April 22, 1924. 1,491,158

R. F. METCALFE

METHOD AND BURNER FOR BURNING LIQUID FUEL

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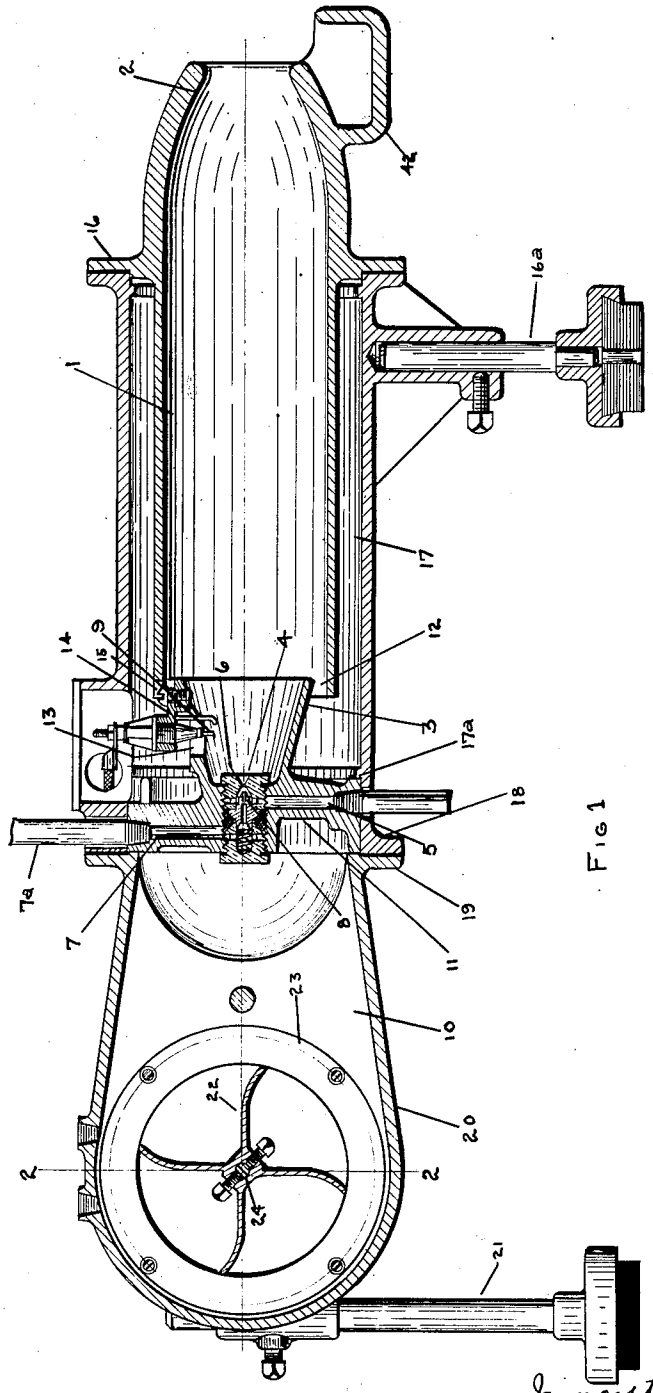


Fig 1

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by [illegible]
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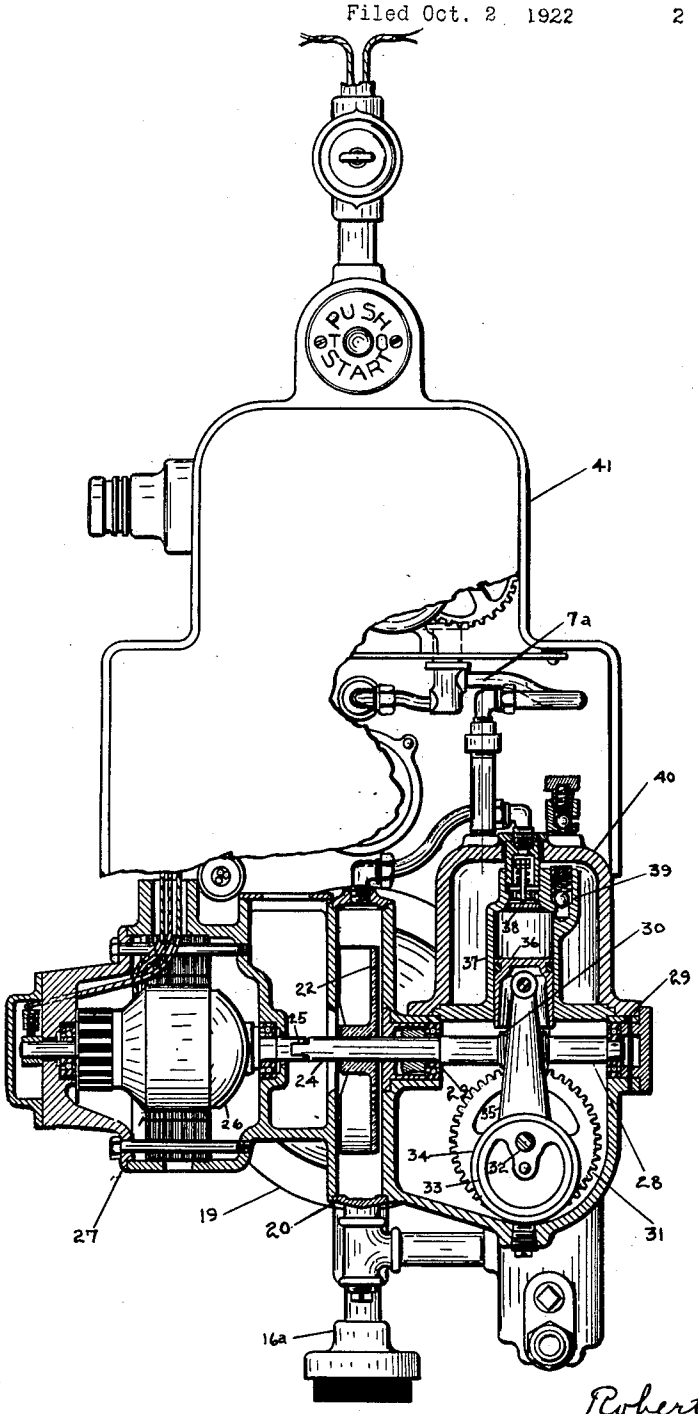


FIG 2

Inventor
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Patented Apr. 22, 1924. 1,491,158

UNITED STATES PATENT OFFICE.

ROBERT F. METCALFE, OF ERIE, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SOCONY BURNER CORPORATION, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

METHOD AND BURNER FOR BURNING LIQUID FUEL.

Application filed October 2, 1922. Serial No. 591,769.

To all whom it may concern:

Be it known that I, ROBERT F. METCALFE, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented new and useful Improvements in Methods and Burners for Burning Liquid Fuel, of which the following is a specification.

This invention is designed to burn liquid fuels, particularly heavy liquid fuels as may be desirable for ordinary furnace use such as domestic furnaces. The furnace, however, is applicable to other uses and in carrying out the invention I introduce an atomized fuel in an over-rich mixture to a burner chamber preferably somewhat elongated and envelop it with a current of air after ignition which air advances with the burning over-rich mixture and is then utilized to complete the combustion of the mixture. Through this method and arrangement some of the fuel in the over-rich mixture vaporizes the balance of the fuel, heats the enveloping air so as to facilitate the combustion, and at the same time the enveloping air insulates and cools the burner walls so as to prolong its use. In this way I am able to get an intense white flame and complete the combustion within a very short distance through the discharge of the burner. Preferably the burner is restricted at the end so as to force a comingling of the enveloping air with the over-rich mixture at the discharge of the burner. Other features of the invention will appear from the specification and claims.

The burner of the invention with which the method is practiced is illustrated in the accompanying drawings as follows:—

Fig. 1 shows a central section through the burner.

Fig. 2 a section on the line 2—2 in Fig. 1.

1 marks the burner chamber. This is provided with a restricted nozzle 2. An ignition cone 3 extends into the burner chamber and an atomizer 4 having a nozzle 6 projects atomized fuel and air into the ignition cone. Fuel is admitted through the fuel passage 5 and air is admitted under pressure through a passage 7, the air jet 8 acting to atomize the fuel and to draw the fuel to the atomizer. The atomizer forms no part of this invention and any desirable atomizer may be used. The over-rich mixture delivered by the atomizer is ignited by a spark furnished from a plug 9. Air for combustion is delivered from a passage 10 past the spider 11 through an opening 12 between the cone 3 and the walls of the chamber 1 and thus envelops and advances with the burning over-rich mixture and is forced to co-mingle with the over-rich mixture to complete combustion by the restricted nozzle. The cone 3 is provided with an opening 13 adjacent to the spark plug and delivers a slight additional amount of air at this point and thus facilitates ignition. The spark plug is mounted on a plate 14 which is secured to the cone by a screw 15 so that the plug may be readily inspected. The wall of the chamber 1 has a flange 16 near its forward end and an insulating chamber 17 surrounds the chamber 1 and is secured to the flange 16 at its forward end and is provided with a flange 18 at its rear end by means of which the frame 20 of the operating parts in which the passage 10 is arranged may be secured, the frame having a flange 19 to engage the flange 18. The spider 11 which carries the cone 3 is clamped in position between the end of the passage 10 and a shoulder 17^a on the wall of the chamber 17.

The burner is supported by posts 16^a and 21. A fan 22 is mounted in a fan case 23 in the frame 20 and is fixed on a shaft 24. The shaft 24 is driven through a clutch 25 from a rotor shaft 26 of a motor 27. The shaft 24 has an extension 28 which is mounted in bearings 29 in the frame. A worm 30 is mounted on the shaft 28 and meshes with a worm gear 31. The worm gear is fixed on a shaft 32 carrying an eccentric 33. The eccentric 33 has a strap 34 from which an eccentric rod 35 extends to a plunger or piston 36 arranged in a pump cylinder 37. The pump cylinder has an inlet valve 38 and a discharge valve 39 and discharges to a receiver 40 which extends over the entire cylinder. A pipe 7^a leads to the passage 7 and delivers air under pressure for atomizing purposes to the passage 7. The controlling mechanism for the motor is arranged in a housing 41 on the frame 20.

In order that any drip from the burner which may accumulate before or after the closing off of the ignition may be caught

and finally consumed I provide a cup 42 immediately below the nozzle 21 which collects any drip and holds it and when the burner is again started gradually burns from this cup.

By this method and arrangement I am able to vaporize the main body of the fuel before it is burned, to heat the air which is used to complete combustion, and insulate the burner parts so that they will stand up under the intense heat of the burner. At the same time a very simple and rugged construction is provided.

What I claim as new is:—

1. The method of burning liquid fuel which consists in atomizing the fuel, admitting sufficient air to form a preliminary over-rich mixture for partial combustion, igniting said over-rich mixture, heating the unconsumed fuel in the over-rich mixture to convert it to a gas, enveloping the over-rich preliminary mixture as it burns with the air, confining and advancing the burning mixture and enveloping air while converting the unconsumed fuel in the mixture to a gas, and completing the combustion of the fuel with the air so advanced.

2. The method of burning liquid fuel which consists in atomizing the fuel, admitting sufficient air to form a preliminary over-rich mixture for partial combustion, igniting said over-rich mixture and heating the unconsumed fuel therein to convert it to a gas, partially isolating and advancing the over-rich mixture, then enveloping the same with air, advancing the air and burning over-rich mixture while confining the same as the unconsumed fuel in the mixture is converted to a gas, and completing the combustion with the air so advanced.

3. The method of burning liquid fuel which consists in atomizing the fuel, admitting sufficient air to form a preliminary over-rich mixture for partial combustion, igniting said over-rich mixture and heating the unconsumed fuel therein to convert it to a gas, partially isolating and advancing the over-rich mixture, then enveloping the same with air, advancing the air and burning over-rich mixture while confining the same as the unconsumed fuel in the mixture is converted to a gas, forcing the enveloping air into ignition relation with the over-rich mixture, and completing the combustion of the fuel with said air.

4. The method of burning liquid fuel which consists in atomizing the fuel, admitting sufficient air to form a preliminary over-rich mixture for partial combustion, igniting said over-rich mixture and heating the unconsumed fuel therein to convert it to a gas, partially isolating and advancing the over-rich mixture, then enveloping the same with air, advancing the air and burning over-rich mixture while confining the same as the unconsumed fuel in the mixture is converted to a gas, forcing the enveloping air into ignition relation with the over-rich mixture by restricting it, and completing the combustion of the fuel with said air.

5. In a liquid fuel burner, the combination of a combustion chamber; a liquid fuel atomizer discharging to the combustion chamber and forming an over-rich mixture; means igniting said over-rich mixture; and means for delivering an enveloping current of air within the chamber and around the burning over-rich mixture, the chamber, atomizer and means being related to convert the unconsumed fuel of the over-rich mixture to a gas within the chamber and to burn the gas with the enveloping air as it is discharged from the chamber.

6. In a liquid fuel burner, the combination of a combustion chamber; a liquid fuel atomizer discharging to the chamber; a cup surrounding the atomizer and leaving an opening between the cup and the chamber wall; means igniting the over-rich mixture; and means for delivering an enveloping current of air through the opening between the cup and chamber wall, the chamber atomizer and means being related to convert the unconsumed fuel of the over-rich mixture to a gas within the chamber and to burn the gas with the enveloping air as it is discharged from the chamber.

7. In a liquid fuel burner, the combination of a combustion chamber; a liquid fuel atomizer discharging to the chamber; a cone-shaped cup surrounding the atomizer and leaving an opening between the cup and the chamber wall; means igniting the over-rich mixture; and means for delivering an enveloping current of air through the opening between the cup and chamber wall, the chamber, atomizer and means being related to convert the unconsumed fuel of the over-rich mixture to a gas within the chamber and to burn the gas with the enveloping air as it is discharged from the chamber.

8. In a liquid fuel burner, the combination of a combustion chamber having a restricted discharge nozzle; a liquid fuel atomizer discharging to the combustion chamber and forming an over-rich mixture; means igniting said over-rich mixture; and means for delivering an enveloping current of air within the chamber and around the burning over-rich mixture, the chamber, atomizer and means being related to convert the unconsumed fuel of the over-rich mixture to a gas within the chamber and to burn the gas with the enveloping air as it is discharged from the chamber.

9. In a liquid fuel burner, the combination of a combustion chamber having a restricted discharge nozzle; a liquid fuel atomizer discharging to the chamber; a cup sur-

rounding the atomizer and leaving an opening between the cup and the chamber wall; means igniting the over-rich mixture; and means for delivering an enveloping current of air through the opening between the cup and chamber wall, the chamber, atomizer and means being related to convert the unconsumed fuel of the over-rich mixture to a gas within the chamber and to burn the gas with the enveloping air as it is discharged from the chamber.

10. In a liquid fuel burner, the combination of a combustion chamber; a liquid fuel atomizer discharging to the combustion chamber and forming an over-rich mixture; means igniting said over-rich mixture; means for delivering an enveloping current of air within the chamber and around the burning over-rich mixture; and an insulating chamber communicating with and surrounding the combustion chamber.

11. In a liquid fuel burner, the combination of a combustion chamber; a liquid fuel atomizer discharging to the combustion chamber and forming an over-rich mixture; a cup extending around the atomizer; a spark plug extending into the cup; and means for delivering an enveloping current of air around the cup and within the walls of the chamber, the chamber, atomizer and means being related to convert the unconsumed fuel of the over-rich mixture to a gas within the chamber and to burn the gas with the enveloping air as it is discharged from the chamber.

12. In a liquid fuel burner, the combination of a combustion chamber; a liquid fuel atomizer discharging to the combustion chamber and forming an over-rich mixture; a cup extending around the atomizer; a spark plug extending into the cup; and means for delivering an enveloping current of air around the cup and within the walls of the chamber, said cup having an opening adjacent to the spark plug and delivering air to the cup adjacent to the plug.

13. In a liquid fuel burner, the combination of a combustion chamber; a fuel atomizer discharging to the chamber; a nozzle at the end of the chamber; and a drip cup adapted to receive any drippings from the nozzle and to burn the same at the nozzle.

14. In a liquid fuel burner, the combination of a combustion chamber having a restricted nozzle at its discharge end and a flange adjacent to the rear of the nozzle, a case around the chamber secured to the flange; a liquid fuel jet discharging into the chamber; a cup extending around the jet and forwardly, said cup leaving an opening between it and the combustion chamber; means for delivering air around the cup to the combustion chamber; a frame secured to the rear end of the case; and means carried by the frame for delivering combustion air and atomizing air to the burner.

In testimony whereof I have hereunto set my hand.

ROBERT F. METCALFE.