

April 18, 1933.

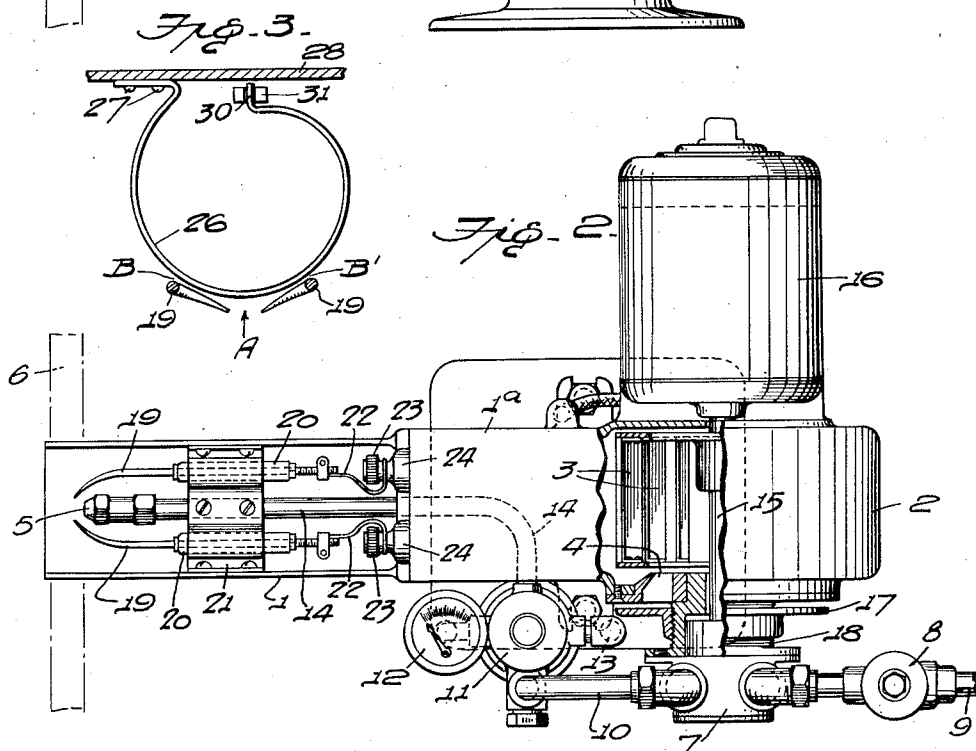
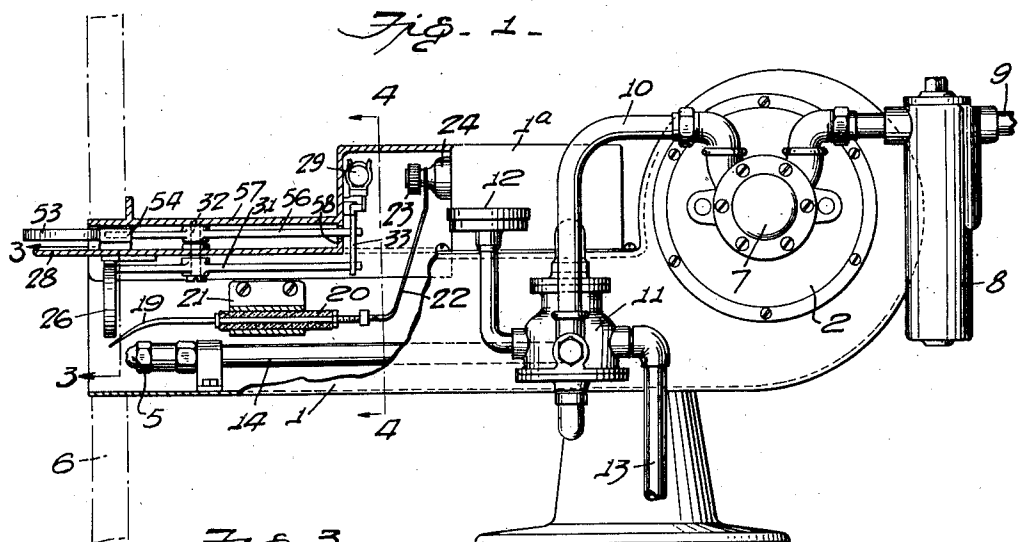
S. SCOGNAMILLO ET AL

1,904,549

OIL BURNER

Filed Aug. 6, 1931

2 Sheets-Sheet 1



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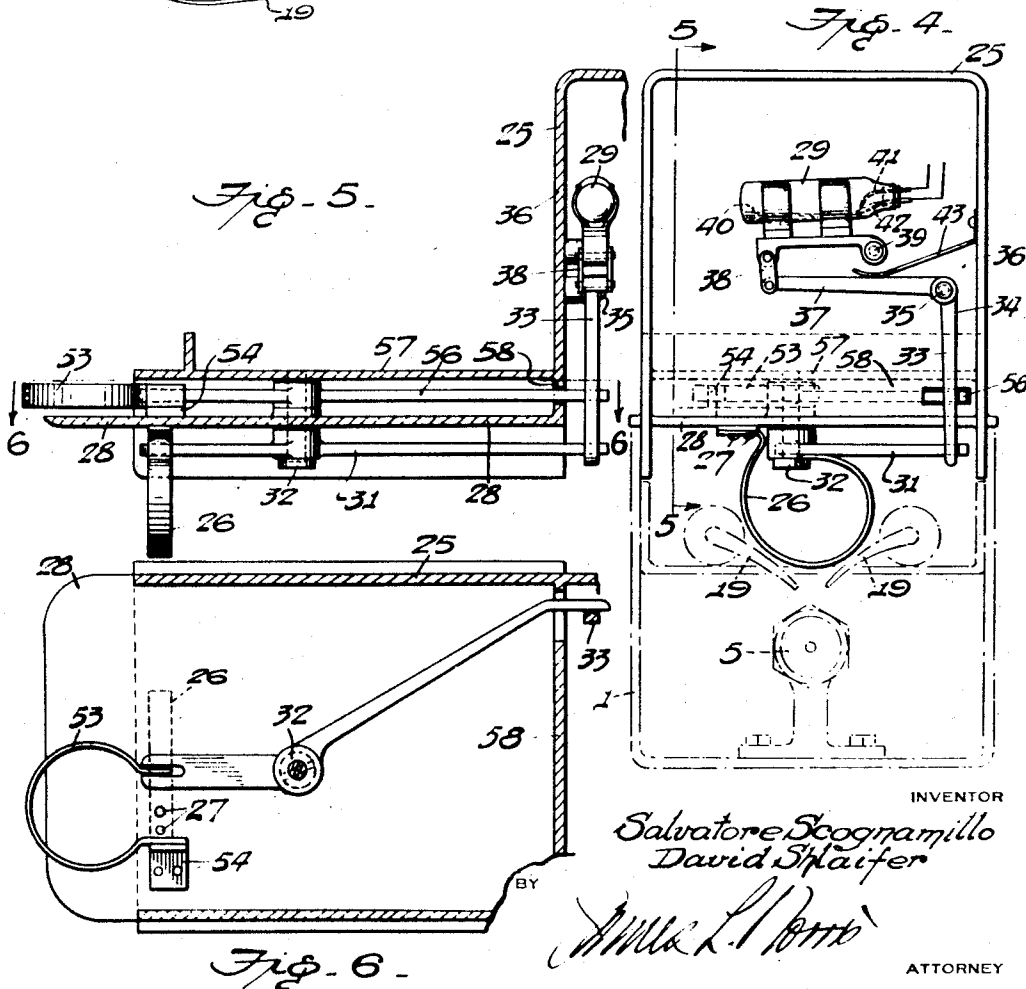
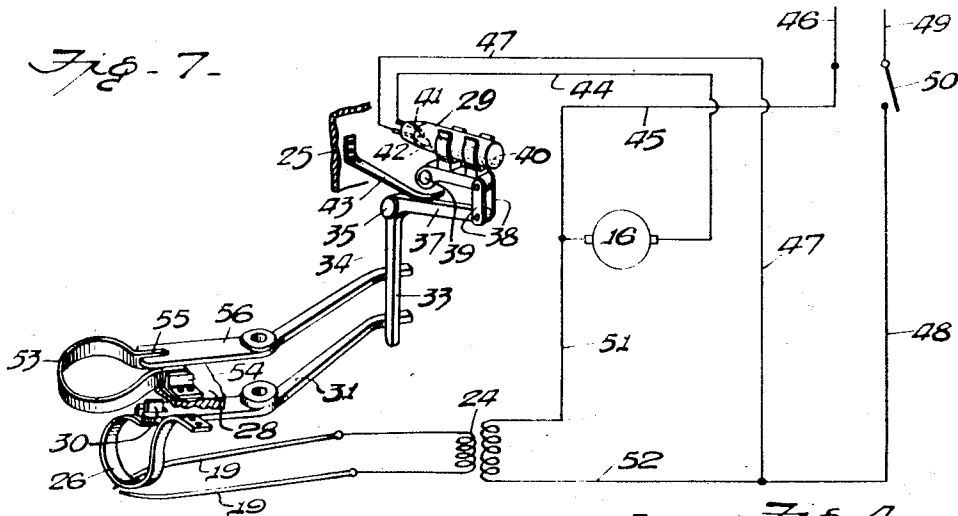
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UNITED STATES PATENT OFFICE

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OIL BURNER

Application filed August 6, 1931. Serial No. 555,577.

The present invention relates to improvements in oil burners and more especially to those of the well known class applied to the furnaces of steam, hot water or other heating systems for residences and for similar purposes and which comprise a motor driving a pump for supplying fuel to a spray nozzle and also operating a blower for feeding air together with the oil fuel to the combustion chamber to support combustion therein, thermostats or other means being usually employed for starting and stopping the burner and electrical ignition means being used to ignite the oil spray at the nozzle to start the burner into operation.

The primary object of the present invention is to provide novel and improved means for controlling the starting of the oil and air supply means whereby the pumping of oil into the furnace is prevented unless the ignition means is in proper operative condition, thereby avoiding any danger of a destructive fire or explosion which might result from the feeding of unburned oil into the furnace. Such means, according to the present invention, comprises thermostatically controlled means, governed by the electrical ignition or spark at the burner nozzle, to control the starting of the oil and air feeding motor.

Another object of the invention is to provide simple, improved and reliable means for automatically stopping the oil and air feeding operation of the motor in the event the flame of the burner ceases or becomes extinguished due to temporary stoppage of the oil flow or other causes, thereby avoiding any danger of continuing the feeding of unburned oil into the furnace, such means comprising thermostatically controlled means governed by the heat of combustion of the oil in the furnace and operating to maintain the oil and air feeding motor in operation while combustion is taking place properly and to stop the motor automatically should such combustion cease or be interrupted from any cause.

To these and other ends, the invention consists in certain improvements and combina-

tions and arrangements of parts all as will be hereafter more fully described, the features of novelty being pointed out particularly in the claims at the end of the specification.

In the accompanying drawings:—

Fig. 1 is a side elevation, partly in section, of an oil burner embodying the present invention;

Fig. 2 is a top plan view, with parts broken away or removed, of the oil burner shown in Fig. 1;

Fig. 3 is a detail sectional view taken on the line 3—3 of Fig. 1, on an enlarged scale and looking forwardly or toward the left in said figure;

Fig. 4 is a transverse vertical section taken on the line 4—4 in Fig. 1 and looking toward the left in said figure, the lower portion of the structure being shown in dotted lines;

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 4 and looking toward the right in said figure;

Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 5; and

Fig. 7 is a diagrammatic view of the motor and burner ignition circuits and the thermostat elements and the control switch governed thereby.

Similar parts are designated by the same reference characters in the several views.

The present invention is applicable generally to oil burners of the class embodying a spray nozzle for feeding the oil or liquid fuel to a furnace or combustion chamber, a blast housing for feeding air past the nozzle and into the furnace or combustion chamber, an oil supply pump for feeding oil or liquid fuel at suitable pressure to the nozzle to be atomized or sprayed thereby, an air blower for blowing air through the blast housing past the nozzle and into the furnace or combustion chamber, and a motor for operating the oil pump and air blower, an electric motor being usually employed the operating circuit of which is controlled by a manual switch or automatically by a thermostatically controlled switch, according to room temperature.

In the present instance, the invention is shown applied to an oil burner which comprises an air blast housing 1 which is connected to the outlet of a rotary air blower 2 which may be of the well known sirocco type having a bladed runner 3 which receives air through an air inlet 4 in one side of the blower housing, and the burner further comprises an oil or liquid spray nozzle 5 which is mounted longitudinally within the air blast housing 1 adjacent to the forward end thereof, this end of the air blast housing being adapted to be mounted in the wall 6 of a furnace or other combustion chamber in the usual or any well known way. The spray nozzle 5 receives oil or liquid fuel under suitable pressure from a pump 7 which may be of any well known rotary type, the inlet of the oil pump being connected, usually through a suitable strainer 8 to an oil or liquid fuel supply pipe 9, and the delivery side of the oil pump being connected by a pipe 10 to a suitable pressure regulating or reducing valve 11 which may be of usual or well known construction capable of maintaining a constant pressure of the oil delivered thereby and having a gauge 12 for indicating the pressure of the oil delivered by this valve to the nozzle and a return pipe 13 for returning excess or surplus oil to the source of supply, the outlet of the pressure regulating valve 11 being connected by a pipe 14 to the nozzle 5 and delivering oil or liquid fuel thereto at a pressure which will cause spraying or atomizing of the oil or fuel from the nozzle, in the manner usual in burners of this type. The rotor or fan 3 of the air blower and the rotor or operating element of the oil pump are connected to and driven from a shaft 15 and this shaft is connected to or is an extension of the shaft of an electric motor 16 which latter serves to drive the air blower and oil pump continuously while the motor is in operation. A flange 17 the hub of which is threaded on the outer bearing 18 for the shaft 15 serves to regulate the amount of air introduced into the furnace or combustion chamber by the air blower in proportion to the amount of oil introduced therein by the spray nozzle, this flange being located opposite to the air inlet 4 in one side of the blower housing and being movable, by rotation on the exteriorly threaded bearing, toward and from the air inlet 4 to vary the size thereof and accordingly the amount of air entering the blower.

The oil or fuel sprayed from the nozzle 5 is ignited, in the burner shown, by a spark or electric arc which passes between a pair of electrodes 19 which are mounted in electrically insulating sleeves 20 supported by a bracket 21 mounted within the air blast housing 1, these electrodes being connected by the conductors 22 to the respective termi-

nals 23 of the secondary winding or circuit of a transformer or ignition coil 24, the latter being mounted preferably in a casing 1^a secured to the upper side of the air blast housing 1. The other or forward ends of the electrodes 19 are bent toward one another to form a spark gap between them which is immediately above and in front of the oil or fuel spray nozzle 5 so that the spark or arc passing through the gap between these electrodes will ignite the oil or fuel sprayed forwardly from the nozzle into the furnace or combustion chamber. This transformer or ignition coil may be of the type commonly used for this purpose in oil burners of this type, such coils being commonly energized or operated from the ordinary 110-volt alternating current line.

In using oil burners of the type hereinbefore described, oil or liquid fuel is sprayed by the nozzle into the furnace or combustion chamber as soon as the operating motor is started, and if the oil or fuel is not promptly ignited, due to failure of the ignition or spark circuit or other causes, and no means were provided for stopping the operating motor in such event, the unburned oil or fuel sprayed into the furnace or combustion chamber would accumulate therein and there would be danger of a fire or an explosion. The present invention provides means which is controlled by the electrical ignition or spark, for controlling the starting of the oil and air injecting motor, so that if the proper spark is not taking place at the nozzle, the motor which injects the oil and air will not start, but if the proper spark or ignition conditions exist at the oil or fuel nozzle, the motor will be started to inject oil or fuel and air into the furnace or combustion chamber. Such means consists, as shown in the present instance, of a thermostat element 26 which is composed of an ordinary strip of bi-metallic thermostat material composed of dissimilar metals having different coefficients of expansion, the strip being bent into a loop or approximate circle so that its diameter will be contracted when it is relatively cool and it will be expanded or its diameter will be increased when it is heated or its temperature increases, thereby causing the ends of the strip to move toward or from one another, according to whether the thermostat element is cool or hot. One end or terminal of this thermostat element is rigidly attached, as by a screw 27, to a stationary plate 28 which is a part of a cover or casing 25 removably mounted on and forming the top wall of the air blast housing 1, and the other or free end of this thermostat element is operatively connected to a switch 29 so that it will operate said switch to close the motor circuit when the thermostat element 26 is heated and expands. In the present in-

stance, the free end and movable end 30 of the thermostat 26 is engaged in a slot in one end of a lever 31, the latter being pivoted on a screw or pivot pin 32 at the lower side of the plate 28 so that the lever 31 will swing in a horizontal plane in accordance with the movements of the free end 30 of the thermostat element 26 in a direction toward and from its relatively fixed end. The other end of the lever 31 is arranged to bear on a vertical arm 33 of a bell crank lever 34, the latter being pivoted at 35 to the relatively stationary wall 36 of the casing 25 so that this bell crank lever will rock in a vertical plane, and the other arm 37 of this bell crank lever, which extends horizontally from its pivot, is operatively connected by links 38 to one end of the switch 29, the opposite end of this switch being pivoted to rock on a pivot pin 39 secured to the stationary supporting wall 36. The switch 29 is preferably of the well known mercury type comprising a glass or similar tube containing a body of mercury 40 freely movable toward one or the other end of the tube as the latter is tilted in one direction or the other about its pivot 39, and one end of the mercury containing tube is provided with a pair of contacts 41 and 42 which are adapted to be bridged or connected by the body of mercury when the switch is tilted upwardly by the bell crank 34, these contacts being unconnected when the switch is tilted downwardly, which carries the mercury to the opposite end of the tube, as shown in Fig. 7. The weight of the switch 27 will normally tend to return it to its downwardly tilted open circuit condition as shown in Fig. 7, and a spring 43 may be attached to a side of the casing 25 and arranged to bear on the arm 37 of the bell crank to assist in returning the switch 27 to its normal open circuit position and retain it in such position. The switch 29 controls the operating circuit for the motor 16, the switch contact 41 being connected by the conductor 44 to one terminal of the motor 16, the other terminal of the motor being connected by the conductor 45 to the line conductor 46, and the other contact 42 of the switch being connected by the conductors 47 and 48 to the other line conductor 49, the latter being connected to the conductor 48 by a switch 50 which may be an ordinary manual switch or may be a thermostat switch controlled by the temperature produced by the heating system to which the furnace and burner are applied. The transformer or ignition coil 24, shown diagrammatically in Fig. 7, has its primary connected directly by the conductors 51 and 52 to the line conductors 46 and 49 respectively, so that the transformer or ignition coil will be set into operation immediately upon the closing of the switch 50.

The thermostat element 26 is so associated with the ignition electrodes 19 of the burner that its operation will be governed according to whether proper ignition conditions are present or absent at the burner nozzle. For this purpose, the thermostat element 26, which projects downwardly into the air blast housing 1, is mounted in a plane transverse to the length of the electrodes 19 and in front of the nozzle and adjacent to the forward ends of the electrodes, so that the intermediate or lower portion of the thermostat element extends across the space between the electrodes 19 and is in close proximity to the respective electrodes so that it forms spark gaps therewith. For example, as shown in Fig. 3, A represents the spark gap formed directly between the terminals of the electrodes 19 and B and B' are the spark gaps which are formed between the thermostat element 26 and the respective electrodes 19. The aggregate length of the spark gaps B and B' between the thermostat element 26 and the respective electrodes 19 is somewhat less than the length of the spark gap A between the terminals of the electrodes, each of the spark gaps B and B' for example being about one-eighth of an inch in length and the spark gap A three-eighths of an inch.

In operation, in starting the burner, the switch 50 is first closed. The closing of this switch sets the transformer or ignition coil 24 into operation immediately, and owing to the shorter aggregate length of the spark gaps B and B' relatively to the length of the spark gap A, sparks or arcs will be formed in these gaps B and B', the ignition current then flowing from one electrode through the spark gaps B and B' and through the intervening portion of the thermostat element 26, to the other electrode and the sparks thus produced in the gaps B and B' will heat and consequently expand the thermostat element 26, moving the free end 30 thereof toward the right in Fig. 3 and causing the lever 31 to swing the bell crank lever 34 in a direction to tilt the switch 29 from its normal lowered open circuit position as shown in Fig. 7 to its circuit closing position, the body of mercury 40 then bridging the contacts 41 and 42 and thereby closing the operating circuit for the motor 16 from the line conductor 46 through the conductors 44 and 45 and 47 and 48 to the other line conductor 49, the switch 50 being then closed, and the presence of the proper spark or electrical ignition medium at the burner nozzle will thereby start the motor 16 and the running of the latter will cause oil to be injected into the furnace or combustion chamber through the nozzle 5 and air to be blown into the furnace or combustion chamber through the air blast housing 1. If, on the other hand, the switch 50 is closed to

start the burner into operation but there is insufficient ignition current at the nozzle to heat and expand the thermostat element 26 in the manner hereinbefore described, the thermostat strip will remain in its normal contracted form so that the switch 29 will not be operated but will remain in its normal open circuit condition so that the motor 16 will not be started to inject oil into the furnace or combustion chamber.

As soon as the burner is started, the air blast from the blower blows the sparks or flame-like arcs from the gaps B and B' forwardly to the forward terminals of the electrodes 19 so that the sparks or arcs then pass directly between the electrodes 19 through the gap A, and since the heating effect of the sparks or arcs is thus removed from the thermostat element 26 and the latter is in the path of the current of air blown forwardly into the furnace through the air blast housing 1, the thermostat element 26 will cool and contract to substantially its normal form, thus allowing the lever 31 to return to its initial position, but in order to cause the burner to continue in operation after properly starting, means is provided for maintaining the operating circuit of the motor 16 in closed or operative condition independently of the thermostat element 26, and the present invention provides means for this purpose which is governed by the combustion of the oil or fuel injected into the furnace or combustion chamber by the nozzle, so that if proper combustion is taking place the burner will continue in operation but if combustion should cease or fail due to failure or interruption of the operation of the spark or ignition means or other causes, the operation of the burner will be automatically stopped. Such means as shown in the present instance comprises a thermostat element 53 composed of a strip of bi-metallic thermostat material bent into a loop and having a tendency to contract when relatively cool and to expand when heated, this thermostat element being similar to the thermostat element 26, one end of this thermostat strip being fixed, as by the bracket 54, to the upper side of the plate 28 so that the thermostat element 53 lies in a horizontal plane with its intermediate portion directed forwardly, and the other or free end 55 of the thermostat element 53 is engaged in a slot in the forward end of a lever 56 which is pivoted to rock freely on the pivot pin 32 at the upper side of the plate 28, the opposite or rear end of the lever 56 being arranged behind the arm 33 of the bell crank lever 34 so that it may come into engagement therewith. The thermostat element 53 is exposed to the heat of combustion of the oil or fuel discharged into the furnace or combustion chamber by the nozzle 5 but it is protected by the plate 28

and by an overlying plate 57 of the casing and the wall 58 which closes the rear end of the space between the plates 28 and 57, from the cooling effect of the air blast through the air blast housing 1. In operation, after the burner has been started by the expansion of the thermostat element 26 and the consequent movement of the switch 29 to close the operating circuit of the motor 16 to cause the feeding of oil or fuel and air into the furnace or combustion chamber, the heat radiated by the flame in front of the nozzle 5 resulting from the combustion of the oil or fuel injected into the furnace or combustion chamber thereby will heat and expand the thermostat element 53, thereby rocking the lever 56 on its pivot 32 in a direction to bring its rear end against the arm 33 of the bell crank which was previously swung toward the left in Fig. 4 to carry the switch 29 into position to close the circuit of the motor, and while the thermostat element 26 will cool and contract under the influence of the air blast through the air blast housing after the ignition sparks or arcs have ceased to pass between this thermostat element and the ignition electrodes, the expansion of the thermostat element 53 under the heat of combustion of the fuel taking place in the furnace or combustion chamber will previously cause the rear end of the lever 56 to come up against the arm 33 of the bell crank and to thereby hold the switch 29 in its circuit closing position so that the operation of the motor 16 will continue. However, should the combustion of the oil or fuel cease, due to failure or interruption of the operation of the spark or ignition means or other causes, the thermostat element 53 will be no longer heated and will cool, and the consequent contraction of this thermostat element will allow the rear end of the lever 56 to recede relatively to the arm 33 of the bell crank lever 34 and the latter and the switch 29 will then return to normal or initial position under the gravity action of the switch assisted by the restoring spring 43, and the operating circuit of the motor 16 will be thereby opened and the operation of the burner will be stopped, thus avoiding dangerous accumulation of unburned oil or fuel in the furnace or combustion chamber.

When the operation of the burner is interrupted either manually or automatically by the opening of the switch 50, the operation of the motor 16 which supplies the oil or fuel and air is interrupted and the transformer or ignition coil 24 also ceases to operate, and the thermostat element 53 will cool and contract, due to the absence of combustion in the furnace or combustion chamber, and the motor controlling switch 29 will therefore return to its normal open

circuit position as shown in Fig. 7, but the burner may be restarted by closing the switch 50, in which event the transformer or spark coil 24 will first operate and if the proper ignition conditions exist at the nozzle, the thermostat element 26 will be heated and expanded and will move the switch 29 into position to start the motor 16 into operation, after which the combustion of the oil or fuel in the furnace or combustion chamber will heat and expand the thermostat element 53 and cause it to hold the motor controlling switch 29 in circuit closing position to maintain the operation of the burner while proper combustion conditions exist, in the manner hereinbefore described.

The control means provided by the present invention will automatically stop and restart the fuel feeding and air blowing motor an indefinite number of times in the event combustion in the furnace or fire box ceases due to any defect in the oil line or failure in the supply of oil or fuel caused, for example, by clogging of the oil supply pipe or nozzle which would cause extinguishing of the flame at the nozzle. In that event, the thermostat element 53 controlled by the heat of combustion would cool and contract and allow the switch 29 to be thrown into open position to stop the motor 16 and thereby interrupt the air blast, but during the following one-half minute or so, the thermostat element 26 will be heated by the ignition sparks which will then pass between it and the electrodes 19 and will expand and throw the switch 29 into closed position to restart the motor 16, and if the oil supply is not restored and no combustion takes place, the thermostat element 26 will be cooled by the air blast from the blower during the following one-half minute or so and will allow the switch 29 to be thrown into open position to stop the motor, and this alternate starting and stopping or recycling of the motor, which will tend to unclog the oil pipe or nozzle, will be carried on as long as no combustion takes place in the boiler furnace or combustion chamber, thus insuring automatic restarting of the burner if the ignition means is in proper condition so that the proper spark takes place at the nozzle and the flow of oil or fuel is restored, in which event the thermostat element 53 will be heated and expanded by the heat of combustion and will maintain the burner in operation, as hereinbefore described.

By providing the thermostat element 26 controlled by the ignition conditions at the nozzle to act on the motor controlling switch 29 to start the motor into operation and the thermostat element 53 to act on the same motor controlling switch to maintain the motor in operation while proper combustion of the oil or fuel is taking place in the fire

box of the furnace or combustion chamber, safety in the starting and also the operation of the burner are insured by a construction which is simple and reliable.

We claim as our invention:—

1. In an oil burner having an oil discharge nozzle, ignition electrodes spaced to form an igniting spark gap between them in igniting relation with the nozzle, and electrically operated means for supplying oil to the nozzle and a current of air past the nozzle, a thermostat element located adjacent the gap between said electrodes and adjacent to said electrodes to form secondary spark gaps therewith in the path of said current of air, said thermostat being expandable by the heating thereof by sparking at the secondary gaps between it and said electrodes, and means including an electric switch operative by the expansion of the thermostat element to energize the electrically operated means to supply oil to the nozzle and the current of air past the nozzle and electrodes.

2. In an oil burner having an oil discharge nozzle, ignition electrodes spaced to form a direct spark gap between them in igniting relation with the nozzle, and electrically operated means for supplying fuel oil to the nozzle and a current of air past the nozzle, a thermostat element mounted adjacent to the direct gap between said electrodes and spaced from the electrodes to form spark gaps therewith in the path of said current of air and the aggregate length of which gaps is less than the length of the direct gap between the electrodes, and means including an electric switch operative by the thermostat element to start the electrically operated means to supply oil to the nozzle and produce a current of air past the spark gaps between the thermostat element and the electrodes.

3. In an oil burner having an oil discharge nozzle, ignition electrodes forming between them an igniting spark gap in igniting relation to said nozzle and having means for supplying ignition current thereto, and electrically-operated means for supplying oil to the nozzle for combustion and a current of air past the nozzle, an electric switch controlling the operation of said oil and air supplying means, a thermostat element located adjacent to the igniting gap between said ignition electrodes and adjacent to said electrodes to form secondary spark gaps in the path of said current of air, said thermostat element being arranged to be heated and operated by sparking at the secondary gaps between it and said electrodes, a second thermostat element located to be heated and operated by the combustion of oil from the nozzle, means shielding said second thermostat element from said current of air, and means actuated succes-

sively by said thermostat elements and operative upon said switch to respectively start the electrically operated oil supplying means into operation and to maintain the
5 oil and air supplying means in operation.

4. In an oil burner having an oil discharge nozzle, ignition electrodes forming between them an igniting spark gap in igniting relation to said nozzle and having
10 means including a main switch for supplying ignition current thereto, and electrically operated means for supplying oil to the nozzle for combustion and a current of air past the nozzle, an electric switch connected to said main switch to be controlled
15 thereby and controlling the operation of said oil and air supplying means independently of the supply of ignition current to the electrodes, a thermostat element located adjacent to the igniting gap between said
20 ignition electrodes and adjacent to said electrodes to form secondary spark gaps in the path of said current of air, said thermostat element being arranged to be heated and operated by sparking at the secondary gaps
25 between it and said electrodes, means actuated by the operation of said thermostat element to move said switch into a position to start operation of the electrically operated oil and air supplying means and capable
30 of retracting, and a second thermostat element located to be heated and operated by the combustion of oil from the nozzle and operative to hold said electric switch in said
35 position to maintain said oil and air supplying means in operation.

In testimony whereof we have hereunto set our hands.

40 SALVATORE SCOGNAMILLO.
DAVID SHLAIFER.

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