Feb. 17, 1925. 1,526,429

A. W. MORSE

LIQUID FUEL BURNER

Filed Aug. 22, 1922 2 Sheets-Sheet 1

Fig: 1

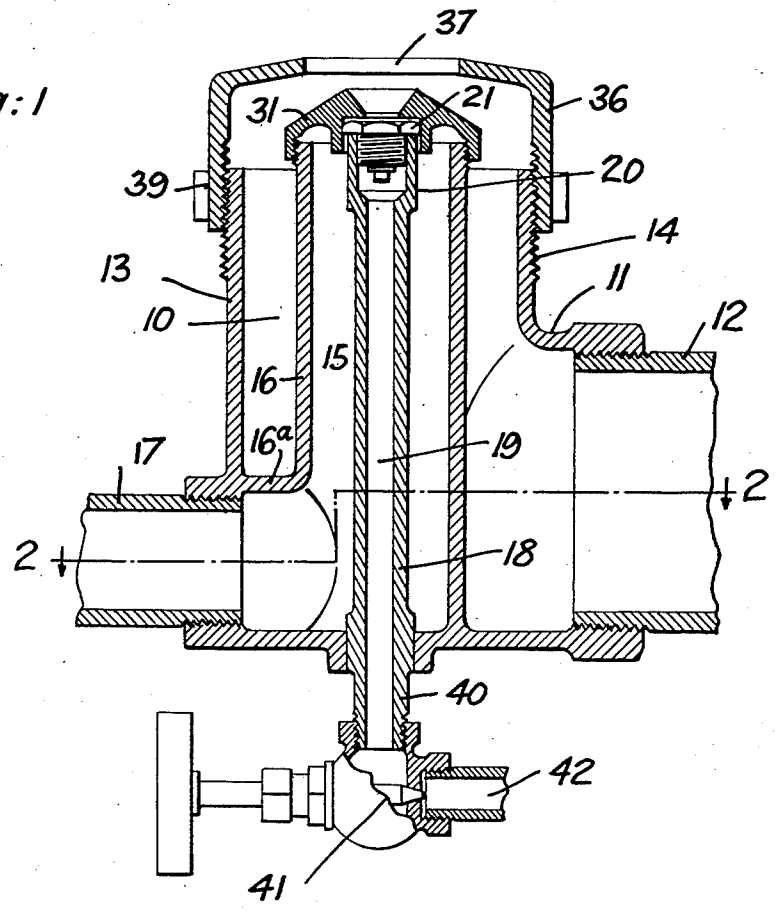
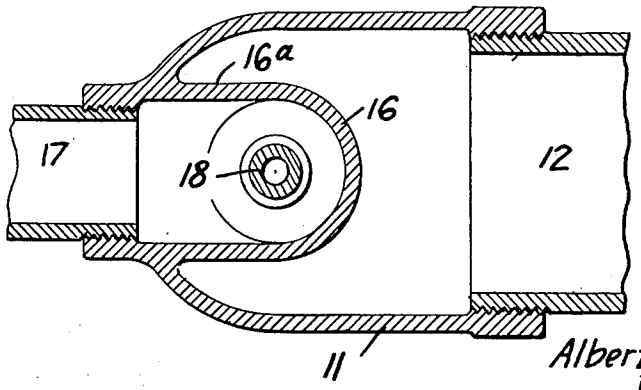


Fig: 2



Albert W. Morse
INVENTOR.

BY Walter E. Woolheim
ATTORNEY.

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Fig:3

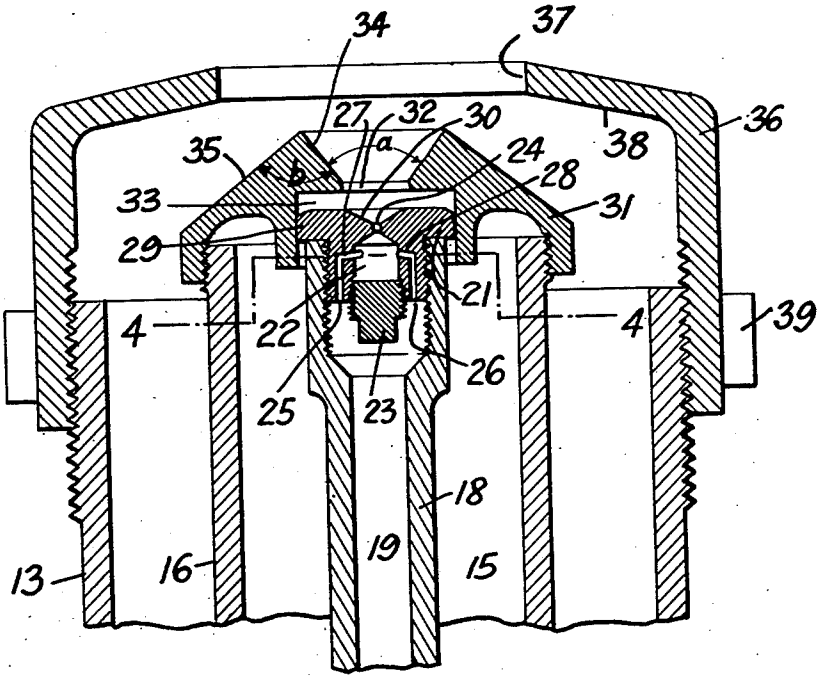
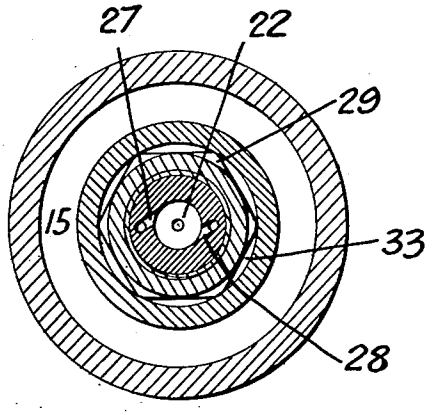


Fig:4



Albert W. Morse
INVENTOR.

BY Walter E. Woolheim
ATTORNEY.

Patented Feb. 17, 1925. 1,526,429

UNITED STATES PATENT OFFICE.

ALBERT W. MORSE, OF LONG ISLAND CITY, NEW YORK.

LIQUID-FUEL BURNER.

Application filed August 22, 1922. Serial No. 583,540.

To all whom it may concern:

Be it known that I, ALBERT W. MORSE, a citizen of the United States, and a resident of Long Island City, in the county of Queens and State of New York, have invented certain new and useful Improvements in Liquid-Fuel Burners, of which the following is a specification.

This invention relates to improvements in liquid fuel burners and more particularly to burners of the externally mixing, low pressure, type, viz, burners in which the fuel and the air do not meet until after they are ejected from the burner and refers more specifically to burners which use so-called "nebulizers" for atomizing the fuel oil into a very fine mist prior to mixing the same with the air, and in which nebulizers the atomizing effect is obtained by the direction of admission of the fuel oil into passages leading into a small swirling chamber.

It is an object of this invention to provide a burner of this type which operates satisfactorily in conjunction with an intensely hot air supply. Another object is to provide within a burner of this kind, means to permit of proper and efficient introduction of cooling air. A further object is to so arrange the vital parts of the burner that it is impossible for them to be out of alignment. The combination of all these objects result in an increased efficiency of operation, greater than any known heretofore.

The invention is illustrated by means of the accompanying drawings, in which—

Fig. 1 is a vertical longitudinal sectional view of the burner;

Fig. 2 is a transverse cross sectional view, taken along the plane of line 2—2, in Fig. 1;

Fig. 3 is an enlarged fragmentary section of the discharge end of the burner; and

Fig. 4 is a cross sectional view along the plane of line 4—4 in Fig. 3.

Like characters of reference denote similar parts throughout the several views and the following specification.

10 is a cylindrical casing of substantially L shape; its shorter branch 11 is threaded interiorly to receive a hot air supply pipe 12. The terminal of the longer branch 13 of casing 10 is threaded exteriorily at 14. A tubular chamber 15 formed by a wall 16 extends through the casing in axial alignment with its longer branch 13. Wall 16^a connects the chamber 15 with the outer wall of casing 10 opposite its shorter branch 11 and is threaded interiorly for connection with a cooling air supply pipe 17.

Casing 10 is bored out, adjacent to branch 11, to receive an oil spindle 18. This oil spindle is of hollow construction, being provided with a central duct 19, and extends through the tubular chamber 15 in central alignment therewith. 20 is an enlarged upper end of spindle 18, threaded interiorly to receive a nebulizer plug 21.

Nebulizer plug 21 is provided in its center with a hollow core 22, cylindrical in shape, called the swirl chamber. 23 is a plug screwed into the lower part of plug 21 for the purpose of facilitating the machining of the chamber 22. At the top of the chamber 22 and in its center is a small circular outlet opening 24. 25 and 26 are small drilled passages extending into the plug 21 at the sides of the chamber 22. 27 and 28 are ducts or inlet orifices joining the innermost ends of passages 25 and 26 with the upper part of chamber 22. These ducts are positioned so as to impinge the circumference of chamber 22 tangentially, as is shown in Fig. 4 and they are further slightly inclined towards the outlet end. 29 is a polygonal projection around the outside of the plug 21, slightly larger than enlarged end 20 of spindle 18, to facilitate screwing the same into the spindle and to provide a passage for the cooling air, as will be more fully explained hereafter. The top of the nebulizer 21 is chamfered at 30, so as to make the final outlet passage 24 as short as possible.

31 is a deflector cap screwed onto the exterior of the cylindrical chamber formed by wall 16, and is provided with a circular central opening 32 which is smaller than the outside diameter of the nebulizer 21. Below 32 is a recess 33 within cap 31 of such diameter as to fit snugly, but slidingly, over the corners of the polygonal portion 29 of plug 21.

34 is an oil deflecting surface extending from outlet 32 to the top of the cap, and 35 is an air deflecting surface surrounding the surface 34 on top of cap 31. The included angle *a* of the oil deflecting surface 34 is about 75 degrees. The angle *b* formed

by the intersection of the oil deflecting surface 34 and air deflecting surface 35 is an acute one, that is 90 degrees or less.

36 is a cap adapted to screw onto the threaded end 14 of branch 13 of casing 10, which cap is provided with a central opening 37 of a diameter larger than the circle in which surfaces 34 and 35 of cap 31 meet. 38 is an inner deflecting face of cap 36. 39 are lugs on the outside of the cap 36 to facilitate screwing the same onto the threaded part 14.

40 is a reduced portion of oil spindle 18, projecting outside of the casing 10 and is threaded exteriorly to receive a needle valve 41 of standard construction, controlling the flow of oil to the burner from a pipe 42.

The operation of the device is as follows: Oil under pressure passes through conduit 19 into the nebulizer 21 through passages 25 and 26 and from there through inlet orifices 27 and 28 into the swirl chamber 22. Owing to the direction of the inlet orifices, tangentially with respect to the wall of chamber 22, the oil is being given a swirling motion and is finally expelled in form of a very fine mist from outlet 24 where it assumes the shape of an inverted cone guided by chamber 30 on the outside of the plug and the oil deflecting surface 34.

Hot air, under pressure, enters the air chamber 10 via the inlet pipe 12 and is deflected under its full pressure into the spray or mist of oil. The resulting mixture leaves the main outlet 37 at high velocity.

Inspection of Fig. 3 shows that cap 31 can be adjusted on the burner so as to leave more or less space between the top of nebulizer plug 21 and top of recess 33. Hot air is deflected against the spray of oil at an angle determined primarily by the surface 35, the amount and velocity of the air being regulated by cap 36. The angle of deflection is further such that it directs the air flow away from the nebulizer. Therefore, when the mixture of hot air and oil is discharged at the burner outlet, a partial vacuum is created around the top and the sides of the nebulizer 21, by means of which a constant supply of cool air is drawn through the space between nebulizer 21 and the walls of recess 33. This air completely surrounds the fuel spindle 18 within the burner body and even protects the outlet face 30 of the nebulizer 21 as long as hot air issues from the burner.

In order to obtain the strongest vacuum, the angle b at which the air strikes the oil spray must be relatively acute, that is 90 degrees or less. As this angle is increased above this degree, there is more and more tendency for the air to force the oil spray particles back into the cooling chamber. It is further of equal importance that the combining angle of the oil and air deflecting surfaces be on a circle less than the diameter of the final outlet 37. It is quite obvious that, if this outlet 37 be smaller than the circle mentioned, the air would be at full pressure after it passes this circle and therefore expand in the direction of the nebulizer and thereby disturb the vacuum. For similar reasons the included angle of the oil deflecting surface has been determined to be the most effective and least inclined to affect the vacuum at 75 degrees.

In other words, the angles of deflection must be so arranged that both air and oil be forced away from the nebulizer and cooling chamber outlet. In order to do so most effectively the angles of deflecting surfaces must be so proportioned as mentioned above.

Another important feature is the recess 33 on the lower side of the deflector cap 31 telescoping over and fitting snugly the extreme corners of the polygonal portion 29 of plug 21. This forms a bearing which always maintains the oil spindle 18 and nebulizer 21 in the exact center of the outlet of the air deflector, and thereby the final outlet. The true alignment of the nebulizer with respect to the circle of deflection as well as the orifice of the air adjusting cap is absolutely essential to the proper operation of the device, because this true alignment is one of the essentials of a uniform and thorough mixture at the outlet of the burner. This bearing for the spindle not only insures exact alignment when the air deflector 31 is screwed up close to the nozzle, but also insures the same alignment when the deflector is adjusted back and forth to vary the distance between it and the face of the nebulizer 21 to produce different vacuum effects under different operating conditions.

The cooling air can be drawn directly from the atmosphere for all ordinary purposes; the construction shown, however, provides for the use of a cooling air supply under pressure should intensely hot conditions make this desirable.

It is understood that while I have above described my invention as applied to one kind of burner, its use and application may be varied and serve other forms of burners as well.

Various changes in the form, proportion and minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of the invention, as defined in the appended claims.

What I claim as new, is:

1. In a liquid fuel burner, a casing having a connection for admitting hot air thereto, a fuel conduit in fixed position within the casing, a nebulizer at the outlet end of the fuel conduit, a chamber around the fuel conduit having a separate inlet connection

in the said casing for cool air and, surrounding the said nebulizer, an outlet from said chamber, and common means to support the outlet end of the fuel conduit and regulate the outlet from the said chamber.

2. In a liquid fuel burner, a casing having a connection for admitting hot air thereto, a fuel conduit in fixed position within the casing, a nebulizer at the outlet end of the fuel conduit, a chamber around the fuel conduit having a separate inlet connection in the said casing for cool air and, surrounding the said nebulizer, an outlet from said chamber, and a cap adapted to telescope over the nebulizer.

3. In a liquid fuel burner, a casing having a connection for admitting hot air thereto, a fuel conduit in fixed position within the casing, a nebulizer at the outlet end of the fuel conduit, a chamber around the fuel conduit having a separate inlet connection in the said casing for cool air and, surrounding the said nebulizer, an outlet from said chamber, and an adjustable cap adapted to telescope over the nebulizer for the purpose of supporting the said conduit within the chamber and regulating the outlet from the said chamber.

4. In a liquid fuel burner, a casing having a connection for admitting hot air thereto, a fuel conduit within the casing, a nebulizer, having irregular outer surfaces, at the outlet end of the fuel conduit, a chamber around the fuel conduit having a separate inlet connection in the said casing for cool air and, surrounding the said nebulizer, an outlet from said chamber, and a deflector cap having one side telescoping over the irregular outer surfaces of the said nebulizer to support the end of the fuel conduit and permit the passage of cool air, the said cap being provided at its other side with fuel and air deflecting surfaces.

5. In a liquid fuel burner, a casing having a connection for admitting hot air thereto, a fuel conduit within the casing, a nebulizer at the outlet end of the fuel conduit, a chamber around the fuel conduit having a separate inlet connection in the said casing for cool air and, surrounding the said nebulizer, an outlet from said chamber, and means to hold the said conduit in central alignment within the said chamber, a regulating cap for the hot air within the casing, concentric with the said nebulizer, having a circular final outlet opening, and a deflector cap telescoping over the said nebulizer and having at its other side fuel and air deflecting surfaces meeting in a circle of a diameter not larger than that of the said final outlet opening.

6. In a burner of the kind described, a nebulizer, a deflector cap, surrounding the said nebulizer, having a central outlet, and concentrically therewith a recess at its interior to slidingly telescope over the said nebulizer, and fuel and air deflecting surfaces at its exterior, the angle between the said fuel and air deflecting surfaces being not more than 90 degrees.

7. In a burner of the kind described, a nebulizer having a small swirl chamber closed at one end and with a small outlet at its other end and small orifices admitting a liquid fuel to whirl in the said chamber toward the said outlet, a deflector cap, surrounding the said nebulizer, having a central outlet and air and fuel deflecting surfaces concentrically at its exterior, the included angle of the fuel deflecting surface being approximately 75 degrees.

8. In a burner of the kind described, a nebulizer having a small swirl chamber closed at one end and with a small outlet at its other end and small orifices admitting a liquid fuel to whirl in the said chamber toward the said outlet, a deflector cap, surrounding the said nebulizer, having a central outlet, and air and fuel deflecting surfaces concentrically at its exterior, the said deflecting surfaces including an angle of not more than 90 degrees.

9. In a burner of the kind described, a nebulizer having a small swirl chamber closed at one end and with a small outlet at its other end and small orifices admitting a liquid fuel to whirl in the said chamber toward the said outlet, a deflector cap having a central outlet, and air and fuel deflecting surfaces concentrically at its exterior, the included angle of the said fuel deflecting surface being approximately 75 degrees and the angle at which the fuel and air deflecting surfaces meet being not more than 90 degrees.

10. In a burner of the kind described, a nebulizer, a deflector cap, surrounding the said nebulizer, having a central outlet, and concentrically therewith a recess in its interior to slidingly telescope over the said nebulizer, fuel and air deflecting surfaces at the other side, the included angle of the fuel deflecting surface being approximately 75 degrees.

11. In a burner of the kind described, a nebulizer, a deflector cap, surrounding the said nebulizer, having a central outlet, a recess at the interior of the cap to slidingly telescope over the said nebulizer, fuel and air deflecting surfaces at the exterior of the cap, the included angle of the said fuel deflecting surface being approximately 75 degrees and the angle at which the fuel and air deflecting surfaces meet being not more than 90 degrees, the said central outlet, the said recess and the said air and fuel deflecting surfaces being in axial alignment with each other.

12. In a liquid fuel burner, a fuel conduit, a nebulizer at the outlet end of the fuel con-

duit, a hot air pipe forming an outer casing, a regulating cap for the said hot air pipe having a circular final outlet opening, a cool air jacket around the said fuel conduit and within the said casing, and a deflector cap adapted to close the said cool air jacket, the said deflector cap being provided at its interior with a recess to telescope over the said nebulizer and with fuel and air deflecting surfaces at its exterior, the said fuel and air deflecting surfaces meeting in a circle of a diameter smaller than that of the said final outlet opening and forming with each other an angle of not more than 90 degrees.

13. In a liquid fuel burner, a fuel conduit, a nebulizer at the outlet end of the fuel conduit, a hot air pipe forming an outer casing, a regulating cap for the said hot air pipe at the outlet end of the burner and having a circular final outlet opening, a cool air jacket around the said fuel conduit and within the said casing having an outlet surrounding the said nebulizer, and a deflector cap adapted to regulate the outlet of the said cool air jacket, the said deflector cap being provided at its interior with a recess to telescope over the said nebulizer and at its exterior with fuel and air deflecting surfaces, the said fuel and air deflecting surfaces meeting in a circle of a diameter smaller than that of the said final outlet opening, the included angle of the said fuel deflecting surface being approximately 75 degrees.

14. In a liquid fuel burner, a fuel conduit, a nebulizer, a hot air pipe forming an outer casing, a regulating cap for the said hot air pipe at the outlet end of the burner and having a circular final outlet opening, a cool air jacket around the said fuel conduit and within the said casing having an outlet surrounding the said nebulizer, and a deflector cap adapted to regulate the outlet of the said cool air jacket, the said deflector cap being provided at its interior with a recess to telescope over the said nebulizer and at its exterior with fuel and air deflecting surfaces, the said fuel and air deflecting surfaces meeting in a circle of a diameter smaller than that of the said final outlet opening and at an angle of not more than 90 degrees, the included angle of the said fuel deflecting surface being approximately 75 degrees, the said fuel conduit, nebulizer, deflector cap and regulating cap being in axial alignment with each other.

15. In a liquid fuel burner, a casing having a connection for admitting hot air thereto, a fuel conduit within the casing, a nebulizer at the outlet end of the fuel conduit having a small swirl core closed at one end and with a small outlet at its other end and small orifices admitting a liquid fuel to whirl in the said core toward the said outlet, a chamber around the fuel conduit having a separate inlet connection in the said casing for cool air and, surrounding the said nebulizer, an outlet from said chamber, means to support the outlet end of the fuel conduit, and means to regulate the outlet from the said chamber.

16. In a liquid fuel burner, a casing having a connection for admitting hot air thereto, a fuel conduit within the casing, a nebulizer at the outlet end of the fuel conduit having a small swirl core closed at one end and with a small outlet at its other end and small orifices admitting a liquid fuel to whirl in the said core toward the said outlet, a chamber around the fuel conduit having a separate inlet connection in the said casing for cool air and, surrounding the said nebulizer, an outlet from said chamber, and a cap adapted to telescope over the nebulizer.

17. In a liquid fuel burner, a casing having a connection for admitting hot air thereto, a fuel conduit within the casing, a nebulizer at the outlet end of the fuel conduit having a small swirl core closed at one end and with a small outlet at its other end and small orifices admitting a liquid fuel to whirl in the said core toward the said outlet, a chamber around the fuel conduit having a separate inlet connection in the said casing for cool air and, surrounding the said nebulizer, an outlet from said chamber, and an adjustable cap adapted to telescope over the nebulizer for the purpose of supporting the said conduit within the said chamber and regulating the outlet from the said chamber.

In testimony whereof I have hereunto set my hand and seal in presence of two subscribing witnesses.

ALBERT W. MORSE. [L. S.]

Witnesses:
WALTER E. WOLLHEIM,
JEANETTE M. PENDLETON.