May 15, 1934. W. W. STUART 1,958,773

IGNITION DEVICE

Filed Sept. 21, 1931

Fig. 1.

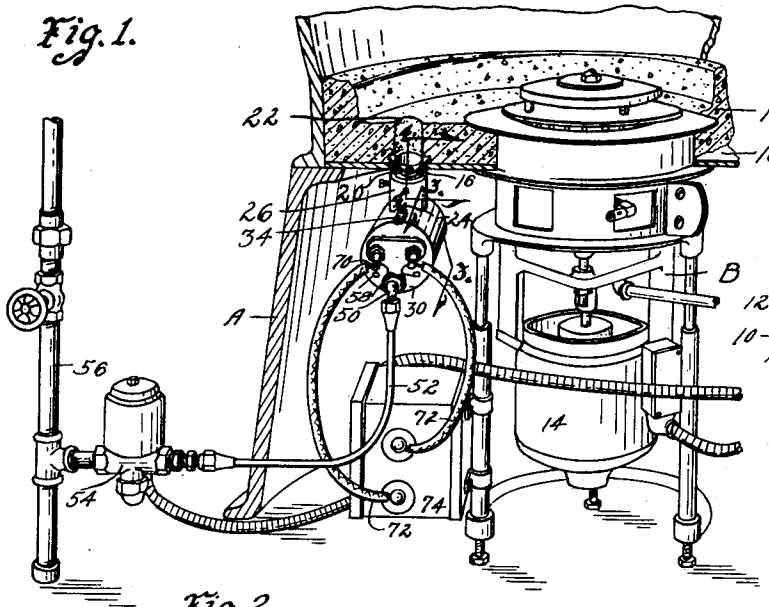


Fig. 4.

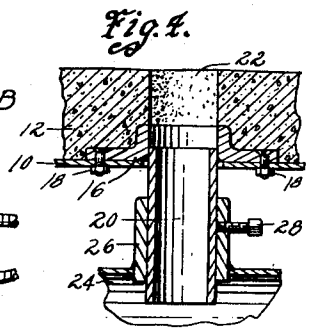


Fig. 2.

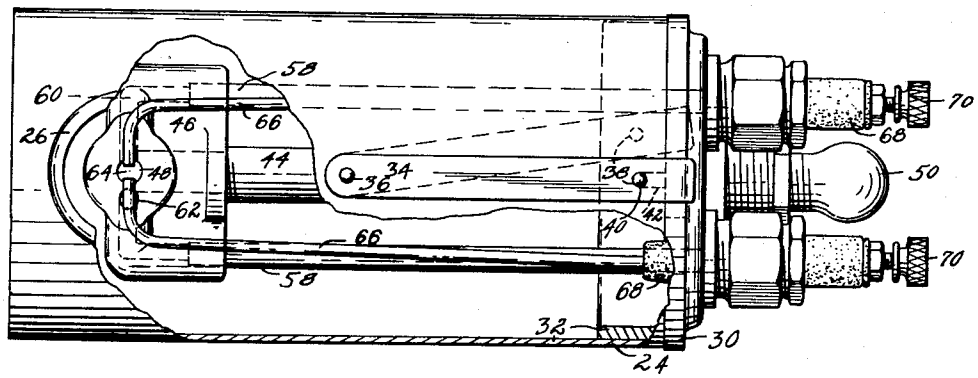


Fig. 3.

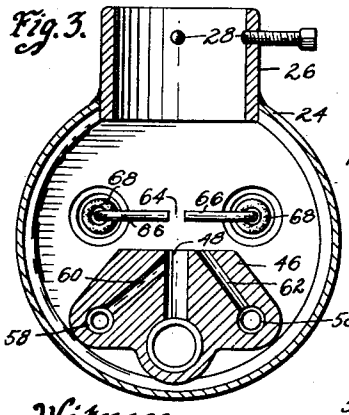


Fig. 5.

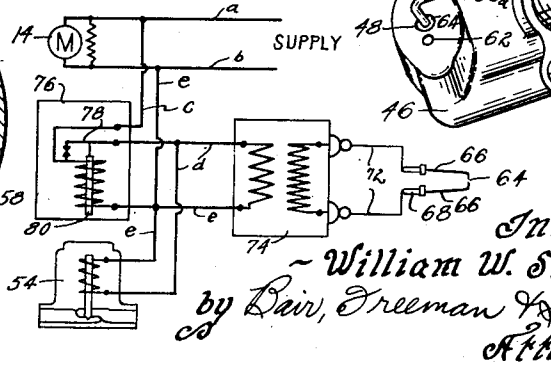
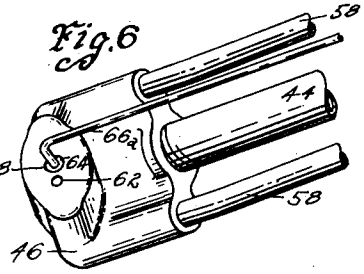


Fig. 6



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Patented May 15, 1934

1,958,773

UNITED STATES PATENT OFFICE

1,958,773

IGNITION DEVICE

William W. Stuart, Des Moines, Iowa

Application September 21, 1931, Serial No. 563,975

2 Claims. (Cl. 158—28)

My present invention relates to a structure including an oil burner and an ignition device therefor, having a gas burner, means for lighting the gas, as by an electric spark or other means, and means for shutting off the gas and ignition means shortly after the oil has been ignited.

The object of my invention is to provide an ignition device especially adapted for oil burners and of simple, durable and comparatively inexpensive construction.

It is a further object of my invention to provide an ignition device consisting of an ignition unit and automatic means for supplying gas thereto and a means for igniting the gas, such as a high tension current to a spark gap within the unit, a glowing element, chemical means or other suitable device.

I have herein illustrated my invention as applied to an electrically operated oil burner, showing an electrically controlled and operated gas valve, and an ignition device including a high tension transformer or coil, for igniting the gas, whenever the burner commences to function, an automatic means being provided for closing the gas valve and de-energizing the transformer after the ignition device has been operated a predetermined period of time.

Still another purpose is to provide means for creating ignition at least as soon as the gas flow begins.

A further purpose is to provide means for assuring a proper supply of oxygen at the time and point of ignition to thereby minimize the failures due to lack of oxygen at the ignition point, without introducing an excessive amount of air into any one part of the oil flame.

Another purpose is to provide a structure in which there will be an air cushion to prevent fouling of parts.

Another object of my invention is in the construction and arrangement and mounting of the ignition device for allowing access and removal for making inspection, cleaning and adjustment outside the heating plant.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawing, in which:

Figure 1 is a sectional perspective view of a portion of a furnace showing a motor-driven oil burner mounted therein and my ignition device associated therewith.

Figure 2 is a plan view of the ignition unit used in the system.

Figure 3 is an enlarged sectional view on the line 3—3 of Figure 1 showing a gas nozzle and a spark gap.

Figure 4 is an enlarged sectional view through the ignition flame tube showing its connection with the hearth plate of the furnace.

Figure 5 is an electrical diagrammatic view illustrating the connections with the controlling circuit of the oil burner, a timing switch, an electrically opened gas valve, a high tension transformer and the electrodes of the ignition device; and

Figure 6 is a perspective view of a modified form of the ignition device.

On the accompanying drawing, I have used the reference character A to indicate generally a furnace. Coal burning furnaces are now being equipped with oil burners as heat from an oil burner can be more readily controlled in an automatic manner and such an installation may include the placing of a hearth plate 10 in place of the grates of the furnace, the mounting of an oil burner unit B with respect to the hearth plate and the provision of a combustion chamber 12 formed of refractory material.

Heretofore various devices have been used for igniting the atomized oil and air discharged into the combustion chamber 12.

In general, this oil and air are delivered to the chamber 12 by the burner B with which is associated the motor 14.

The automatic operation of the burner B is such that when the room temperature rises to a predetermined degree, the burner is shut off and when the room temperature lowers to another predetermined degree, the oil burner is turned on. When the burner is turned on, the pilot light or some other means has heretofore been depended upon for igniting the flow of atomized oil and air.

A good many problems arise in connection with pilot lights, the first of which is that the light must be of substantial size so as not to be blown out by the oil and air discharged into the combustion chamber 12 and yet must be small enough to consume a minimum amount of gas to prevent excessive gas bills. It has been found that pilot lights of sufficient size to insure ignition at all times consume a prohibitive amount of gas.

Where a pilot light is used, the gas frequently cakes in the passages and as the coke accumulates the gas flame is reduced in size until it is easily

blown out or is too small to ignite the incoming oil.

Where an expanding gas pilot is used, wax and other impurities often close the by-pass that supplies gas for the standing pilot. The tips or pilot castings of continuously burning gas pilots are often destroyed during the normal operation of the burner.

Many other forms of igniters have vital parts in the oil stream and are often injuriously affected by the oil stream, or interfere with combustion. Many of them are limited to igniting of the higher grade and more expensive oils. Often they are difficult to remove or replace, especially when the combustion chamber is hot.

I have provided an igniter which is not subject to these objections.

My ignition device consists of a mounting flange 16 adapted to be secured to the hearth plate 10 by means of bolts 18 or the like. An ignition flame tube or hearth tube 20 is welded or otherwise fixed within the flange 16 as best shown in Figure 4. The flange 16 is embedded beneath the refractory combustion chamber 16 and the hearth tube 20 communicates with an opening 22 formed therein which forms a discharge nozzle for the tube 20.

A casing 24 is provided with a neck 26 detachably connected with the hearth tube 20 by means of set screws 28 or the like. One end of the casing 24 is closed while the opposite end thereof is provided with a closure plate 30 having an aligning sleeve 32 within the casing 24. The closure plate 30 is held within the casing 24 by means of a leaf spring latch 34 pivoted at 36 and provided with an opening 38 adapted to fit over a pin 40 on the sleeve 32. A slot 42 is provided in the casing 24 for the pin 40 to slide through when inserting the sleeve 32 in the casing 24.

A tube 44 extends from the closure plate 30 into the casing 24 and serves for conducting gas and for supporting the pilot tip 46, mounted on the inner end of the tube 44. The pilot tip 46 has a discharge opening 48 centered below the hearth tube 20.

Through the tube 44 the discharge opening 48 communicates with a connection 50 and a tube 52 connected to a solenoid gas valve 54. The valve 54 is connected with a gas supply pipe 56, whereby gas under pressure such as illuminating gas can be supplied to the nozzle 46 when the valve 54 is opened.

A pair of air tubes 58 are provided communicating through the closure plate 30 with atmosphere as best shown in Figure 1 and with the nozzle 46 as best shown in Figure 3. An air passageway 60 extends from one of the tubes 58 into the discharge opening 48 while a passageway 62 extends from the other air tube 58 through the nozzle 46 and discharges air above the discharge end of the opening 48.

A spark gap indicated at 64 is provided above the discharge opening 48 and the passageway 62 points toward this gap. The gap 64 is between a pair of electrodes 66 which extend through insulating bushings 68 and are provided with terminal nuts 70. A pair of high tension leads 72 are connected with the terminal nuts 70 and with the secondary of a high tension transformer 74 or with a high tension coil.

In Figure 6, I have illustrated a single electrode 66*a* which may be used instead of the two electrodes 66 for forming a spark gap between the electrode 66*a* and the upper edge of the discharge opening 48. In an ignition device of this type one of the secondary terminals of the transformer 74 is grounded relative to the nozzle 48.

In Figure 5, I have illustrated an electrical hook-up for the ignition device in which a pair of current supply wires *a* and *b* energize the burner motor 14. Suitable automatic controls are provided, of course, for energizing the wires *a* and *b*. A timing switch 76 is provided in which there is a normally closed switch arm 78 which is adapted to be moved to open position by a solenoid armature 80 of the dash pot retarded type. This is a timing switch which when energized will supply current from the wires *a* and *b* through wires *c*, *d* and *e* to the primary winding of the transformer 74 and the solenoid of the gas valve 54. The retarded armature 80, after a predetermined length of time, raises the switch arm 78 and thereafter holds it in raised position so that the valve 54 and the transformer 74 will not function as long as the wires *a* and *b* are energized. When they are de-energized and again re-energized, then the valve 54 will be opened and the electrodes 66 charged with electricity for another predetermined period of time necessary for ignition of the atomized oil and air from the burner B.

Other means may be used instead of the time switch for cutting off the gas and spark.

Thus it will be seen that a large volume of gas may be supplied to the ignition flame for a short time and completely cut off thereafter so as to reduce the expense of fuel for the ignition flame to a minimum.

With this large flame, it is possible to ignite as low a grade of oil as it is practical to use in a fully automatic burner. In practice, more than one igniter is used on larger burners or where very low grade oils are used.

The arrangement is such that there is a spark as soon as the gas flow begins. Oxygen is supplied just at the point of ignition where it must be had. Gas alone is difficult to ignite. No unnecessary air is supplied to any part of the oil flame. The small air tubes 58 carry such a small amount of air that it has no detrimental effect on the oil fire. If too much air were supplied, the surplus would travel up into the combustion chamber, and interfere with proper combustion of the oil. By introducing air at the point where it is needed, only a small air opening is necessary. This is placed at a point in the device, such that it will not destroy the air cushion protecting the insulators. This is important because back pressure from the combustion chamber often immediately follows the ignition of the oil, especially in large installations. If there were air holes in the plate 30, the air cushion would be bled and destroyed. Any gas remaining at the burner nozzle from a previous opening of the valve, is washed away by the air entering through the tubes 58.

Where a pilot flame is used with an oil burner, there is a constant flow of a small supply of gas to the pilot flame. The great heat of the oil flame from the main burner tends to cause the formation of coke in the passage leading to the pilot burner.

One advantage of my construction by which the ignition flame is lighted only for the short period necessary to establish ignition and then is closed off, entirely, arises from the fact that after such closing off no gas is flowing through heated parts where coking might occur. Hence with my construction, there is never any coking of the opening 48. In addition the continued

flow of a certain amount of air through the air tubes and upwardly through the opening 22 contributes to keeping the parts cool.

Temporary operation of the burner can be obtained in case of failure of the transformer by opening the by-pass now provided in the solenoid valve to provide a standby pilot.

For inspecting, testing and cleaning or adjusting the igniter unit, the pipe 52 may be disconnected, the spring latch 34 may be released, and the plate 30 with the entire electrode and nozzle assembly may be withdrawn from the casing 24, whereupon every part thereof is readily accessible. The entire device may be removed by loosening the set screws 28. This is rarely necessary.

After withdrawal of the electrode and nozzle assembly from the casing, the pipe 52 may be again connected and the apparatus operated and tested in plain sight. All this can be done without disturbing the proper arrangement of the spark gap with relation to the nozzle.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope. For example, I have here shown spark gap devices as means for ignition but other suitable means, such as glowing elements, chemical igniters and so forth might be used. By "flame lifting" in the claims, I intend to cover the action contemplated, whether the flame continues to burn above or simply spaced from the nozzle.

I claim as my invention:

1. In a structure of the kind described, a tubular casing having a discharge passage leading from its upper part adjacent one end, a closure detachably secured to the other end, fuel supply means, an air supply means and current conducting means all supported on said closure, a fuel nozzle located to discharge through said discharge passage at the first end of the casing, connected with the fuel supply means, having air passages connected with the air supply means, and electric ignition means adjacent the nozzle and near the discharge ends of the air passages, connected and supported with the current conducting means, said casing being otherwise closed.

2. In a structure of the kind described, a casing having a discharge passage at one end, a closure detachably secured to the other end, fuel supply means, air supply means and current conducting means, all supported on said closure, a fuel nozzle located to discharge through said discharge passage connected with the fuel supply means and associated with the air supply means, and electric ignition means adjacent to the nozzle, near the point of discharge from the air supply means, connected and supported with the current conducting means, said casing being otherwise closed.

WILLIAM W. STUART.