July 25, 1933. L. F. SPEAR 1,920,115

IGNITION MEANS FOR OIL BURNERS

Filed Nov. 28, 1930

Fig. 1.

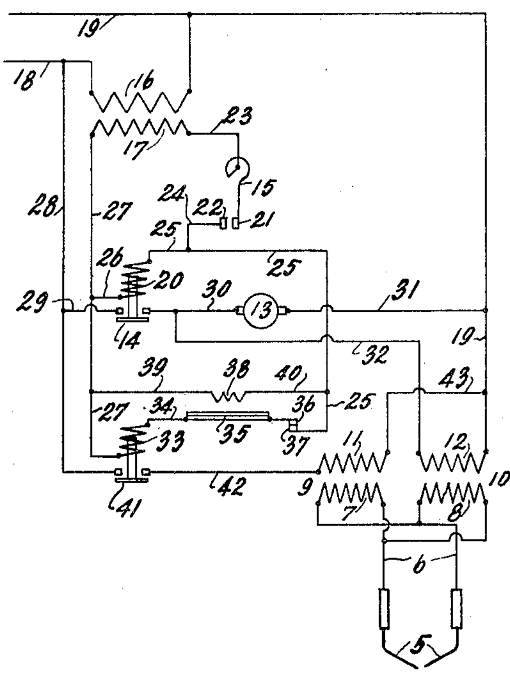


Fig. 2.

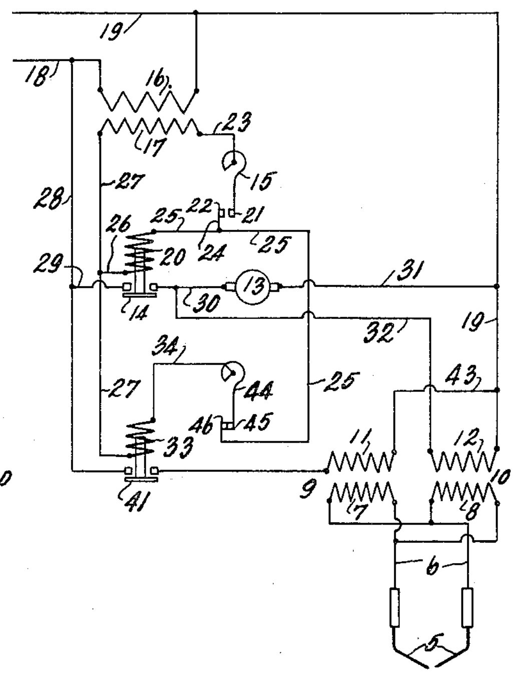


Fig. 3.

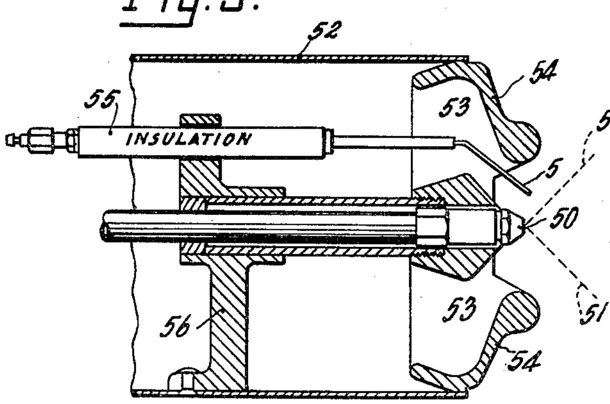
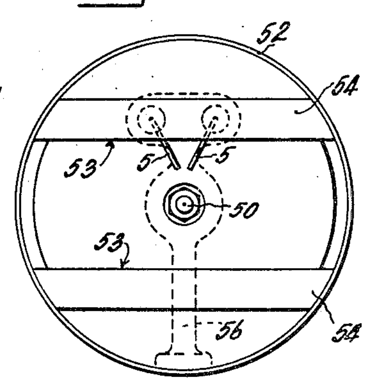


Fig. 4.



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Patented July 25, 1933 **1,920,115**

UNITED STATES PATENT OFFICE

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IGNITION MEANS FOR OIL BURNERS

Application filed November 28, 1930. Serial No. 498,718.

This invention relates to improvements in electrical ignition means for oil burners.

It has been the practice heretofore to use electrical ignition for oil burners and to operate it in either of two general ways. According to one way, the ignition means operates intermittently and only when required for ignition purposes, as when the burner is started. According to the other way, the ignition means operates continuously while the burner is in operation. While continuous ignition has the obvious disadvantage of extra cost of power and more rapid wear of the electrodes, there are important advantages which more than offset these disadvantages and make continuous ignition preferable to intermittent ignition. With continuous ignition, the spark electrodes are kept clean,—the spark burning off carbon as fast as it forms. Also, since ignition is always available while the burner is in operation, flame fluctuations such as fluttering of the flame and drifting of the flame away from the oil nozzle, are prevented or at least minimized. If the flame tends to drift away from the nozzle, oil will be ignited at the proper point close to the nozzle and flame reestablished at such point. The presence of the spark serves to hold the flame to the burner and anchor it in place.

This invention has for its object to provide in an electrical ignition system of the continuously operating type, an arrangement for providing a relatively heavy ignition current to initiate operation of the burner and for cutting down and substantially reducing the ignition current after the burner has been started, maintaining ignition current sufficient to keep the spark electrodes clean and anchor the flame to the nozzle and yet materially reducing the power consumption and wear on the electrodes over what it would be in ordinary ignition systems of the continuously operating type.

While the invention is not so limited, it is especially desirable in oil burners having a relatively heavy rate of oil consumption. A greater amount of energy is required for ignition of the oil in such cases. Ignition of oil occurs only after the oil has been vaporized. The spark must supply sufficient heat to vaporize a given amount of oil in a given amount of time. As the rate of oil flow from the burner increases, the film of oil which has to be broken down and vaporized by the heat from the spark, increases in thickness and a greater degree of energy is required to accomplish the work of vaporization in the same and very short space of time. Where such relatively heavy current consumption is required for ignition, the continuous plan of operation becomes very costly and hence the desirability of the ignition system of this invention which maintains continuous ignition at a relatively low rate of current consumption to secure the important advantages aforesaid and intermittently increases the ignition current for its heavy duty work on starting up of the burner.

Other objects of invention will appear as the detailed description proceeds and will be pointed out in the appended claims.

The invention will be disclosed with reference to the accompanying drawing in which:—

Fig. 1 is a wiring diagram of an ignition system embodying my invention;

Fig. 2 is a similar diagram showing a modification; and

Figs. 3 and 4 are sectional and end elevational views respectively of the ignition electrodes and their mounting in relation to the burner.

Referring to Fig. 1 of this drawing; the ignition spark electrodes are marked 5 and they are supplied from circuit wires 6, to which are connected in parallel the secondary coils 7 and 8 of two transformers 9 and 10, respectively. The primary coils 11 and 12 of transformers 9 and 10, respectively, are arranged to be energized on starting of the burner and the primary coil 12 continues to be energized during operation of the burner. The primary coil 11, however, is cut out of circuit shortly after ignition of the burner has been effected. In this way, it will be clear that ignition current is continually available during the period of burner operation from transformer

10 and that additional current is available from transformer 9 during the starting period of the burner. The result is a heavy current when needed for starting and a smaller current at all other times to anchor the flame and keep the electrodes 5 clean. At the start a heavy current flows across electrodes 5, producing a relatively large amount of heat to quickly vaporize and ignite the oil, even when fed at high rates. Thereafter, a smaller spark is maintained across the electrodes for the above mentioned purposes.

The particular means for the cutting in and out of the transformers 9 and 10 is not particularly important and various expedients will readily occur to those skilled in the art for accomplishing the same purposes. In Fig. 1, I have shown in conventional form one simple form of control. The burner motor, or any other electrically operated means for producing or controlling a flow of oil at the burner, is represented at 13. It is controlled by a switch 14, operated in any suitable way but usually by a room thermostat shown conventionally at 15. Usually, although not necessarily, thermostat 15 is in a low voltage circuit supplied from the secondary 17 of a transformer, the primary 16 of which is connected across the supply wires 18 and 19 of relatively high voltage. In such case, the switch 14 is operated by an electromagnet 20, controlled by thermostat 15. When thermostat 15 calls for heat its movable and fixed contacts 21 and 22, respectively, engage and current flows through secondary 17, wire 23, thermostat 15, wires 24 and 25, electromagnet 20, and wire 26 and 27. The closing of switch 14, effected by the electromagnet 20 establishes a high voltage circuit from line wire 18 through wires 28 and 29, switch 14 by wire 30, motor 13 and wire 31 to line wire 19, thus starting the burner. A second circuit from switch 14 through wire 32 to primary 12 of transformer 10 is also established. Thus, transformer 10 is energized coincidentally with the starting of the burner and continues to be energized while the burner is in operation.

The transformer 9 is cut into circuit in much the same manner but it is subsequently cut out of circuit by different means. A second electromagnet 33 is connected in the low voltage circuit controlled by thermostat 15, as by wires 25, 27 and 34. Interposed between wires 25 and 34 is any suitable time limit switch 35 which will separate the contacts 36 and 37 after a predetermined time has elapsed after the starting of the burner. As shown, the switch is a bi-metallic thermostat, subjected to the heat from an electric heating coil 38, connected by wires 39 and 40 to wires 27 and 25, respectively. The heating coil is energized coincidentally with the energization of magnets 20 and 33 under the control of thermostat 15. Magnet 33 closes a switch 41 and completes a circuit through the primary 11, as follows;—from wire 18 by wire 28, switch 41, wire 42 to primary 11, thence by wire 43 to wire 19. As soon, however, as the heat from coil 38 has warped the switch 35 to separate contacts 36 and 37, the circuit through magnet 33 is broken and switch 41 opens the circuit to transformer 9.

Another expedient for cutting out transformer 9 is shown in Fig. 2. The time limit switch 35 is replaced by a thermostat 44 which may respond to the temperature of the furnace or of the stack thereof and separate the contacts 45 and 46 after combustion is initiated at the burner. The thermostat 44 will thus open the circuit to magnet 33 and cause switch 41 to open. All other connections are the same as in Fig. 1 except that the heating coil 38 and its connections are omitted.

It is understood that the diagrams of Figs. 1 and 2 are illustrative of two expedients of the many available for accomplishing the result. It will also be understood that, for the sake of simplicity, the diagrams include just so much of the electric circuits and mechanism as is necessary to an understanding of the invention. In actual practice, there are various electrical control and safety devices associated with the burner which devices have no functional relation to the present invention and have been omitted to avoid needless complications in description and illustration.

In Figs. 3 and 4, I have shown, by way of illustrative example, a portion of one type of burner with which my invention may be used. The oil nozzle 50 is of the pressure or mechanical atomizing type. Oil supplied to it under heavy pressure is emitted in finely divided form and in the form of a hollow conical spray, indicated at 51. Air is supplied through the tube 52 and is emitted through the openings 53 in the head 54 to mingle with the oil particles and form a combustible mixture. The electrodes 5 are mounted in one of the air openings 53. They are supported in tubes 55 of insulating material from a bracket 56, mounted in tube 52 back of head 54. The electrodes 5 may be maintained out of the path of spray 51 because the air passing through opening 53 will blow the spark into said path.

The characteristics of the transformers 9 and 10 may, of course, be varied to suit the particular conditions encountered. They may be alike or dissimilar, as desired. Without limiting myself thereto, I state the characteristics of the transformers which I consider suitable to solve my present problem. Both transformers 9 and 10 are step up transformers of equal capacity designed to produce in the secondary a current of about 22 milli-amperes under a voltage of about 10,000. The primary is intended to be coupled to a 110 volt supply circuit. Under these conditions, I obtain on the starting up of the burner a current of about 44 milli-amperes which produces a heavy arc across the electrodes 5 to quickly vaporize and then ignite the oil fed from nozzle 50 within the required short time limit even though such oil is fed at a high rate, say thirty gallons per hour. In the ordinary domestic oil burners, oil is emitted at rates seldom greater than ten gallons per hour, and usually much less, and a single transformer of the characteristics described is suitable.

In operation, as the burner is started, under the control of thermostat 15 or in any other suitable manner, both transformers 9 and 10 are simultaneously energized. This, as just set forth, produces a relatively heavy current across the electrodes sufficient to vaporize quickly and ignite relatively thick films of oil emitted from nozzle 50. It will be appreciated that, as the rate of oil flow increases, the thickness of the hollow conical spray 51 increases and much more heat is required to vaporize it within the same and exceedingly short time interval than would be necessary where smaller rates of oil flow, say up to ten gallons per hour are emitted. The oil must be heated to the vaporization point before it can be ignited and with the larger rates of flow more heat is required. To meet this requirement I have, by doubling the secondary current, doubled the heat available for the purpose. The continued use of this heavy current would result in heavy power consumption and rapid wear of the electrodes. Also, there is no necessity for the maintenance of ignition current beyond just so much as is necessary for the purpose of maintaining the electrodes 5 clean and reigniting the oil to accomplish the purpose of anchoring of the flame to the nozzle, to prevent drifting or fluttering of the flame. Less heat is needed for the last named purposes because the burner, being in operation, supplies heat so that the oil is much more readily vaporized and ignited than it is when cold, as at starting. In a short time, say 30 seconds for example, the transformer 9 is cut out of circuit by the time limit switch 35, the burner or stack thermostat 44, or any other means suitable for the purpose.

Thus, I have provided an ignition means suitable for igniting oil when supplied at heavy rates without entailing any substantial increase in power consumption for ignition and without increasing the rate of wear of the electrodes. While the ignition means is especially desirable in burners having a relatively high rate of oil consumption, it is capable of application to, and useful in connection with burners having smaller rates of oil consumption. Whatever maximum secondary current is necessary for proper ignition of the oil at any specified rate of flow, that current may, after the event of ignition be substantially reduced to effect savings in cost of power and wear of the electrodes.

While I have disclosed my invention in one specific form for the purposes of illustration, I recognize that it may be embodied in various forms differing specifically from the one herein disclosed. Therefore, I desire to claim my invention in the broadest possible legal manner.

What I claim is:

1. In an oil burner, electrically operated means for producing a spray of oil, spark electrodes positioned adjacent the path of said spray, a plurality of transformers having their secondary coils connected in multiple to said electrodes, means for energizing the primary coils of all said transformers on the starting of said electrically operated means, and automatic means for deenergizing certain but not all of said transformers after said spray has been ignited by the spark at said electrodes.

2. In an oil burner, means for supplying oil, spark electrodes for igniting the oil, a pair of transformers the secondary coils of which are connected in multiple and to said electrodes, means for starting and stopping said first named means and for simultaneously energizing the primary coils of both said transformers, and means responsive to ignition at the burner to deenergize one of said transformers, the other transformer continuing in operation until the first named means is stopped.

3. In an oil burner, means for supplying oil, spark electrodes for igniting the oil, a pair of transformers the secondary coils of which are connected in multiple and to said electrodes, means for starting and stopping said first named means and for simultaneously energizing the primary coils of both said transformers, and means operable a predetermined time after the starting of said first named means to deenergize one of said transformers, the other transformer continuing in operation until the first named means is stopped.

LEOLYN F. SPEAR.