Nov. 10, 1931. W. W. WILLIAMS 1,831,277

FLUID FUEL BURNER CONSTRUCTION

Filed March 13, 1930 2 Sheets-Sheet 1

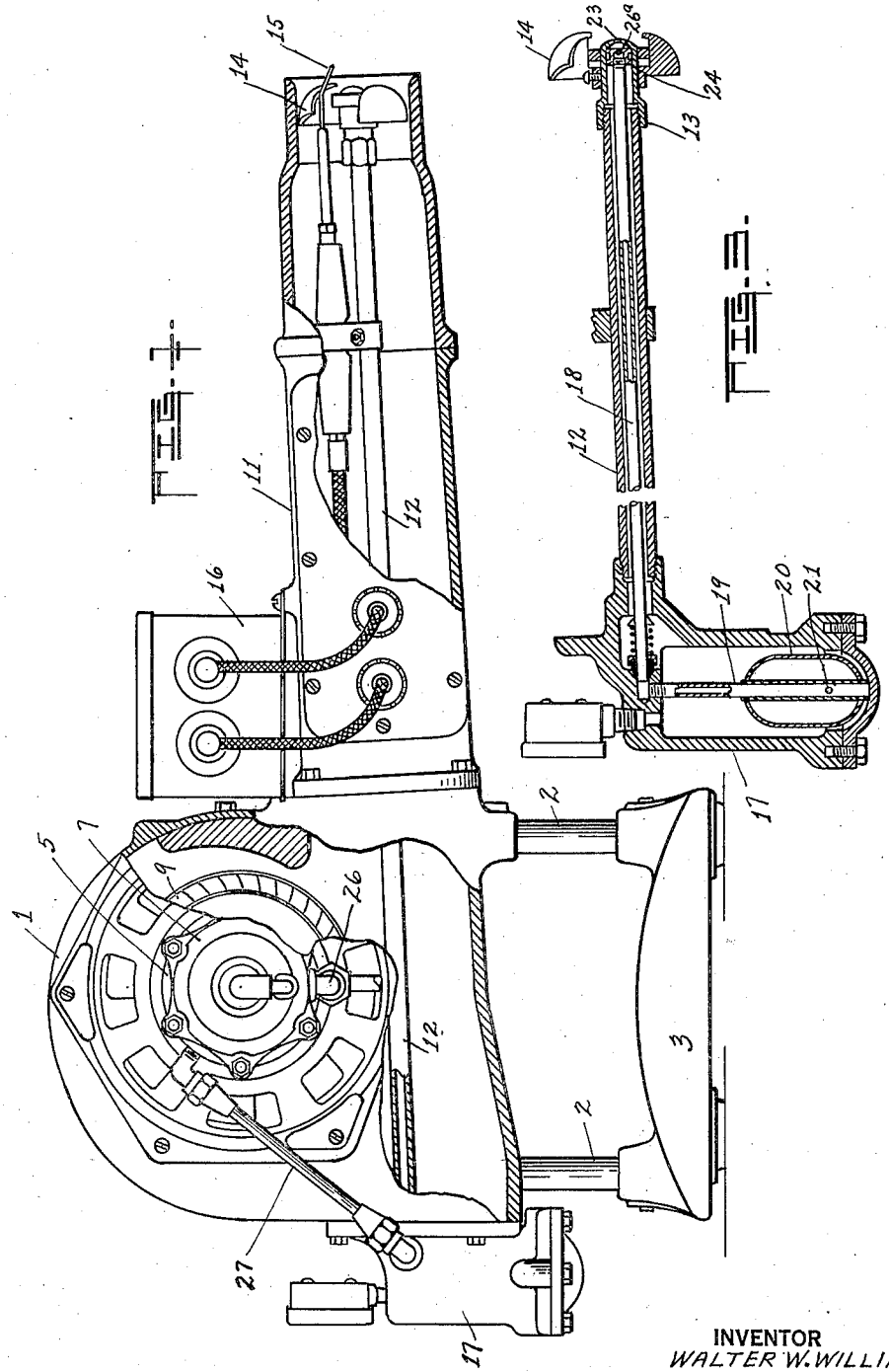


FIG. 1.

FIG. 3.

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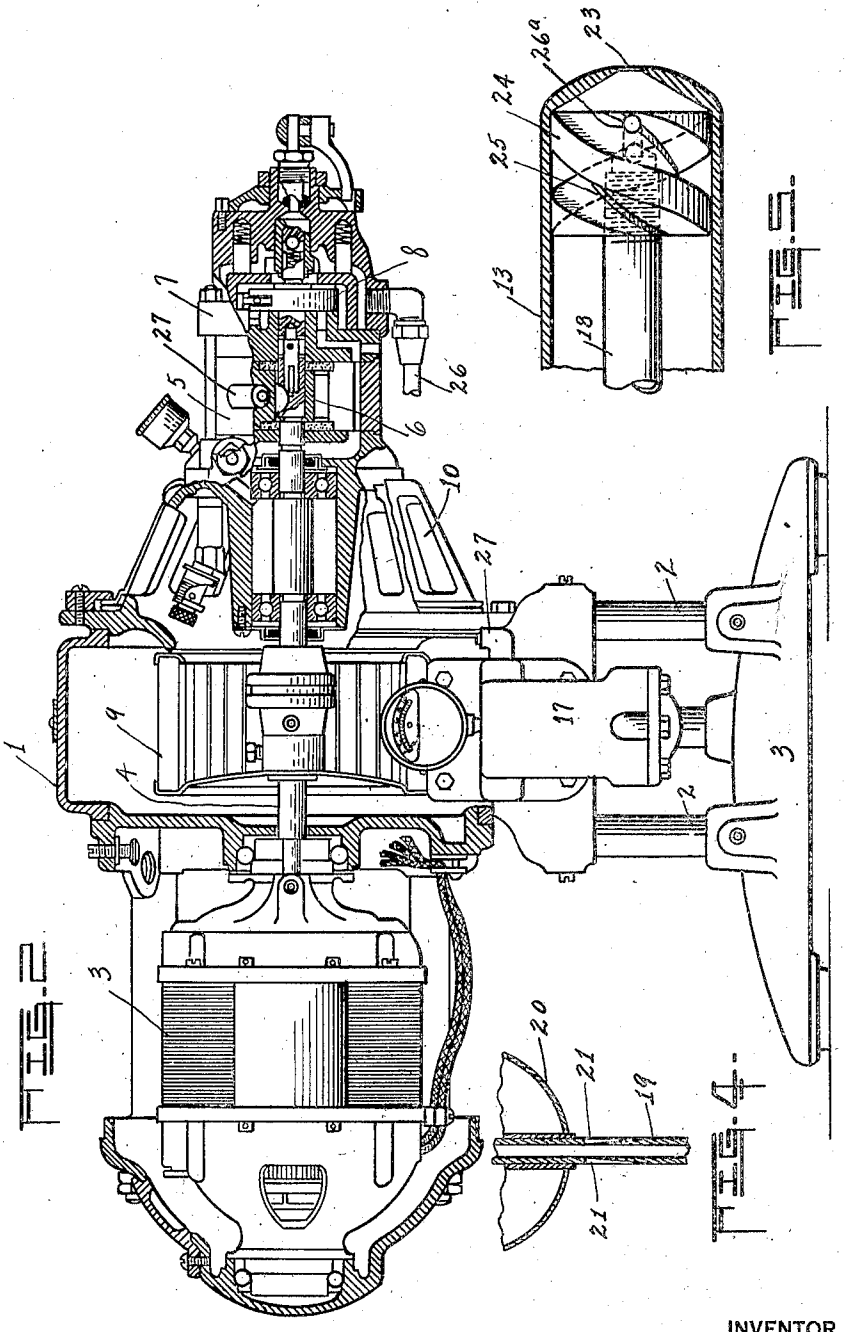


FIG. 2

FIG. 5

FIG. 4

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Patented Nov. 10, 1931 1,831,277

UNITED STATES PATENT OFFICE

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FLUID FUEL BURNER CONSTRUCTION

Application filed March 13, 1930. Serial No. 435,424.

This invention relates to improvements in fluid fuel burner construction and more particularly to the provision of a particular construction for delivering the fluid fuel to the nozzle of the burner.

It is an object of this invention to provide a uniform flow of liquid fuel regardless of the character of the fuel and particularly the heavier type, such as is commercially known as fuel oil, to a nozzle and discharging the heavy oil in a finely divided state through the nozzle opening into a combustion chamber where it is ignited and burned. To deliver a liquid in a finely divided state into the surrounding atmosphere is called atomization. One of the recognized means for producing atomization is to force a liquid under pressure through a small opening from which the liquid emerges in a finely divided state or spray. It is an object of this invention to provide means for atomizing or spraying the heavy fuel oil through a much larger opening than is ordinarily required to atomize or spray such a fluid and to deliver only such a quantity of the fuel as is required in a domestic fluid fuel or oil burner. A domestic fluid fuel or oil burner should produce only the amount of heat required for operating the heating system and an excess of heat will not only be injurious to the furnace but will be an unnecessary waste of the fuel. If a heavy fluid fuel, such as commercial fuel oil, be forced under pressure through a nozzle having a discharge opening small enough to permit the passage of only sufficient fuel to produce the heat necessary to safely operate the heating system, such a small opening will easily become clogged and render the burner inoperative. If a much larger discharge opening was provided in the nozzle and sufficient pressure was placed upon the fuel oil passing therethrough to atomize or spray it, the amount of fuel would be far greater than that required and if ignited would produce a temperature that would be dangerous to the ordinary furnace.

With these objects in view, reference is made to the accompanying sheets of drawings which illustrate a preferred embodiment of this invention, with the understanding that minor detail changes may be made therein without departing from the scope thereof.

Figure 1 is a view in side elevation of a preferred embodiment of this invention with the parts broken away and partly in section.

Figure 2 is a view in rear elevation of Figure 1 with parts broken away and partly in section.

Figure 3 is an enlarged detail view in longitudinal vertical section of a fluid fuel delivery means constructed in accordance with this invention and illustrated as applied in Figures 1 and 2.

Figure 4 is an enlarged detail view illustrating the construction of the fluid controlled fluid fuel port.

Figure 5 is an enlarged detail view partly in cross section and partly in side elevation illustrating the discharge nozzle and the arrangement of parts therein.

While Figures 1 and 2 illustrate the application of this invention to a commercial domestic liquid fuel or oil burner, it is to be understood that it may be applied to other types of oil burners for domestic and industrial purposes as well.

Figures 1 and 2 illustrate a housing 1, mounted upon supports 2, on a base 3. The housing mounts on one side a suitably supported electric motor 3 having a driven shaft 4 passing through the center of the housing 1 and extending there beyond on the opposite side. This opposite side of the housing supports a rotating air compressor 5, the rotor 6 of which is mounted upon the motor driven shaft 4, and on the exterior of the air compressor is mounted a fluid fuel metering pump 7, the rotor 8 of which is also mounted upon the shaft 4 driven by the motor. This air compressor and fluid fuel metering pump are constructed in accordance with the disclosure in this applicant's prior co-pending application Serial No. 284,545, filed June 11, 1928, and as they form no particular part of this invention it is thought that only a brief reference to these parts is necessary to the understanding of this invention. A fan blower 9 is mounted upon the motor driven shaft 4 within the central housing 1, which draws air in through openings 10 provided

on the side of the housing supporting the air and fuel pumps and delivering this air under slight pressure through a draft pipe 11 extending at right angles to the motor shaft 4 from the casing 1, the exterior end of which is adapted to enter within the combustion chamber of the furnace or heater to which the fluid fuel burner is attached.

The fluid fuel is delivered through a pipe 12 passing centrally through the draft pipe 11, terminating in a nozzle 13 adjacent the combustion chamber end of the draft pipe, which nozzle supports an air spiral 14 at this end, which construction is also illustrated in said prior co-pending application of this applicant. The electric motor is adapted to be connected to the commercial electric lighting system of the building and is provided with the usual controls which do not form any part of this invention. The fuel discharged from the nozzle in the form of a spray mixing with the air delivered from the open end of the draft pipe 11 is preferably ignited by an electric spark jumping across between two electrodes 15, preferably connected with a transformer 16, and as this general type of ignition is illustrated in the said prior co-pending application of this applicant and as it forms no part of this invention it is not thought that a more detailed description is necessary to the understanding of this device.

The pipe 12 extends through the casing 1 under the fan 9 and communicates with a float chamber 17, secured on the outer rear end of the casing 1. A fuel discharge pipe 18 of less exterior diameter than the inner diameter of the pipe 12 is mounted centrally therein and is connected at one end to a vertically arranged pipe 19, of preferably the same diameter, extending centrally of the float chamber 17 to the bottom thereof at which end it is closed. A float 20 is mounted to slide vertically upon the fuel discharge pipe 19 within the float chamber 17. This portion 19 of the fluid discharge pipe adjacent its lower closed end is provided with one or more inlet ports 21, the float 20 is arranged to snugly embrace the pipe 19 and its movement up and down acts to cover and uncover the inlet ports and forms, in effect, a valve.

The nozzle 13 is preferably secured to the outer end of the pipe 12, as shown in Figure 3. The nozzle is provided with a discharge opening 23 arranged concentric with the pipe 12 and is of greater diameter than would ordinarily be required to produce a spray of heavy liquid fuel, such as fuel oil. The fuel discharge pipe 18 terminates within the nozzle 13 and mounts a spiral 24 having a recess therein of the same diameter as the pipe 18. This spiral 24, as shown in Figures 3 and 5, comprises a cylindrical member snugly fitting and supported within the nozzle 13 adjacent the discharge opening 23 and is provided with two helical grooves 25 forming a means of communication from the space between the pipes 13 and 18, on one side, to the space between the end of the spiral and end of the nozzle, on the other side. The recess within the spiral 24 communicating with the pipe 18 is preferably provided with oppositely disposed radial passageways 26 connecting the interior of the recess with the bottom of each groove of the spiral 24 adjacent the opening of these grooves into the space leading to the discharge opening 23 of the nozzle. It is preferable that the sum of areas of the two helical grooves be slightly less than the area of the discharge opening 23.

In the present embodiment of this invention, as illustrated in connection with this particular type of commercial oil burner, the fluid fuel is conducted from a source, not shown, through a pipe 26 to the intake side of the metering pump 7 by which a predetermined uniform amount of fluid fuel is constantly delivered into the rotary air compressor 5 and from thence through a pipe 27 it is delivered, together with air under pressure, to the upper side of the float chamber 17. It is not necessary to this invention that the air under pressure and fluid fuel be delivered in the manner just specified. Since a rotary air compressor of the type illustrated requires lubrication it has been found that not only is the arrangement of the metering pump and compressor, as shown with the rotors of each mounted upon the shaft 4 driven by the motor 3, a convenient manner of assembly for production but it also provides lubrication for the air compressor as well. As far as this invention is concerned a metering pump for the fluid fuel and a compressor for the air could be mounted independently of each other and driven by separate independent means as long as the fluid fuel and the air under compression are both delivered to the interior of the float chamber 17, being delivered through the same or separate passageways.

In the manner shown upon the drawings, the fluid fuel and air under pressure are together delivered by the pipe 27 through the upper casing of the float chamber 17. A separation immediately takes place, the fluid fuel collecting at the bottom of the chamber while the air under pressure passes out through the space between the pipe 12 and the fuel discharge pipe 18 and thence through the helical grooves and spiral 24 and discharge opening 23 of the nozzle 13, the area of the spiral groove being less than the area of the discharge opening of the nozzle, a pressure is created above the surface of the fluid fuel within the float chamber 17. As the fluid fuel collects in the bottom of the float chamber, the float is caused to rise and uncover the ports 21 in the pipe 19.

As shown in Figure 4, the inlet ports 21 are preferably two in number arranged diametrically opposite each other in the pipe 19

and the body of the pipe on the under side of each port is tapered downwardly, as shown in this figure. The ports 21 are arranged so that the bottom of the float will completely uncover the ports when sufficient fluid fuel is being delivered into the float chamber to produce the maximum flame for the burner, and to uncover the lowermost passageway formed by the tapered sections of the pipe when sufficient fluid fuel is being delivered into the float chamber to produce the minimum flame for the burner, whereby as the float ascends it will gradually uncover the ports 21 and allow the internal pressure within the float chamber 17, to pass the fluid fuel through the ports into the pipe 19. The fluid fuel passing through the inlet ports 21 passes through the pipes 19 and 18 to the recess within the spiral 24 and thence through the radial passageways 26[a] leading to the bottoms of the grooves 25 adjacent the forward end of the spiral. The air under pressure rushing through the spiral grooves picks up the particles of the fluid fuel and carries them through the discharge opening 23 of the nozzle in a whirling spray to mix with the air issuing from the draft pipe to form a combustible mixture to be ignited by the electrodes 15 within the combustion chamber of the furnace. Inasmuch as it is a recognized custom in oil burners of the type illustrated to introduce the discharge end within the combustion chamber of the furnace it is not thought necessary to illustrate this feature to understand the present invention.

When the motor or driving means for the fluid fuel and air pumps cease operation the pressure within the float chamber 17 equalizes with the pressure about the end of the nozzle and the fluid fuel remaining in the pipes 18 and 19 will drain back into the bottom of the float chamber 17. The drawings illustrate the fuel pipe 12 mounting the nozzle slightly above the float chamber 17.

As heretofore stated, this device is primarly constructed to provide a uniform flow of fluid fuel to the burner nozzle regardless of the character of the fluid fuel. While a needle valve in the fluid fuel supply pipe would answer to control the amount of fluid fuel admitted into the float chamber it would require constant adjustment to compensate for change in viscosity of the fuel as well as change in the temperature of the fuel and it is therefore preferable to employ the metering pump illustrated. The particular type of metering pump preferable is disclosed in this applicant's prior Patent 1,451,789 of April 17, 1923, and when a metering pump of this character is adjusted to deliver a predetermined amount of fluid fuel it will continue to deliver a constant volume of the fluid fuel regardless of the quality of said fuel. It is therefore preferable that the metering pump be employed to deliver a constant quantity of the fluid fuel to the float chamber. The float 20 which is mounted to cover and uncover the tapered inlet ports 21 may be said to be a metering valve to insure a constant discharge of the fluid fuel from the float chamber to the nozzle.

In fluid fuel burners the volume of the flame depends upon the amount of fluid fuel discharged from the burner nozzle and various conditions require various size flames, depending upon the heating plant, the character of the furnace, etc. The metering pump is therefore adjusted in accordance with the volume of the flame desired and will deliver the amount of fuel to the float chamber 17. As the fuel is discharged into the float chamber, the float will rise and gradually uncover the ports 21. If the volume of the flame desired is less than the maximum for which the device is constructed the float will only partially uncover discharge ports 21 so that the pressure above the liquid level in the float chamber will cause a constant flow of the liquid through the ports 21 and thence through pipes 19 and 18 to the passageways 26[a] in the spiral to the nozzle regardless of the character of the fluid fuel. It is to be noted that the float automatically adjusts itself to compensate for any adjustments in the metering pump and it at all times insures a constant flow of the liquid fuel through the burner nozzle. In the construction shown, as heretofore said, upon the cessation of the operation of the metering and air pumps the fluid fuel will drain out of the nozzle through pipes 18 and 19 into the bottom of the float chamber. As it takes a certain amount of time after the pumps have ceased operating for the pressure within the float chamber to equalize with the pressure exterior of the nozzle whatever fluid fuel may be entrapped or fail to have drained from the passageways 26[a] in the spiral will be blown out, so that it may be said upon cessation of operation of the burner, the burner nozzle is blown dry.

A fluid fuel burner to operate efficiently should produce a heat of constant intensity, which is a very difficult matter in view of the fact that commercial fluid fuels vary in character. This applicant by the means above described has insured a constant flow of fluid fuel to the burner nozzle and hence a constant flame to the furnace irrespective of the character of the commercial liquid fuel employed.

What I claim is:

1. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a predetermined constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under a predetermined pressure to the chamber, means for conducting the fluid fuel

from the chamber under the air pressure to the burner nozzle, means including a float within the chamber for insuring a constant flow of fluid through said conductor, and means for conducting the air from the chamber and delivering it to contact and atomize the fuel delivered at the nozzle.

2. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a predetermined constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under a predetermined pressure to the chamber, a fluid discharge pipe from the chamber to the nozzle, means including a float controlled valve within the chamber for insuring a constant flow of fluid fuel under chamber pressure through said discharge pipe, a pipe connecting the interior of the chamber above the fluid level to the interior of the nozzle for conducting air under chamber pressure to the nozzle, and means within the nozzle restricting the passage of the air therethrough and directing the passing air over the liquid fuel emerging from the discharge pipe to atomize the fuel as it is discharged from the nozzle.

3. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a predetermined constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under a predetermined pressure to the chamber, a fluid fuel discharge pipe from the chamber to the nozzle having a normal vertically arranged portion extending to the bottom of the chamber, fluid fuel inlet ports provided in said vertical portion, a float mounted for vertical movement about said vertical portion and adapted to cover and uncover said ports in accordance with the liquid level in said chamber, a pipe connecting the interior of the chamber above the fluid level to the interior of the nozzle for conducting air under chamber pressure to the nozzle, and means within the nozzle restricting the passage of the air therethrough and directing the passing air over the liquid fuel emerging from the discharge pipe to atomize the fuel as it is discharged from the nozzle.

4. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a predetermined constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under a predetermined pressure to the chamber, a fluid fuel discharge pipe from the chamber to the nozzle having a normal vertically arranged portion extending to the bottom of the chamber, fluid fuel inlet ports provided in said vertical portion, a float mounted for vertical movement about said vertical portion and adapted to cover and uncover said ports in accordance with the liquid level in said chamber, a pipe connecting the interior of the chamber above the fluid level to the interior of the nozzle for conducting air under chamber pressure to the nozzle, and means within the nozzle restricting the passage of the air therethrough and directing the passing air over the liquid fuel emerging from the discharge pipe to atomize the fuel as it is discharged from the nozzle, said means including a recessed helical spiral member mounted on the end of the fluid fuel discharge pipe and engaging the inner walls of the nozzle provided with radial passages from the interior of the said recess to the bottoms of the discharge ends of the said helix.

5. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a predetermined constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under a predetermined pressure to the chamber, a fluid fuel discharge pipe from the chamber to the nozzle having a normal vertically arranged portion extending to the bottom of the chamber, fluid fuel inlet ports provided in said vertical portion having the wall of said portion therebelow tapered from the inner bottom edge of each port, a float mounted for vertical movement about said vertical portion and adapted to cover and uncover said ports in accordance with the liquid level in said chamber, a pipe connecting the interior of the nozzle for conducting air under chamber pressure to the nozzle, and means within the nozzle restricting the passage of the air therethrough and directing the passing air over the liquid fuel emerging from the discharge pipe to atomize the fuel as it is discharged from the nozzle, said means including a recessed helical spiral member mounted on the end of the fluid fuel discharge pipe and engaging the inner walls of the nozzle provided with radial passages from the interior of the said recess to the bottoms of the discharge ends of the said helix.

6. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under pressure to the chamber, means for conducting the fluid fuel from the chamber under the air pressure to the burner nozzle, automatic compensating means including a float within the chamber for insuring a constant flow of the fluid fuel through said conductor, and means for con-

ducting the air from the chamber and delivering it to contact and atomize the fuel delivered at the nozzle.

7. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under pressure to the chamber, a fluid fuel discharge pipe from the chamber to the nozzle, means within the chamber for insuring a constant flow of fluid fuel under chamber pressure through said discharge pipe including the provision of a fuel inlet port in the discharge pipe within the chamber and a float coacting with said port to regulate the size thereof in accordance with the level of the liquid fuel within the chamber, a pipe connecting the interior of the chamber above the fluid level to the interior of the nozzle for conducting air under chamber pressure to the nozzle, and means within the nozzle restricting the passage of the air therethrough and directing the passing air over the liquid fuel emerging from the discharge pipe to atomize the fuel as it is discharged from the nozzle.

8. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under pressure to the chamber, means for conducting the fluid fuel from the chamber under the air pressure to the burner nozzle, automatic compensating means including a float controlled valve within the chamber for insuring a constant flow of the fluid fuel through said conductor, means for conducting air from above the liquid level in the chamber to the nozzle, and means within the nozzle restricting the passage of air therethrough and directing the air under pressure passing therethrough over the fluid fuel to spray the fuel through the discharge of the nozzle.

9. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under pressure to the chamber, a fluid fuel discharge pipe from the chamber to the nozzle, means within the chamber for insuring a constant flow of fluid fuel under chamber pressure through said discharge pipe including the provision of a fuel inlet port in the discharge pipe within the chamber and a float coacting with said port to regulate the size thereof in accordance with the level of the liquid fuel within the chamber, a pipe connecting the interior of the chamber above the fluid level to the interior of the nozzle for conducting air under chamber pressure to the nozzle, means for conducting air from above the liquid level in the chamber to the nozzle, and means within the nozzle restricting the passage of air therethrough and directing the air under pressure passing therethrough over the fluid fuel to spray the fuel through the discharge of the nozzle.

10. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a predetermined constant uniform flow of the fluid fuel to the chamber, means for delivering a constant flow of air under a predetermined pressure to the chamber, a fluid fuel discharge pipe from the chamber to the nozzle having a normal vertically arranged portion extending to the bottom of the chamber, oppositely disposed fluid fuel inlet ports increasing in size upwardly provided in said vertical portion, a float mounted for vertical movement about said vertical portion and adapted to cover and uncover said ports in accordance with the liquid level in said chamber, a pipe connecting the interior of the chamber above the fluid level to the interior of the nozzle for conducting air under chamber pressure to the nozzle, a recessed member mounted on the end of the fluid fuel discharge pipe and engaging the inner walls of the nozzle provided with a plurality of helical grooves about the outer portion thereof and a corresponding number of radial passages from the interior of the said recess to the bottoms of the discharge ends of the said grooves whereby the passage of air thereon produces a whirling spray of the fuel through the nozzle discharge.

11. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a controlled flow of the fluid fuel to the chamber, means for delivering a constant flow of air under pressure to the chamber, means for conducting the fluid fuel from the chamber under the air pressure to the burner nozzle, means including a float within the chamber for insuring a constant flow of the fluid through said conductor, and means for conducting the air from the chamber and delivering it to contact and atomize the fuel delivered at the nozzle.

12. An electrically operated fluid fuel burner mechanism provided with means for producing a combustible mixture of fluid fuel at the burner nozzle including a chamber, means for delivering a controlled flow of the fluid fuel to the chamber, means for delivering a constant flow of air under pressure to the chamber, a fluid discharge pipe from

the chamber to the nozzle, means including a float controlled valve within the chamber for insuring a constant flow of fluid fuel under chamber pressure through said discharge pipe, a pipe connecting the interior of the chamber above the fluid level to the interior of the nozzle for conducting air under chamber pressure to the nozzle, and means within the nozzle restricting the passage of the air therethrough and directing the passing air over the liquid fuel emerging from the discharge pipe to atomize the fuel as it is discharged from the nozzle.

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