Feb. 21, 1928. 1,660,106

C. M. STROUD

LIQUID FUEL BURNER

Filed April 5, 1926 2 Sheets-Sheet 1

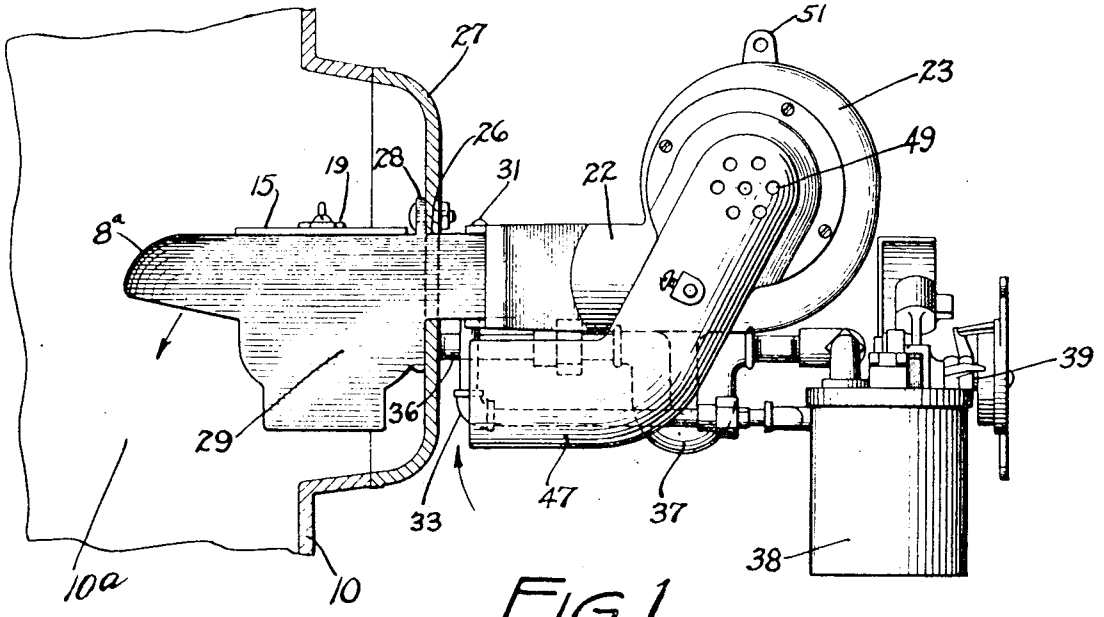


FIG. 1

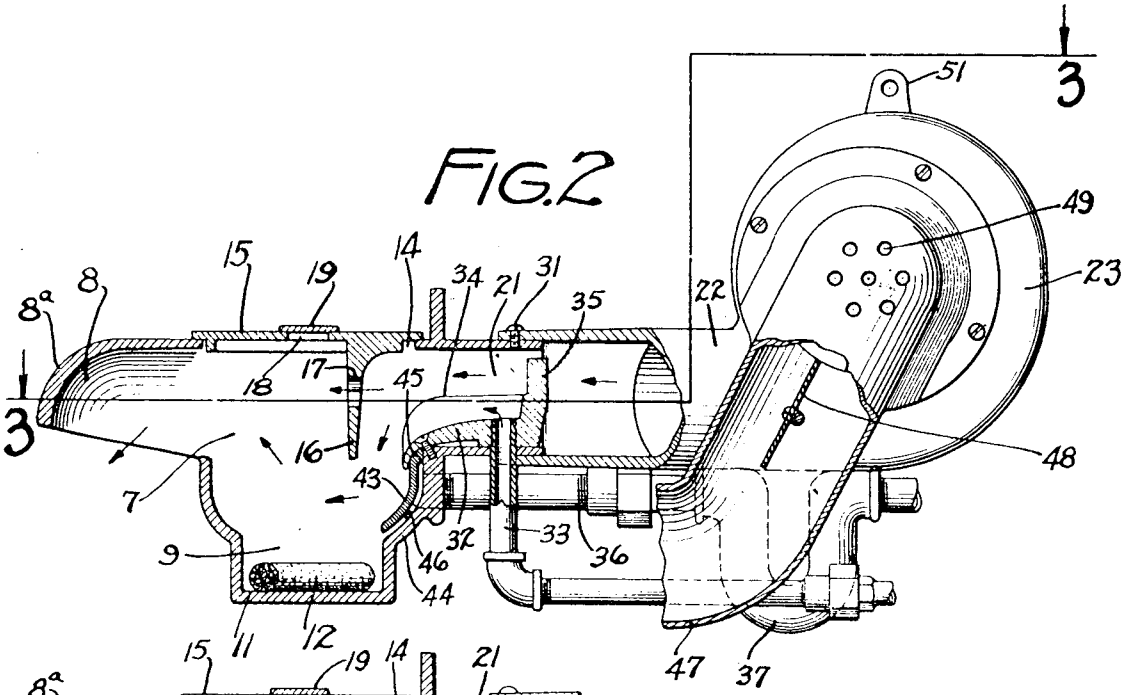


FIG. 2

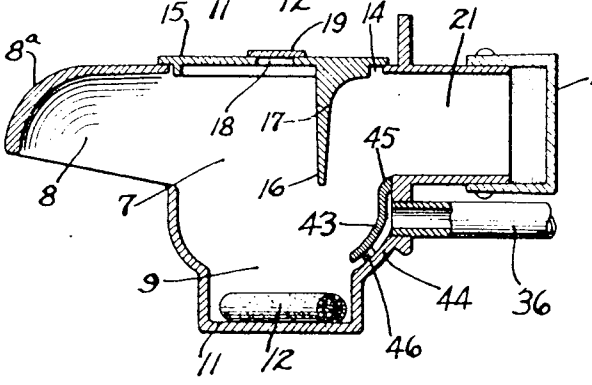


FIG. 4

Inventor
CHARLES M. STROUD
By Parker, Paul & Woodward
ATTORNEYS

Feb. 21, 1928.

1,660,106

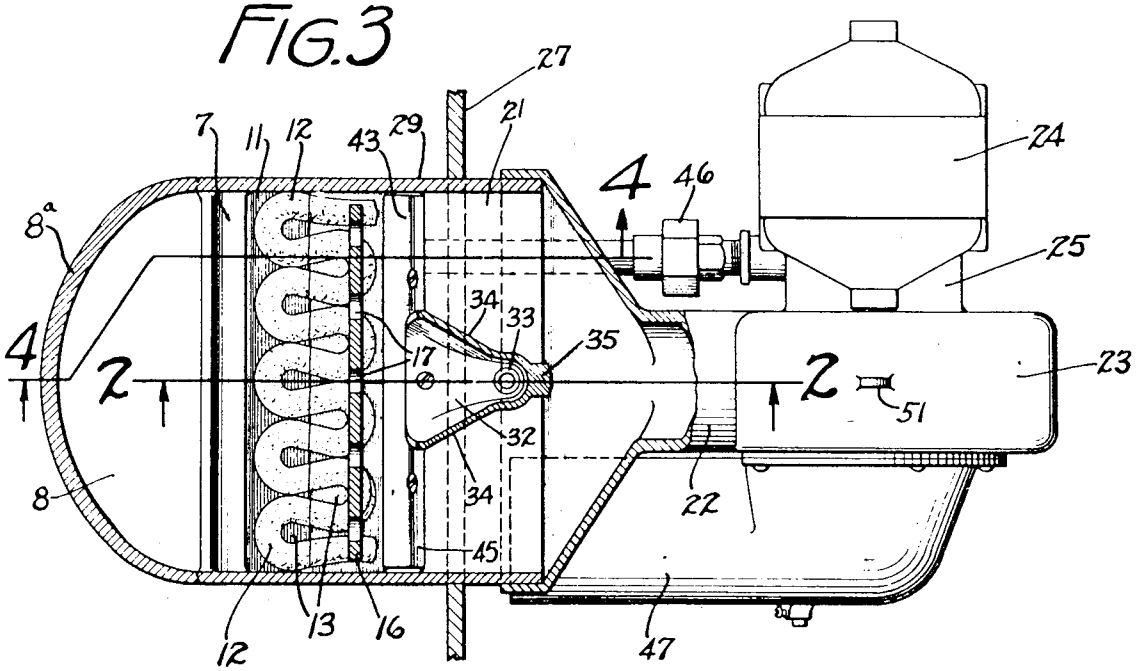
C. M. STROUD

LIQUID FUEL BURNER

Filed April 5, 1926

2 Sheets-Sheet 2

FIG.3



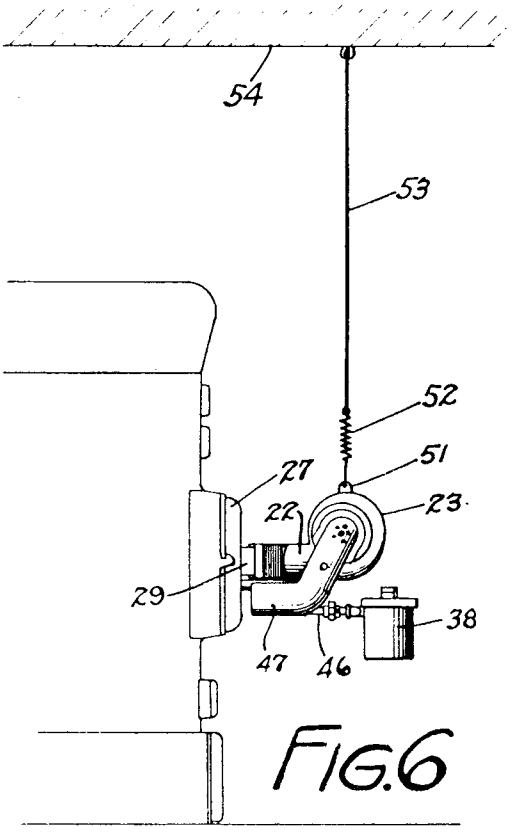
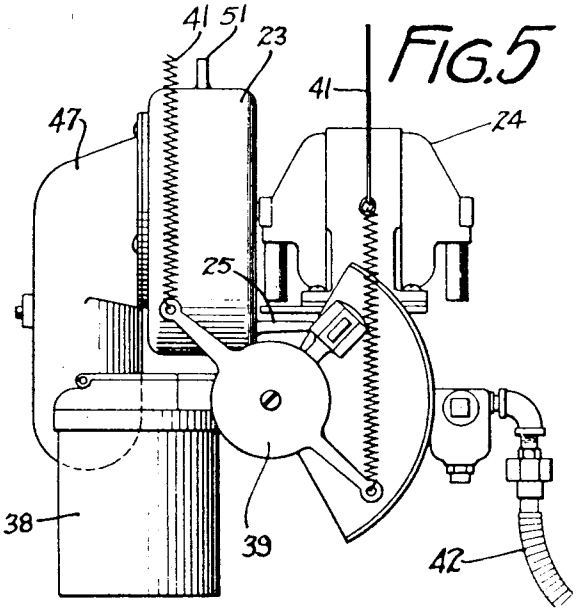


FIG.6

FIG.5



Inventor
CHARLES M. STROUD
By Paul, Paul & Moore
ATTORNEYS

Patented Feb. 21, 1928. 1,660,106

UNITED STATES PATENT OFFICE.

CHARLES M. STROUD, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR OF ONE-HALF TO LESLIE H. FAWKES, OF MINNEAPOLIS, MINNESOTA.

LIQUID-FUEL BURNER.

Application filed April 5, 1926. Serial No. 99,956.

This invention relates to improvements in liquid fuel burners, and is an improvement over the form of burner shown in my pending application, Serial #45,302, filed July 22, 1925.

An object of the invention is to provide a liquid fuel burner comprising a vaporizing chamber having an air expansion chamber communicating therewith which has a connection with a source of air supply under pressure; and means being provided within the expansion chamber to direct a portion of the air outwardly against the vertical walls of the expansion and vaporizing chambers to prevent the formation of carbon deposits thereon, and to insure more uniform distribution of the air therein.

A further object of the invention is to provide a burner having a fuel discharge spout mounted in the expansion chamber and having its discharge end flared outwardly to provide a relatively large surface over which the liquid fuel oil delivered thereto will flow in a comparatively thin sheet or film, thereby causing the fuel to become partially vaporized before reaching the vaporizing chamber, caused by the heated condition of the discharge spout when the burner is functioning.

A further object is to provide such a burner having the intake end of the air supply pipe positioned adjacent the furnace door, whereby the air will be preheated before being delivered to the expansion chamber, and means also being provided for regulating the flow of air to the burner.

A further object is to provide a liquid fuel-burning apparatus which can be assembled and mounted upon a furnace door as a unit, to swing therewith, and such apparatus including the fuel vaporizing and air mixing means, the necessary valve mechanism to control the operation of the burner, and the motive power for supplying air thereto under pressure.

A further object is to provide an oil burner of the above mentioned type having means at its outer end for connecting it with a fixed supporting means whereby, when the furnace door is opened, a portion of the weight of the burner will be carried by such supporting means, thereby relieving the furnace door of unnecessary strains.

Other objects of the invention will appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings, there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown, as various changes may be made within the scope of the claims which follow.

In the accompanying drawings forming part of this specification,

Figure 1 is a side elevation of the improved burner mounted in a furnace door;

Figure 2 is a detail sectional view on the line 2—2 of Figure 3;

Figure 3 is a sectional plan view on the line 3—3 of Figure 2;

Figure 4 is a detail sectional view on the line 4—4 of Figure 3;

Figure 5 is a front view of the burner unit; and

Figure 6 is a diagrammatic view illustrating the means supporting the outer portion of the burner to relieve the furnace door of unnecessary strains.

The novel burner featured in this invention is similar to the one shown in the above mentioned application, and comprises a vaporizing chamber 7 having an outlet or nozzle 8 adapted to direct the ignited fuel mixture downwardly into the combustion chamber 9 of the furnace 10, as shown in Figures 1 and 2. One vertical wall of this chamber 7 is formed by a depending baffle plate, transversely dividing the burner casing into said vaporizing chamber and into an air expansion and mixing chamber 21 later to be more fully described. The baffle may be considered as forming one wall of each chamber. The discharge nozzle or snout 8 is preferably substantially semi-circular in form as shown in Figure 3, and its top wall 8^a is curved as shown, so that when the ignited fuel mixture is discharged from the vaporizing chamber all unvaporized particles of fuel oil will impinge against this wall and will instantly become vaporized as a result of the wall being heated to an exceedingly high temperature when the burner is functioning. The vaporizing chamber is preferably rectangular in form as shown. The shape of the outlet or flame orifice, and its disposition transversely entirely across the casing, acts to provide a continuous sheet of flame, over the whole area of dis-

charge. It will also be noted by reference to the drawings that the outer edge of the flame outlet is disposed slightly above the upper edge of the outer wall of the casing. The curv-configuration of the top wall 8a also prevents carbon deposit.

The lower portion 9 of the vaporizing chamber is relatively smaller than the main or central portion of the chamber, and is provided with a flat bottom 11 upon which an asbestos wicking 12 is disposed as shown in Figure 2. This wicking is preferably rope-like in form and is placed in the bottom of the vaporizing chamber in the manner shown in Figure 3, to provide a series of openings 13 between the coils thereof, thereby exposing a considerable area of the inner surface of the bottom 11, which, in actual practice, has been found to render the burner more efficient as a result of the added effective vaporizing surface of the vaporizing chamber.

An opening 14 is provided in the upper wall of the vaporizing chamber 7 and has a cover plate 15 mounted therein to provide a closure therefor. A baffle plate 16 having a series of spaced openings 17 therein, is secured to the cover plate 15 and depends to form one wall of chambers 7 and 21, as shown in Figure 2. This baffle plate extends substantially from end to end of the vaporizing chamber as shown in Figure 3, so as to direct the air and fuel downwardly into the bottom of the vaporizing chamber. The baffle plate 16 is also preferably offset longitudinally of the vaporizing chamber as shown in Figure 2 to provide a greater area on the furnace side of the baffle plate, whereby the admixture of air and fuel oil will be thorough and complete before being discharged into the combustion chamber of the furnace. A small peep-hole 18, having a closure 19, is provided in the cover plate 15 through which the functioning of the burner may be observed.

A feature of this invention resides in the provision of an air expansion chamber 21 provided at the air-receiving side of the vaporizing chamber, as shown in Figures 2 and 3. Chambers 7 and 21, as before stated, are formed by transversely dividing the casing 29 by the depending baffle 16, the arrangement being such that the chambers intercommunicate beneath the baffle. This expansion chamber is preferably of a length equal to that of the vaporizing chamber as shown in Figure 3, and has a connection with an air supply pipe 22 connecting it with a blower 23 operatively connected to a small motor 24 mounted upon a bracket 25 secured to the blower casing. (See Figures 3 and 5.) The walls defining the expansion chamber 21, are preferably arranged in rectangular formation, and are adapted to be inserted through an opening 26 provided in the furnace door 27 as shown in Figure 1. A flange 28 is provided upon the upper wall of the expansion chamber to provide means for securing the casing 29 to the furnace door. The discharge end of the air pipe 22 is flared outwardly as shown in Figure 3, and is adapted to receive the end of the casing 29 which is suitably secured thereto by such means as screws 31. (See Figures 2 and 3.)

Another feature of the invention resides in the means provided within the expansion chamber 21 for deflecting the air currents outwardly towards or against the end walls of the expansion chamber and vaporizing chamber. Such means preferably consists of a triangularly shaped discharge spout 32 having a connection with a fuel feed pipe 33, shown in Figure 2. The side walls 34 of the spout 32 are divergingly arranged as shown in Figure 3 and extend upwardly substantially to the median line of the expansion chamber. These diverging walls 34 are arranged in the path of the inrushing air currents and function to direct a portion of the air outwardly against the side walls of the expansion chamber as above stated. A vertical post or spreader 35 is provided upon the spout 32 and extends upwardly substantially to the upper wall of the expansion chamber as shown in Figure 2. This post functions to divide the air currents, thereby causing the air to impinge against the entire length of the baffle plate 16 with almost uniform pressure. The baffle post 53, as well as the spout 32, form eddies, which act to spread and mix. The delivery end of the oil tube is adjacent the baffle post, whereby a portion of the oil is picked up and spread in sheet form as it travels toward the lip or discharge end of the spout. Moreover, as a result of having the intake end of the air pipe flared, the air reaches the vertical sides of the casing by spreading, and deposit of carbon is prevented.

The bottom of the spout 32 is preferably curved as shown in Figure 2, and as a result of the walls 34 thereof being flared outwardly as shown in Figure 1, the fuel oil discharged into the spout 32 from the pipe 33 will flow over the expanded surface thereof in a thin film, and will thereby become partially vaporized before being discharged into the vaporizing chamber 7 as a result of the heated condition of the discharge spout when the burner is functioning. An overflow pipe 36, having a trap 37 therein, connects the vaporizing chamber 7 with a drip bucket 38 operatively connected with an automatically operable safety shutoff valve mechanism adjacent the drip bucket 38, as shown in Figures 1 and 5. The feed pipe 33 has its other end connected with a valve mechanism 39 having flexible connections 41 connecting it with a suitable control device (not shown). The valve mechanism 39 has a con-

nection with a source of fuel supply through a flexible pipe connection 42, shown in Figure 5.

A guard plate, shown in Figures 2, 3 and 4, is demountably secured to the upper portion of the curved wall 44 of the vaporizing chamber 7 as shown in Figure 4. The upper marginal edge 45 of this plate is slightly offset and adapted to engage the wall 44 to space the guard plate therefrom as shown. Lugs or bosses 46 are provided upon the back face of the plate 43 adapted to engage the wall 44 so as to retain the plate 43 in spaced relation thereto. This guard plate 43, as will be noted by reference to Figure 4, covers the receiving end of the discharge pipe 36 and thus prevents the air currents or flame as well as carbon deposit, from entering the pipe. In case of ignition failure, the unburned fuel oil will accumulate in the bottom of the vaporizing chamber, and, as it rises therein, will enter the space between the guard plate 43 and the wall 44 until it flows into the pipe 36 and into the drip bucket 38, thereby causing the safety valve mechanism to function to automatically interrupt the supply of fuel oil to the burner.

A feature of the invention also resides in the arrangement of the air intake means to the blower casing 23. As shown in Figure 1, an air intake pipe 47 has its upper end flanged whereby it may be secured to the housing of the blower 23 as shown in Figures 1, 2 and 3. This intake pipe preferably extends downwardly from the blower housing and then inwardly towards the furnace door on a line practically below the level of the air supply pipe 22 conducting the air from the blower to the expansion chamber 21. The intake end of the pipe 47 is positioned adjacent the furnace door 27, and is spaced therefrom a distance sufficient to provide ample clearance for the circulation of air into the pipe 47 and into the blower as indicated by the arrow in Figure 1. By thus positioning the receiving end of the intake pipe 47 adjacent the heated furnace door 27, the supply of air to the burner will be preheated before being delivered to the expansion chamber, thereby increasing the efficiency of the burner. A butterfly valve 48 is preferably interposed in the inclined portion of the intake pipe 47 to regulate the flow of air therethrough. A series of apertures 49 are provided in the upper portion of the intake pipe 47 through which additional air may be drawn into the blower from the atmosphere. The wick chamber provides vertical walls, as shoulders, to prevent displacement, or "riding out" of the wick, the submerged pocket being provided for this reason. The guard 43 positively prevents carbon from reaching the overflow pipe 36, but is spaced to permit an unobstructed overflow of the oil.

The openings 49 are provided to prevent rattling of the device as a whole when the damper is entirely closed, and the openings are preferably made small to prevent accidental introduction of the fingers.

It will be noted that the baffle plate 16 does not extend entirely across the casing, see Figure 3, and that the same is perforated. This arrangement has been found to prevent the formation of eddies at the forward side of the baffle, and thus to prevent carbon deposit both upon the baffle and upon the top of the casing in the combustion chamber.

Means are also provided for supporting the outer end of the burner unit to relieve the furnace door of unnecessary strains. Such means preferably consists of providing an eye 51 upon the upper portion of the blower casing 23, and securing thereto one end of a spring 52 having its other end connected by means of a flexible connection 53 to a fixed supporting member such as the usual joists or ceiling 54 of the building. (See Figure 6.) By thus supporting the outer portion of the burner unit, the furnace door 27 may be opened and closed without being subjected to unnecessary strains as a result of the burner being mounted thereon.

I claim as my invention:

1. The combination with a furnace having a swinging door, of a liquid fuel-burning apparatus adapted to be mounted in said furnace door as a unit, to swing therewith, said fuel-burning apparatus comprising a vaporizing chamber, an expansion chamber, means for delivering liquid fuel to said chambers, a blower and motor for supplying air to the burner, a valve mechanism for controlling the operation of the apparatus, and a flexible and yieldable supporting means connecting the projecting portion of said burner unit with a fixed member for supporting a portion of the weight of said burner when the furnace door is opened, thereby relieving said door of unnecessary strains.

2. A device of the class described having, a casing having a depending baffle plate transversely dividing the same into, a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe having its delivery end flared inwardly and divergent toward the vertical side walls of the casing for spreading the air laterally toward and along the side walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof, and extending entirely across the chamber, and means for delivering oil vertically to the air expansion and mixing chamber substantially centrally of the flared portion of the air intake pipe.

3. A device of the class described having

a casing having a depending baffle plate transversely dividing the same into, a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe having its delivery end flared inwardly and divergent toward the vertical side walls of the casing for spreading the air laterally toward and along the side walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof, and extending entirely across the chamber, and means for delivering oil vertically upwardly to the air expansion and mixing chamber.

4. A device of the class described having a casing having a depending baffle plate transversely dividing the same into a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe having its delivery end flared inwardly and divergent toward the vertical side walls of the casing for spreading the air laterally toward and along the side walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof, and extending entirely across the chamber, and means for delivering oil vertically upwardly to the air expansion and mixing chamber substantially centrally thereof, and adjacent its bottom wall.

5. A device of the class described having a casing having a depending perforated baffle plate transversely dividing the same into a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe having its delivery end flared inwardly and divergent toward the vertical side walls of the casing for spreading the air laterally toward and along the side walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof, and extending entirely across the chamber, and means for delivering oil vertically to the air expansion and mixing chamber substantially centrally thereof.

6. A device of the class described having a casing having a depending baffle plate transversely dividing the same into a vaporizing and flame discharge chamber and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe having its delivery end flared inwardly and divergent toward the vertical side walls of the casing for spreading the air laterally toward and along the side walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof, and extending entirely across the chamber, and means for delivering oil to the air expansion and mixing chamber, said means comprising a receptacle arranged within the mixing chamber, and an oil pipe arranged to flow oil upon the receptacle.

7. A device of the class described having a casing having a depending baffle plate transversely dividing the same into a vaporizing and flame discharge chamber and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe having its delivery end flared inwardly and divergent toward the vertical side walls of the casing for spreading the air laterally toward and along the side walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof, and extending entirely across the chamber, and means for delivering oil to the air expansion and mixing chamber, said means comprising a receptacle arranged within the mixing chamber, and an oil pipe arranged to flow oil upon the receptacle, said receptacle constructed and arranged to spread the oil laterally, and toward the baffle.

8. A device of the class described having a casing having a depending baffle plate transversely dividing the same into a vaporizing and flame discharge chamber and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe having its delivery end flared inwardly and divergent toward the vertical side walls of the casing for spreading the air laterally toward and along the side walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof, and extending entirely across the chamber, and means for delivering oil to the air expansion and mixing chamber, said means comprising a receptacle arranged within the mixing chamber, and an oil pipe leading upwardly through the casing and arranged to flow oil upon the receptacle, said receptacle arranged and constructed to spread the oil laterally across the baffle and to direct the oil downwardly at a point adjacent the baffle.

9. In a device of the class described in combination a furnace having, a door, a casing traversing the door horizontally and having an end projecting through the door, a depending baffle plate transversely dividing the casing into a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe connected with the outwardly projecting portion of the mixing chamber, said pipe having a delivery terminal divergent toward and connected to the side walls of the casing, for spreading the air laterally toward and along said

walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof and extending entirely across the chamber transversely, means for delivering oil to the air expansion chamber, a blower including a casing having a delivery connection with the air pipe, and an oil reservoir having its delivery side connected with the oil delivery means, and having a return pipe communicating interiorly of the casing at a point below the mixing chamber.

10. In a device of the class described in combination a furnace having a door, a casing traversing the door horizontally and having an end projecting through the door, a depending baffle plate transversely dividing the casing into a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe connected with the outwardly projecting portion of the mixing chamber said pipe having a delivery end divergent toward and connected to the side walls of the casing for spreading the air laterally toward and along said walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof and extending entirely across the chamber transversely, means for delivering oil vertically to the air expansion chamber, a blower connected for delivering through the air pipe, and an oil reservoir having its delivery side connected with the oil delivery means, and having a return pipe communicating interiorly of the casing at a point below the mixing chamber, and baffle.

11. In a device of the class described, in combination, a furnace having a door a casing traversing the door horizontally and having an end projecting through the door, a depending baffle plate transversely dividing the casing into a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe connected with the outwardly projecting portion of the mixing chamber said pipe having a delivery end divergent toward and connected to the side walls of the casing for spreading the air laterally toward and along said walls, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly and leading from the end thereof and extending entirely across the chamber transversely, means for delivering oil vertically to the air expansion chamber substantially centrally thereof, a blower connected for delivering through the air pipe, and an oil reservoir having its delivery side connected with the oil delivery means, and having a return pipe communicating interiorly of the casing at a point below the mixing chamber, and baffle, the reservoir and blower being supported upon the door.

12. A liquid fuel burner comprising a horizontally elongated casing having a depending baffle arranged transversely thereof and dividing the casing into a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, the lower edge of the baffle being spaced upwardly from the bottom of the casing, a horizontal air intake pipe having its delivery end divergent toward the vertical side walls of the casing, a feed pipe delivering upwardly into the expansion chamber substantially at the transverse middle thereof and immediately adjacent the delivery end of the air intake pipe, a shallow receptacle within and upon which the oil is flowed and through which said feed pipe extends, said receptacle having raised sides flared to direct a portion of the oil current laterally toward the vertical side walls of the expansion chamber to spread the same across the baffle, and further having a vertical post substantially in its apex, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly.

13. A liquid fuel burner comprising a horizontally elongated casing having a depending baffle transversely thereof dividing the casing into a vaporizing and discharge chamber, and an air expansion mixing chamber, intercommunicating beneath the baffle, the lower and side edges of the baffle being spaced from the corresponding walls of the casing, an air intake having a delivery end divergent toward and connected to the vertical side walls of the casing for spreading the air outwardly and directing it along the vertical side walls of the casing, a feed pipe delivering upwardly into the expansion chamber substantially at the transverse middle thereof, an open top receptacle arranged to receive the oil to flow it in direction of the baffle, said receptacle shaped to allow and direct a lateral spread of the oil generally in a direction toward the vertical side walls of the expansion chamber, and across the baffle, said vaporizing chamber having a transversely and vertically curved discharge spout directed downwardly.

14. A device of the class described having a casing having a depending baffle plate transversely dividing the same into, a vaporizing and discharge chamber, and an air expansion and mixing chamber, inter-communicating beneath the baffle, an air intake pipe having its delivery end flared inwardly and divergent toward the vertical side walls of the casing for spreading the air laterally toward and along the side walls, said vaporizing chamber having a transversely and vertically curved discharge

spout directed downwardly and leading from the end thereof, and extending entirely across the chamber, means for delivering oil within the air expansion and mixing chamber.

15. A furnace having a door, a liquid fuel burner including a casing traversing the door, a blower supported by the casing and including a fan, said blower having its delivery end connecting to deliver within the casing, and further having an intake conduit with its intake end positioned adjacent the furnace, said intake conduit having a damper and having openings between the damper and the fan.

16. A furnace having a horizontally swingable door, a liquid fuel burner apparatus supported on the door to deliver within the furnace, and arranged to permit the door to be swung open, and a suspending element connecting by opposite ends respectively with the apparatus at the outer side of the door and with a fixed support above the apparatus, a portion of the suspending element being yieldable in a lengthwise direction.

In witness whereof, I have hereunto set my hand this 26th day of March 1926.

CHARLES M. STROUD.