energized and cause the safety switch 66, 67 to open after a predetermined period of time. Here again, the system could not be automatically restarted until the safety switch is manually reset, and this would be done only when the trouble which prevented the establishment of combustion was corrected.

Let it be assumed now that the relay winding 53 and primary winding 43 of the transformer 17 have just been energized in response to a call for heat by the thermostat 57 and that the electrodes 12 and 13 are so widely spaced as to not produce a proper spark for establishing combustion. Under these conditions, a very small current will flow through the secondary winding 16 which will cause a very large current to be induced in the secondary winding 19. The abnormally large current flow through the relay winding 22 will not only cause the armature 25 to be attracted but will also cause the armature 31 to be attracted with the result that the operating member 34 will be pulled downwardly to move the stationary contact 28 away from the movable contact 27. Under these conditions the burner motor 11 will not be energized and combustion at the burner will not be established. Therefore, the combustion responsive device 72 will remain in its cold position and the bimetallic blade 68 will warp toward the right and open the safety switch 66, 67 as before.

It sometimes occurs that when the electrodes 12 and 13 are spaced a little too widely apart they may still produce a spark and cause a sufficient flow of current through the secondary winding 16 to cause a normal current to be induced in the secondary winding 19 and hence flow through the relay winding 22. Under these conditions therefore, the armature 25 will be attracted and close the switch 27, 28 to energize the burner motor 11. Inasmuch as the electrodes 12 and 13 are a little too widely spaced the energization of the burner motor 11 in blowing the vaporized oil from the nozzle of the burner may blow out the spark between the electrodes 12 and 13 with the result that the current flow through the secondary coil 16 will take a sudden drop and therefore cause an abnormally large current to flow through the

relay coil 22. This will attract the armature 31 and cause the operating member 34 to open the switch 27, 28, and therefore deenergize the burner motor 11. The stopping of the burner motor 11 may again cause the production of a spark between the electrodes 12 and 13 to reduce the current flow through the relay winding 22 to a normal value again. Therefore, unless some means were provided for preventing it the armature 31 would be released and the burner motor switch 27, 28 would close and reenergize the burner motor 11 and the cycle would repeat itself over and over again. In order to prevent this, the trip member 38 has been provided so that when the armature 31 has been pulled in due to an abnormally large current flowing through the relay coil 22, it cannot be released until the trip member 38 has been removed manually. Thus, the burner motor switch 27, 28 will remain open and the burner motor 11 will remain deenergized so that after a predetermined period of time the bimetallic element 11 will warp to the right and trip the safety switch 66, 67 to open circuit position.

Figure 2 shows a slightly modified form of relay which may be substituted for the relay 22 of Figure 1. A relay coil 110 is adapted to attract armature 112 which is pivotally mounted on bracket 111 and biased to its unattracted position by means of a biasing spring shown at 113. The armature 112 carries a movable contact 114 by means of a resilient blade 115, the movable contact being adapted to cooperate with a stationary contact 116. The relay armature 112 is shown in its attracted position in which the movable contact 114 is in engagement with the stationary contact 116. The armature 112 pivotally carries a second armature 117 in the form of an angled lever mounted beneath the resilient blade 115. It will be clear that when the current flow through the relay coil 110 reaches an abnormally high value the armature 117 will be attracted and rotated in a counter-clockwise direction so that the end 118 will lift the resilient contact blade 115 and cause the movable contact 114 to separate from the stationary contact 116. No trip mechanism has been shown in this modification for locking the switch 114, 116 in open position but it will be obvious that such a mechanism could be added to this relay without the exercise of invention.

Many changes and modifications in this invention will doubtless occur to those who are skilled in the art, and I therefore wish it to be understood that I intend to be limited only by the scope of the appended claims and not by the specific embodiment which has been disclosed herein only for the purposes of illustration.

I claim as my invention:

1. In a fluid fuel burner control system, in combination, a switch which, when closed, causes the delivery of fuel to a burner, an electric circuit, means responsive to the current flow in said circuit for closing said switch when said current flow is within a predetermined range, means including a transformer for delivering power to a high voltage circuit supplying a sparking device for igniting the fuel delivered to the burner, said transformer including means for varying the current flow in said electric circuit in accordance with the current flow in said high voltage circuit, the arrangement being such that when the flow of current in said high voltage is normal the flow of current in said electric circuit will be within said predetermined range, but when the current flow in said high voltage circuit is ab-

normally high or low the current flow in said electric circuit will be below or above said predetermined range respectively, and means for locking said switch in open position when the current in said electric circuit rises above said predetermined range.

2. A spark check system for fluid fuel burners comprising in combination, electrically operative means for delivering fuel to a burner, a high voltage circuit including a spark gap for igniting the fuel, an energizing circuit for said fuel delivery means, a normally open switch controlling said circuit, an electric relay for operating said switch, a circuit for said relay, said relay operating to close said switch when the current in said relay circuit exceeds a first value, means including a transformer which supplies power to said high voltage circuit and relay circuit for varying the current flow in said relay circuit in accordance with current flow in said high voltage circuit, the arrangement being such that the flow of current in said relay circuit exceeds a second higher value when the spark gap is too wide and is less than said first value when there is a substantial short circuit in said high voltage circuit, means operated by said electric relay for opening said switch in the event that the current through said relay should exceed said second value, and trip means released by said last named means for preventing reclosure of said switch until said trip means has been manually reset.

3. A spark check system for fluid fuel burners comprising in combination, electrically operated means for controlling the delivery of fuel to a burner, a high voltage circuit including a spark gap for igniting the fuel, an energizing circuit for said fuel controlling means, a normally open switch controlling said circuit, an electric relay for operating said switch, said relay comprising a relay coil and two armatures actuable in succession as the current through said relay coil increases, a first of said armatures being actuated when the current through the relay coil rises above a first value, a second of said armatures being actuated when said current increases above a second value, said first armature being effective when actuated to close said switch and said second armature being effective to open said switch, and means including a transformer which supplies power to said high voltage circuit and relay coil in accordance with current flow in said high voltage circuit, the arrangement being such that the flow of current through said relay coil is between said first and second values only when the spark across said spark gap is of the proper character for igniting the fuel.

4. A spark check system for fluid fuel burners comprising in combination, electrically operated means for controlling the delivery of fuel to a burner, a high voltage circuit including a spark gap for igniting the fuel, an energizing circuit for said fuel controlling means, a normally open switch controlling said circuit, an electric relay for operating said switch, said relay comprising a relay coil and two armatures actuable in succession as the current through said relay coil increases, a first of said armatures being actuated when the current through the relay coil rises above a first value, a second of said armatures being actuated when said current increases above a second value, said first armature being effective when actuated to close said switch and said second armature being effective to open said switch, and means including a transformer which supplies power to said high voltage circuit and relay

coil in accordance with current flow in said high voltage circuit, the arrangement being such that the flow of current through said relay coil is between said first and second values only when the spark across said spark gap is of the proper character for igniting the fuel, said relay being provided with means effective when said second armature is actuated to latch said second armature in a position with respect to said first armature such that said first armature is thereafter ineffective to open said switch.

5. In a fluid fuel burner control system, in combination, a switch which, when closed, causes the delivery of fuel to a burner, an electric circuit, means responsive to the current flow in said circuit for closing said switch when said current flow is within a predetermined range, means in-

cluding a transformer for delivering power to a high voltage circuit supplying a sparking device for igniting the fuel delivered to the burner, said transformer including means for varying the current flow in said electric circuit in accordance with the current flow in said high voltage circuit, the arrangement being such that when the flow of current in said high voltage is normal the flow of current in said electric circuit will be within said predetermined range, but when the current flow in said high voltage circuit is abnormally high or low the current flow in said electric circuit will be outside of said predetermined range, and means for locking said switch in open position when the current in said electric circuit rises above said predetermined range.

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