

June 10, 1930.

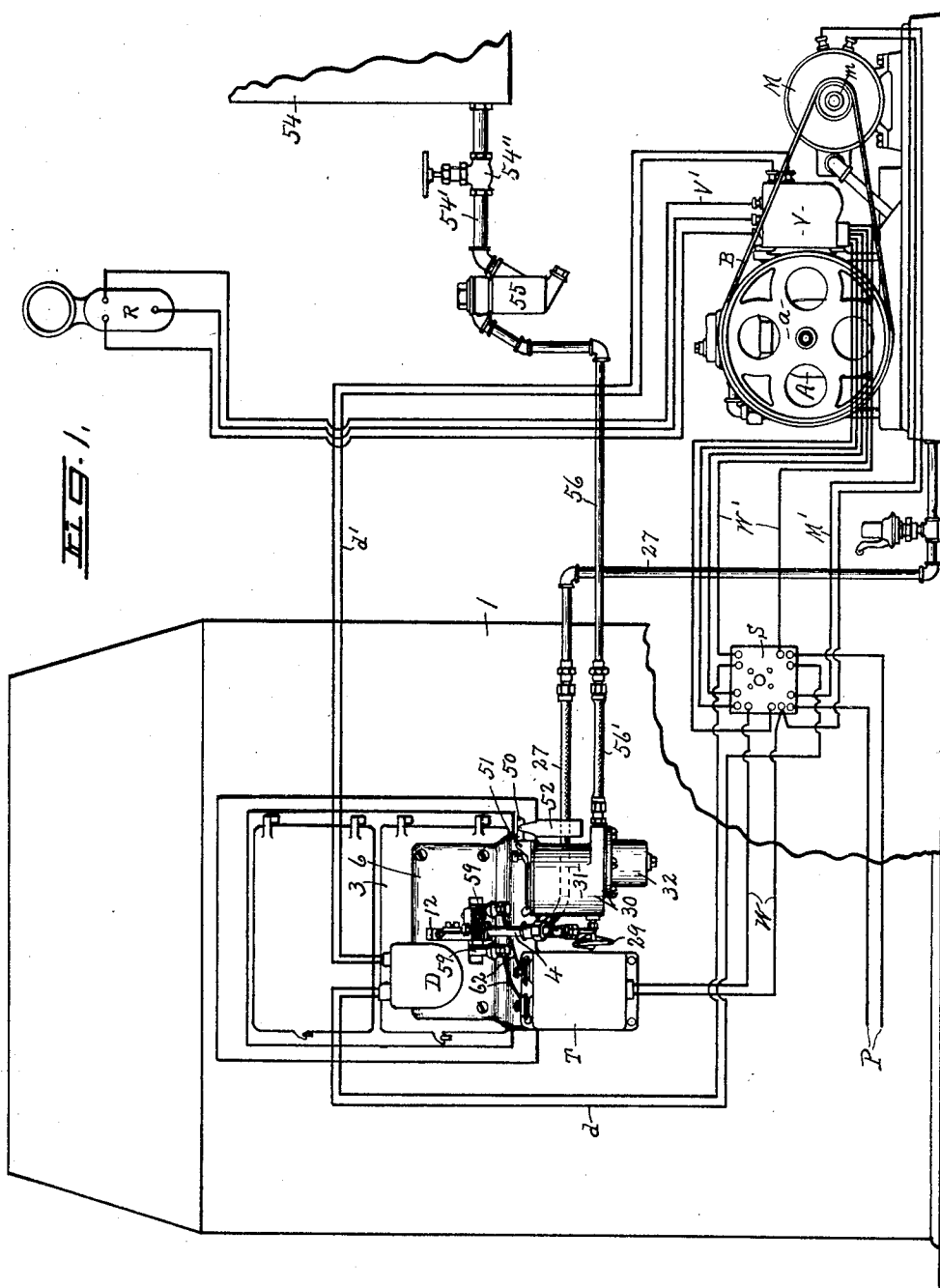
A. C. BRYAN

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OIL BURNER

Filed Sept. 2, 1927

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H. H. H. H.

INVENTOR
A. C. Bryan
BY *Druid & Thompson*
ATTORNEYS

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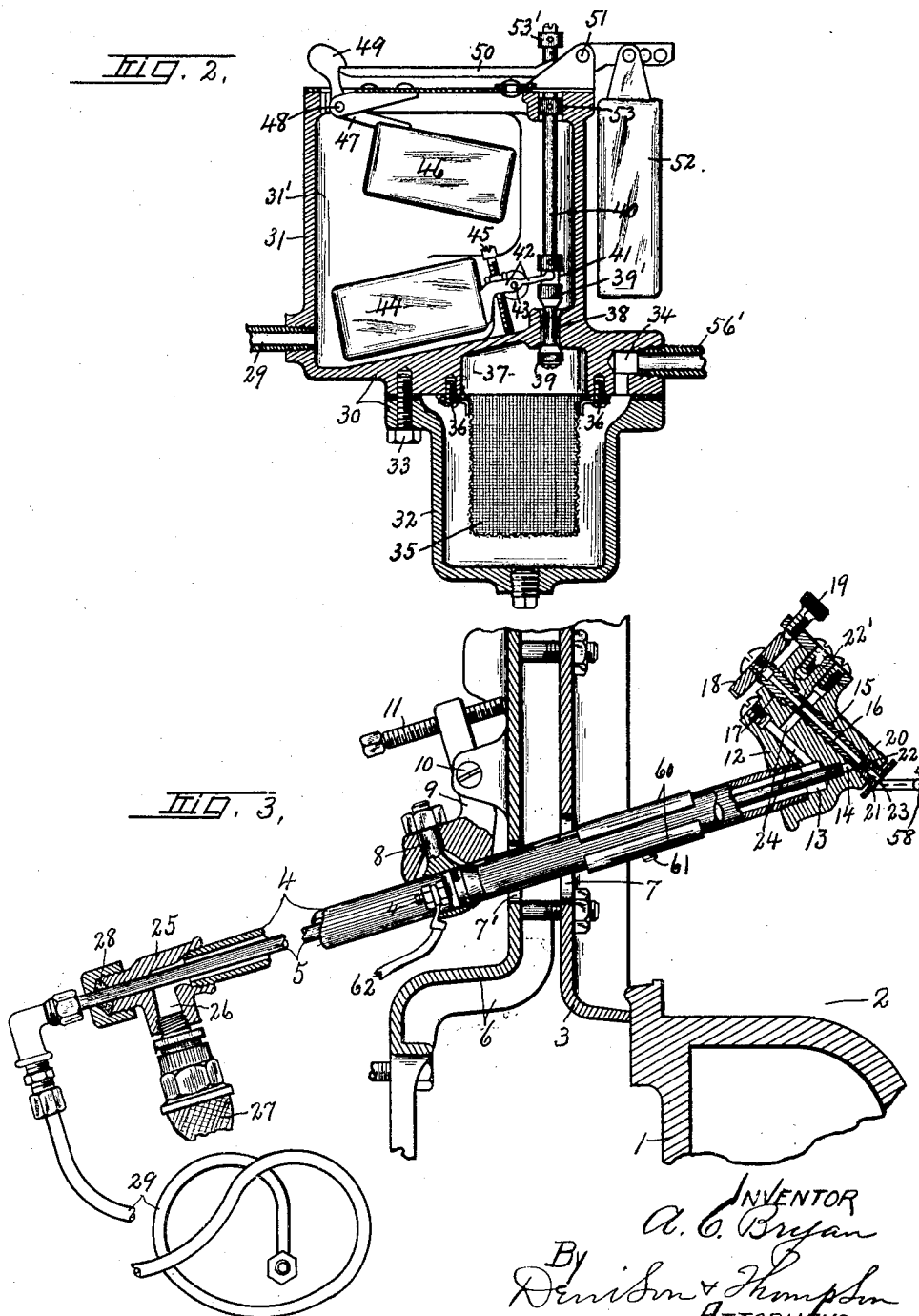
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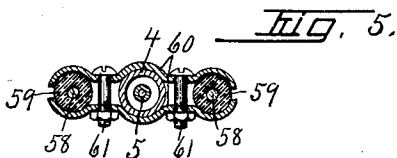
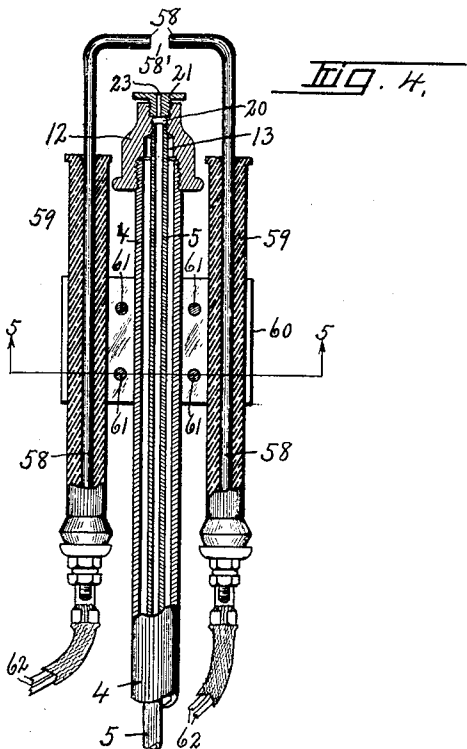
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3 Sheets-Sheet 3



INVENTOR
A. C. Bryan
By
Dennis Thompson
ATTORNEYS

UNITED STATES PATENT OFFICE

ARTIS CHESTER BRYAN, OF SYRACUSE, NEW YORK

OIL BURNER

Application filed September 2, 1927. Serial No. 217,123.

This invention relates to a liquid fuel heating apparatus adapted to be used more particularly for the combustion of crude petroleum and other low grade oils in house-heating and analogous uses where economy, convenience and elimination of ash are desired.

The main object is to provide an installation of this character at a lower cost than has heretofore been practised and at the same time capable of giving a maximum heat efficiency with a minimum expenditure of time, labor and cost of operation and maintenance.

In other words, I have sought to obtain a maximum amount of heat for a given quantity of fuel and to render the operation of the various parts of the installation practically automatic and entirely safe when used by inexperienced operators.

Another object is to mount the burner, including the fuel nozzle and spark terminals together with the automatic fuel feed control, and such other parts of the apparatus as may be necessary or desirable, directly upon the fuel door of the furnace or other house heater so that the fuel nozzle, spark terminals and other parts directly effecting the combustion may be conveniently inspected from time to time by simply opening the fuel door which also permits replacement or repair of those parts without disconnecting them and without disturbing any of the other elements.

One of the specific objects is to provide the fuel-feeding system with a float-controlled safety device adapted to automatically cut off the fuel feed from the float chamber to the burner in case of leakage of the liquid fuel to the float chamber or an excess quantity of oil therein beyond what is consumed by the burner.

Another object is to locate the float chamber at a lower level than the burner so that in case the air pressure at the fuel nozzle or operation of the apparatus ceases the fuel will drain back from the fuel nozzle into the float chamber.

A further object is to construct the burner in such manner that the fuel mixture will

have a freer and greater discharge when cold or at a relatively low temperature than when heated and that as the heat increases the fuel discharge will be gradually diminished and if the heat is excessive, the discharge will be entirely cut-off thereby establishing a close regulation of the combustion of the fuel according to the degree of heat developed by the combustion directly in the discharge nozzle.

Other objects and uses relating to specific parts of the apparatus will be brought out in the following description.

In the drawings:—

Figure 1 is a side elevation and diagrammatic view of a liquid fuel heating apparatus embodying the various features of my invention, portions of the furnace and oil-supply tank being broken away.

Figure 2 is an enlarged vertical sectional view of the float tank and detachable screen filter thereon.

Figure 3 is an enlarged longitudinal vertical sectional view, partly broken away of the burner attachment and portion of the furnace door upon which it is mounted.

Figure 4 is a horizontal sectional view of a portion of the burner attachment taken in the plane of line 4—4, Figure 3, showing more particularly the electrodes or spark terminals and manner of mounting the same upon the periphery of the air tube.

Figure 5 is a transverse sectional view taken in the plane of line 5—5, Figure 4.

In order that the invention may be clearly understood I have shown an ordinary house furnace —1— as provided with the usual combustion chamber —2— and fuel door —3— upon which the burner attachment is adapted to be mounted in a manner hereinafter described.

This burner attachment comprises an air-supply pipe —4— and a relatively smaller fuel supply pipe —5— extending through and beyond the opposite ends of the air pipe —4— in spaced relation to the interior thereof so that the latter may form in an air jacket for the fuel pipe.

The door —3— is provided with a front plate —6— secured thereto for receiving

and supporting the burner and certain other parts of the apparatus hereinafter described.

The air tube —4— and fuel pipe —5— therein extend through registering openings —7— and —7'— in the door —3— and its auxiliary plate —6—, the intermediate portion of the air tube —4— being clamped by means of an eye bolt —8— directly to the lower end of a lever —9— which is pivoted at —10— to the plate —6— to swing about a horizontal axis for the purpose of tilting the burner to different angles as may be required when installed in different types of furnaces to bring the fuel discharge nozzle and spark terminals closer to or farther from the incandescent material commonly used in heating apparatus of this character and also to maintain the fuel pipe —5— in a forwardly and downwardly inclined position to enable the fuel to drain back into the float chamber from which it is supplied when the air pressure in the tube —4— or operation of the apparatus ceases.

The angular adjustment and tilting movement of the burner and its supporting lever —9— are effected by means of an adjusting screw —11— engaging in a threaded aperture in the upper end of the lever and having its rear end engaged in the front face of the plate —6— as shown in Figure 3.

A suitable fuel and air delivery head —12— is screwed or otherwise connected to the inner ends of the air tube —4— and fuel pipe —5— within the combustion chamber —2— and is provided with an air inlet —13— and a fuel inlet —14— connected respectively with the air tube —4— and fuel pipe —5—.

The head —12— is also provided with an inwardly and downwardly inclined bore or opening —15— for receiving an air tube —16— which closely fits within the bore —15— to form an air and liquid-tight joint therewith and has its lower end extended across the fuel inlet —14— and its upper end threaded and engaged in a threaded aperture —17— in the adjacent portion of the head to permit said tube to be adjusted axially by turning movement in one direction or the other.

A hand wheel —18— is secured to the outermost end of the tubular stem —16— to facilitate the turning thereof and is adapted to be engaged by a set screw —19— to hold the tubular stem in its adjusted position.

The inner end of the tubular stem —16— adjacent the fuel inlet —14— is slightly reduced in external diameter to form an intervening chamber —20— which communicates with a discharge nozzle —21— in the adjacent lower end of the head —12—.

This discharge nozzle —21— is provided with a central lengthwise opening —23— therethrough to permit the discharge of the fuel mixture formed in the chamber —20—

in a manner presently described and is threaded externally and engaged in a threaded opening in the adjacent portion of the head —12— to permit it to be adjusted axially when turned in either direction.

The tubular stem —16— and nozzle —21— are co-axially disposed end to end and are both adjustable axially to set and control the amount of mixture discharged through the nozzle which latter forms a valve seat for the adjacent end of the stem —16—.

The head —12— and stem —16— are made of different metals having different co-efficients of expansion in such relation that any increased temperature of the head will cause the valve —16— to expand endwise toward the inner end of the nozzle —21— to gradually reduce the amount of mixture entering the discharge nozzle.

The lower end of the tubular stem —16— is provided with a relatively small central lengthwise air passage —22— in direct alinement with the opening as —23— in the discharge nozzle but otherwise this end of the stem is closed and constitutes a valve cooperating with the adjacent end of the nozzle —21— to entirely cut-off the supply of fuel from the inlet —14— to the nozzle in case of excessive endwise expansion of the stem —16— by overheating thereby preventing further combustion until the temperature of the head —12— and tube —16— is reduced.

It is, therefore, evident that the fuel for combustion beyond certain temperature limits is controlled automatically by the unequal expansion between the head —12— and tube —16— as previously described.

The intermediate portion of the tubular stem —16— is provided with a plurality of relatively small radial openings —22'— therethrough communicating through passages —24— with the air inlet —13— to allow air to flow from the interior of the tube —4— into the tubular stem —16— and thence through the relatively small opening —22— in the lower end of the stem to the mixing chamber —20— where it mixes with the fuel entering through the inlet —14— and is discharged through the passage —23— in the form of an explosive mixture for ignition by suitable electric spark terminals, presently described.

The outer end of the air tube —4— is provided with a head —25— having an air inlet —26— communicating with the interior of the adjacent end of the tube —4— and adapted to be connected by a flexible conduit —27— to any suitable source of air supply under pressure.

For this purpose, I have shown what is known as a two-cylinder pump —A— having the usual expansion tank and pressure gage and adapted to be driven by an electric motor —M— through the medium of a belt

—B— and pulleys —m— and —a—, Figure 1.

The head —25— is screwed upon the adjacent end of the air tube —4— and is provided with a gland —28— co-axial with said tube for receiving and supporting the adjacent end of the liquid-fuel-supply tube —5— having its outer end connected by a flexible pipe coil —29— to an oil feed-regulator —30— as shown more clearly in Figure 2.

This oil feed regulator —30— constitutes a part of an oil-feeding system of the gravity feed type and is preferably mounted upon the plate —6— of the fuel-door —3— in a plane some distance below the lower end of the fuel supply pipe —5— of the burner to allow the oil to drain from the burner back into the regulator in case of stoppage of the air line to the burner and resultant cessation of combustion thereby conserving the fuel and reducing the liability of carbonization of the fuel in or upon the burner.

As shown more clearly in Figure 2 the regulator comprises a float containing section —31— and filtering section —32— secured together one above the other by bolts —33— or equivalent fastening means so that they may be readily detached one from the other.

The float-containing section —31— is provided with a liquid-fuel-inlet —34— communicating with the interior of the filtering section —32— which contains a filtering screen —35— which is secured by bolts —36— to the underside of the section —31— to permit it to be readily removed for cleaning or other purposes when the section —32— is removed and serves to screen or filter the oil before passing into a receiving chamber —37— in the lower side of the section —31—.

The section —31— is provided with a float chamber —31'— communicating with the receiving chamber —37— through a vertical port —38—, the opposite ends of which form suitable valve seats for cooperation with a pair of opposed valves —39— and —39'— both mounted upon one and the same vertically movable valve stem —40—.

The valves —39— and —39'— are spaced axially a greater distance apart than the distance between the opposite end seats of the port —38— to allow a limited opening and closing of both valves.

The portion of the valve stem —40— adjacent the uppermost valve —39'— is provided with an annular groove —41— for receiving one end of a lever —42— which is pivoted at —43— to the interior walls of the section —31— and has its lower end provided with a float —44— movable vertically in the chamber —31'— about the axis of the pivot —43—.

The normal position of the valve —39—

and —39'— is regulated by an adjusting screw —45— engaged in a threaded aperture or nut on the float end of the lever —44— and has its lower end normally resting upon the bottom of the chamber —31— so that when an insufficient amount of oil is present in the chamber —31— to raise the float —44— both valves —39— and —39'— will remain open.

On the other hand, if the oil continues to flow from the receiving chamber —37— through the open port —38— and into the float chamber —31'—, the float —44— will be raised thereby causing the lever —42— to move the valve stem —40— downwardly for gradually closing the upper valve —39'— so that the float —44— constitutes what may be termed an automatic oil feed regulator.

An additional float —46— is supported upon one end of a lever —47— within the float chamber —31'— in a plane some distance above the float —44—, said lever —47— being pivoted at —48— to the interior walls of the section —31— and has its upper end extending through an opening in the top wall of said section and provided with a detent —49— normally engaged with the adjacent end of another lever —50— which is pivoted intermediate its ends at —51— to the top wall of the section —31— and has its other end provided with a weighted member —52—.

The lever —50— extends across the top of the section —31— in a plane intersecting the path of movement of the valve rod —40— which extends upwardly through an opening in the top of the section —31— and is provided with axially spaced collars —53— and —53'— in planes above and below the adjacent portion of the lever —50— for engaging the lower and upper faces thereof between the pivot —51— and detent —49—.

The float —46— is placed in the float chamber for safety purposes to cut off the oil supply thereto in case of leakage of the upper valve —39'— or in case the supply of oil to said chamber exceeds the combustion of the fuel mixture.

Under these conditions the continued rise of the level of the liquid fuel in the chamber —31'— would raise the float —46— and thereby trip the detent —49— to allow the lever —50— to be operated by the weight —52— for raising the valve stem and thereby closing the lower valve —39— against the adjacent end of the port —38— to positively cut off the further supply of liquid fuel from the receiving chamber —37— to the float chamber —31'— the groove —41— being of sufficient length to permit the seating of the valve —39— without the lower shoulder of the groove —41— contacting with the lever —42—.

The inlet —34— leading to the interior of the filtering case —32— is connected to an oil supply tank —54— through the medium of suitable pipes —54'—, —56— and —56'— and a suitable filtering device —55—, Figure 1, the pipe —54'— being provided with a valve —54''— adapted to be operated at will for regulating the flow of oil from the tank —54— to the filtering chamber —32—.

One of the pipe sections as —56'— together with a part of the pipe —27— adjacent the burner are preferably flexible to permit the door —3— with regulator —39— thereon to be opened and closed without straining any of the pipe joints.

The tank —54— is preferably located in a plane some distance above the regulator —30— so as to establish a gravity feed of the liquid fuel therefrom to the float chamber —31'—.

As previously stated the regulator —30— is disposed in a plane below the burner to allow the liquid fuel to drain from the burner tube back into the regulator when the apparatus is not in operation but as soon as air pressure is established in the burner tube —4— it will pass through the tubular stem —16— across the fuel inlet —14— of the head —12— and thereby draw the fuel by suction into the mixing chamber —30— for discharge as an explosive mixture through the nozzle —23— and into the combustion chamber.

This explosive mixture is preferably ignited by a pair of electrode terminals —58— which are supported in suitable insulating sleeves —59— adjacent opposite sides of and parallel with the air tube —4— so as to form a spark gap —58'—, Figure 4, adjacent the discharge end of the nozzle —21— or approximate the path of the discharged mixture.

The insulating sleeves —59— with the electrodes —58— therein are connected intermediate their ends by a yoke —60— consisting of lower and upper plates which are clamped together by bolts —61— to hold the sleeves in spaced relation to the air tube —4—.

The ends of the electrodes —58— opposite the gap —58'— are connected by insulated wires —62— to the secondary circuit of a transformer —T— having its primary coil connected by wires —W— to a combination terminal block and release switch —S— to which is connected the power circuit —P—, Figure 1.

The transformer —T— may be of any suitable make preferably of the double terminal high tension type capable of stepping up the current from the ordinary 110-volt current to 10,000 volts.

The switch terminal block and release switch —S— is also connected by wires

—W'— to a suitable motor switch —V— forming a part of the floor assembly on or adjacent the pump —A— or motor —M—, which latter is connected by wires —M'— to the combination terminal block and release switch —S—.

The motor switch —V— is also connected by wires —V'— to a thermostat switch —R— which may be located in the room of the building into which the heat is supplied from the heater —1— whereby the motor switch may be controlled by varying temperatures in the room.

A combustion safety control device —D— is mounted upon the plate —6— of the door —3— to open and close therewith and is connected by wires —d— to the combination terminal block and release switch —S— and also by wires —d'— to the motor switch —V— as shown in Figure 1.

Although I have shown standard types of a pump —A—, motor —M—, motor switch —V—, combination terminal block and release switch —S—, transformer —T—, combustion safety control device —D— I do not wish to limit myself to the use of those devices for the reason that equivalents thereof may be hereafter adopted and installed in connection with the liquid fuel gravity feed heating system including the regulator —30— in combination with the specific construction of the burner and the manner of mounting the same upon the fuel door of the heater.

It is also possible that other forms of thermostatic switches in place of the switch —R— may be installed without departing from the spirit of the invention.

The combustion safety control device —D— is provided with thermally controlled means such, for example, as mercury tube electric switch electrically connected by the wires —d'— to the motor switch —V— to open and close the latter as the temperature in the combustion chamber or flue leading therefrom varies beyond certain pre-determined limits thereby establishing an automatic control of the motor —M— and air pump —A— actuated thereby.

Operation

When starting the heater the current is first turned on to the primary of the transformer —T— thereby energizing the electrodes —58— to produce the desired spark of the gap —58'— following which the motor —M— is operated to actuate the air pump —A— to force air pipe —4— into the mixing chamber —20— of the burner thereby drawing the liquid fuel through the fuel pipe —5— into the mixing chamber —20— to mingle with the inflowing air to produce the necessary combustible mixture which is then discharged through the nozzle —23— in the sphere of the spark at

the gap —58'— where the mixture is ignited and is directed downwardly into the combustion chamber of the heater —1—, the combustion taking place some distance from the outlet of the discharge nozzle thereby relieving the same from carbonization and producing an intense heat within the combustion chamber to be transferred through the air in the air tubes or chamber of the heater —1— for distribution into the rooms to be heated.

The fuel is supplied to the burner through the fuel pipe —5— directly from the chamber —31— of the regulator —30—, the air under pressure passing through the pipe —4— acting upon the ejector principle to draw the fuel from the pipe —5— directly into the mixing chamber —20—.

What I claim is:—

1. In an oil burner, a head having an inlet for the liquid fuel and an outlet for the combustible mixture communicating with the fuel inlet, an air tube extending into the head across the fuel inlet and discharging into the outlet and having a different co-efficient of expansion than the head adapted when heated to expand toward the outlet to reduce the amount of mixture passing through said outlet, and means for igniting the mixture.
2. In an oil burner, a fuel-delivering head having a discharge nozzle and a liquid fuel inlet adjacent and communicating with said nozzle, an air tube extending into the head across the inlet and communicating with the nozzle, said tube and nozzle having different co-efficients of expansion arranged to reduce the amount of combustible mixture passing through the nozzle after their temperatures increase, and means for igniting the mixture.
3. In an oil burner, a fuel-delivering head having a discharge nozzle and a liquid fuel inlet adjacent and communicating with said nozzle, an air tube extending into the head across the inlet and communicating with the nozzle, said tube and nozzle being relatively adjustable axially to regulate the amount of combustible mixture passing through the nozzle, and means for igniting the mixture, said tube having a different co-efficient of expansion than the head adapted when heated to approach the nozzle to reduce the amount of mixture discharged through the nozzle.
4. The combination with the fuel inlet door of a heater of coaxial pipes one within the other extending through an opening in the door and some distance beyond the inner and outer faces thereof, means for supplying air to the outer end of one of the pipes, means for supplying liquid fuel to the outer end of the other pipe, a head secured to the inner ends of both of said pipes, and provided with an opening therethrough

inclined inwardly and downwardly across the inner ends of both of said pipes, a tubular stem extending from the top downwardly into said opening across the inner ends of both of the pipes and having its interior communicating with one of said pipes, a nozzle mounted in the lower end of said opening and communicating with the other pipe and with the interior of the tubular stem, and means at the top of the head for adjusting the tubular stem endwise toward and from the nozzle.

In witness whereof I have hereunto set my hand this 16th day of August, 1927.

ARTIS CHESTER BRYAN.