Sept. 26, 1961 A. BIBER ET AL 3,001,576

AIR DIRECTING APPARATUS

Filed Nov. 17, 1958 2 Sheets-Sheet 1

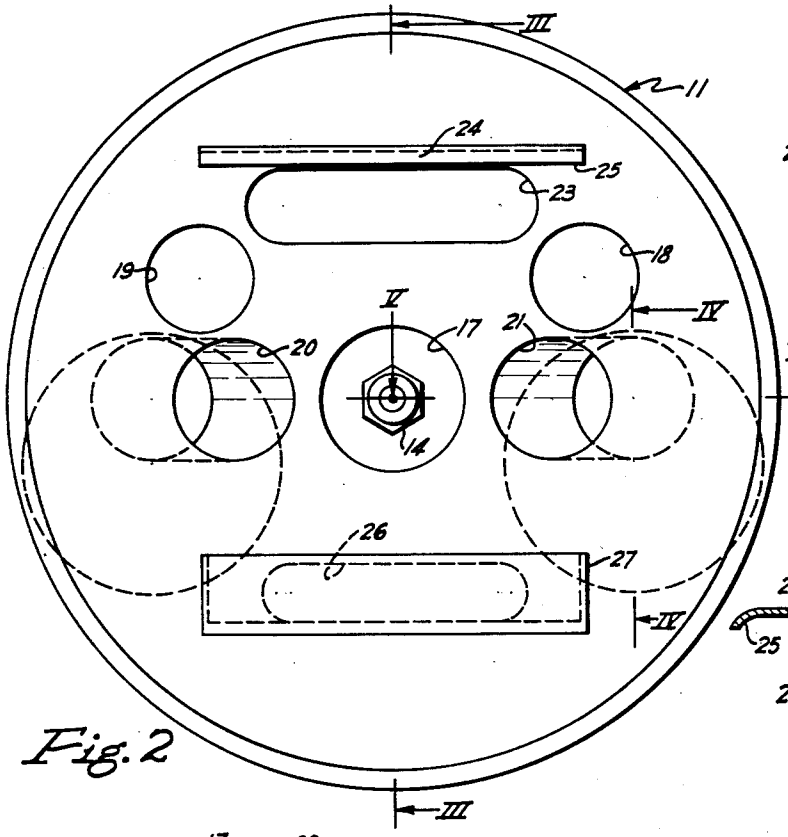


Fig. 2

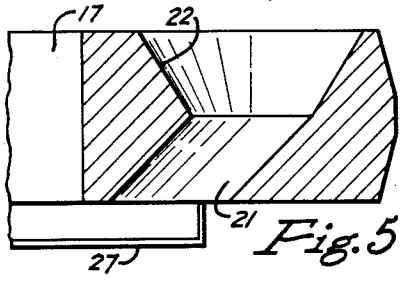


Fig. 5

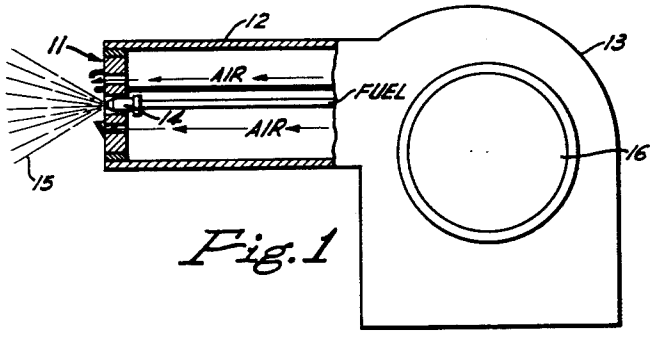


Fig. 1

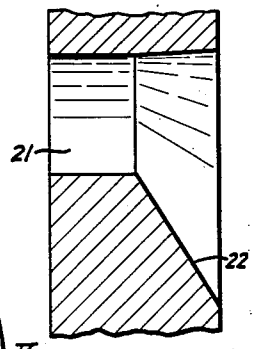


Fig. 4

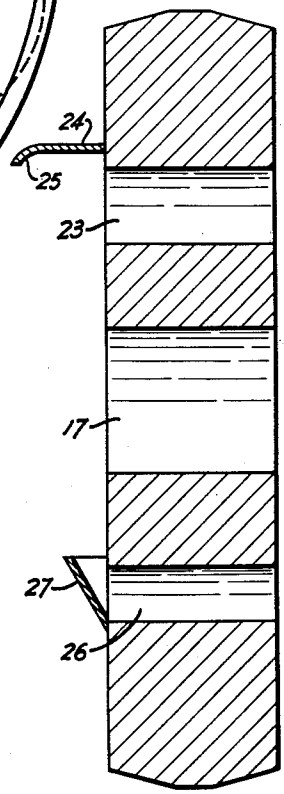


Fig. 3

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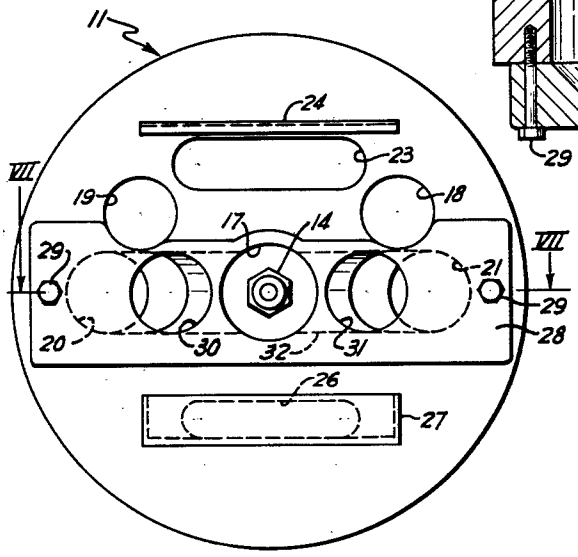


Fig. 6

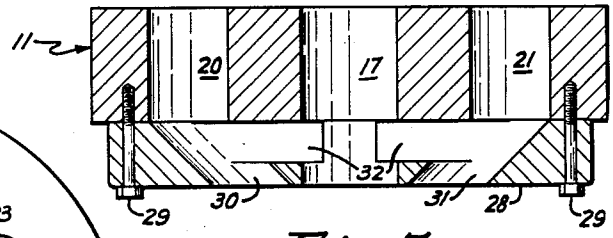


Fig. 7

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AIR DIRECTING APPARATUS

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9 Claims. (Cl. 158—76)

This invention relates to an air directing device for gun-type fuel oil burners and more particularly to a device for attachment to the nozzle end of the air blast tube of gun-type fuel oil burners.

In gun-type fuel burners, liquid fuels are supplied to a combustion chamber generally in the form of a conical spray. Some means is necessary to provide a supply of air or oxygen to the atomized fuel in order to produce combustion of said fuel.

The present invention provides a novel device for mixing the atomized fuel and air to bring about more perfect combustion of the fuel.

The device of the invention is adapted for mounting over the nozzle end of the air blast tube of a gun-type fuel burner, and comprises a plate having a relatively large central orifice in which the fuel nozzle is located and a plurality of orifices surrounding said central orifice so oriented to direct jets of air into the fuel spray cone in order to insure maximum mixing of the air while combustion takes place.

The invention is illustrated in the drawings accompanying the specification and forming a part thereof and in which:

FIGURE 1 is a side elevation partially broken away of a gun-type fuel burner and shows the relative location of its various parts including the improved air injector of the invention.

FIGURE 2 is an end elevation of the improved air direction means of the invention when attached to the nozzle end of the air blast tube.

FIGURE 3 is a sectional view of FIGURE 2 taken along the line III—III.

FIGURE 4 is a sectional view of FIGURE 2 taken along the line IV—IV.

FIGURE 5 is a sectional view of FIGURE 2 taken along the line V—V.

FIGURE 6 is a modified structure of the air direction means of the invention when attached to the nozzle end of the air blast tube.

FIGURE 7 is a sectional view of FIGURE 6 taken along the line VII—VII.

Referring to FIGURE 1, the air directing means of this invention comprises a plate **11** which is adapted for mounting over the nozzle end of air blast tube **12** of gun-type fuel burner **13**. Plate **11** is adapted to be frictionally held in position within the air blast tube **12**. Other fastening means, as for example, set screws can be employed for holding the plate in position. Fuel nozzle **14** with its fuel supply tube is located centrally of air blast tube **12** and is approximately flush with the front face of plate **11**. The liquid fuel issues from fuel nozzle **14** as a conical spray as at **15**. In the embodiment shown, the air blower **16** is located at the rear end of air blast tube **12** and projects the air through the blast tube into the combustion chamber as indicated by the arrows in FIGURE 1.

In FIGURE 2 numeral **11** again designates the entire air directing means of this invention. Numeral **17** designates the relatively large central circular opening in which fuel nozzle **14** is located. Openings **18** and **19** are provided to receive insulated electrodes (not shown) which serve the purpose of igniting the liquid fuel which is atomized and discharged into the combustion chamber.

Located on each side of central orifice **17** are openings **20** and **21**. As brought out in FIGURE 5, orifices **20** and **21** are disposed in plate **11** at an angle with respect to the axis of the center orifice, to direct converging jets of air toward the fuel spray cone so as to impinge upon and penetrate the fuel spray cone. The side orifices are preferably inclined inwardly at an angle of approximately 30° more or less to the axis of the center orifice **17**.

As shown also in FIGURE 5, the rear portions of orifices **20** and **21** are flared as at **22** to present a relatively large air intake area and a somewhat more restricted discharge outlet. This structure tends to impart greater velocity to the jet of air leaving the orifices and assists the air in penetrating the fuel spray cone and intermingling with the atomized fuel. Numeral **23** designates a relatively elongated slot positioned above the central orifice **17** through which a relatively broad stream of air is discharged into the combustion zone. As shown in FIGURE 3, deflector **24** extends outwardly from plate **11** above slot **23** for the purpose of directing the air stream which is discharged through slot **23**. The deflector **24** is provided with a downwardly projecting tip as at **25** which structure insures that the air stream emerging from slot **23** does not diverge upwardly from the fuel cone. Numeral **26** designates another somewhat smaller elongated slot located below the central orifice **17** through which a portion of the air is discharged. As shown also in FIGURE 3, lip **27** extends from plate **11** below slot **26** and is inclined upwardly to define with the face of plate **11** an angle of approximately 30° in order to direct a stream of air upwardly into the fuel cone. A distinctive feature of this arrangement is that the air is directed through the various orifices in a manner to penetrate the fuel cone at a plurality of points thus insuring that a supply of air is available throughout the fuel spray cone. In addition, by means of the described arrangement a curtain of air is supplied above the flame which causes the flame to be confined and provides an additional supply of air to insure more complete combustion.

The over-all size of the plate comprising the air directing device of the invention will depend upon the size of the air blast tube of the gun burner in which it is to be used. For example with a gun-type burner having a blast tube 4 inches in diameter the plate **11** will be constructed so as to have a diameter of slightly less than 4 inches to permit it to be inserted and held within the discharge end of the blast tube. The size of the various orifices provided in plate **11** will vary with the volume of the combustion space and with the amount of oil to be burned. By way of example, the following size orifices have proved feasible for use in a gun-type burner equipped with a fuel nozzle delivering ¾ gallon of fuel per hour. The center orifice **17** is made large enough the accommodate a conventional fuel nozzle and will be for example, approximately ¾ inch in diameter and the side orifices **20** and **21** approximately ⅝ inch in diameter. The lower elongated slot **26** is approximately ⅜ inch by 1¼ inches and the upper elongated slot **23** is approximately ⅜ inch by 1⅝ inches. When burning larger amounts of oil the air supply will, for proper combustion be greater and the size of the orifices will be correspondingly increased.

In FIGURES 6 and 7, there is shown a preferred embodiment of the invention wherein the side inwardly projecting orifices are carried in a strip **28** which is attached to the front face of plate **11** by means of screws **29**. In this embodiment of the invention the side orifices **20** and **21** are disposed in plate **11** parallel with the axis of the central orifice **17**, thus simplifying manufacture of the plate **11**. To obtain the effect of the side air streams converging toward the fuel cone, strip **28** is provided with two inwardly projecting side orifices **30** and **31**

which are suitably spaced to register with side orifices 20 and 21 in plate 11. As seen also in FIGURE 7, the inner face of strip member 28 adjacent the central orifice 17 is recessed as indicated at 32 to permit a portion of the air emerging from orifices 20 and 21 to flow parallel to the face of plate 11 and to intersect the fuel spray cone relatively near the fuel nozzle. With this embodiment of the invention, it is a simple matter to replace the strip member 28 with one in which the side orifices are of larger size to compensate for any change in the amount of fuel being supplied to the combustion chamber as would occur upon substitution of a fuel nozzle of greater capacity.

In operation of the air directing device of the invention, air from blower 16 travels down air blast tube 12 to plate 11. The relatively large stream of air is broken up at this point into a number of air jets of shapes corresponding to the configuration of the various orifices in the plate. A minor portion of the air passes through center hole 17 around fuel nozzle 14 and performs the function of creating an initial spray of oxygen for the combustion of the atomized fuel emerging from nozzle 14. A larger blast of air passes through the lower slot-like opening 26 and is directed upwardly by lip 27 to encounter the fuel cone at a point relatively near the fuel nozzle. The side orifices 20 and 21 deliver two high velocity jets of air which impinge upon the fuel cone at a point farther away from the fuel nozzle to support a later stage of combustion. The upper elongated slot 23 discharges a relatively broad sheet-like curtain of air over the flame which supports further combustion and in addition causes the flame to be confined.

Thus, by means of the air directing device of the invention, air is caused to surround and penetrate the fuel cone and a thorough intermingling of the fuel and air is insured. Moreover, substantially all of the air comes into contact with the burning oil and gases during combustion so that it is unnecessary to provide an excessive amount of air which will tend to reduce the temperature and efficiency in order to secure clean and complete combustion.

As is apparent, a gun-type fuel burner equipped with the air directing device of the invention can be utilized to supply a mixture of fuel and air to any conventional combustion chamber.

The principal advantage produced by this invention is that of improved combustion efficiency. Tests have proven that the use of the air directing device of this invention results in a blue flame within the combustion chamber and combustion products having low smoke numbers and high carbon dioxide content.

Those modifications and variations which fall within the spirit of the invention and the scope of the appended claims are to be considered part of the invention.

We claim:

1. An air directing device for use in fuel burners comprising a plate having a relatively large central orifice through which a substantially conical spray of fuel is delivered to a combustion zone, said plate having an elongated horizontally extending slot-like opening located above said central orifice and means in said plate including a plurality of orifices adjacent said central orifice having their axes disposed at an angle to the axis of said central orifice for delivering a plurality of forwardly converging streams of air which impinge upon the said fuel spray.

2. An air directing device for use in fuel burners comprising a plate having a relatively large central orifice through which a substantially conical spray of fuel is delivered to a combustion zone, said plate having an elongated horizontally extending slot-like opening located above said central orifice through which a stream of air is delivered above said fuel spray, said plate having a second elongated horizontally extending slot-like opening located below said central orifice through which a stream of air is supplied for combustion of the fuel, a lip member extending outwardly and upwardly from below said last mentioned opening to direct the air emerging therefrom so that it impinges upon the said fuel spray, said plate having openings located on opposite sides of said central orifice and disposed at an angle to the axis thereof for delivering a plurality of forwardly converging streams of air which impinge upon the said fuel spray.

3. An air directing device for use in fuel burners comprising a plate having a relatively large central orifice through which a substantially conical spray of fuel is delivered to a combustion zone, said plate having an elongated horizontally extending slot-like opening located above said central orifice and axially paralled thereto through which a stream of air is delivered above said fuel spray, a deflector member located above said elongated opening and extending outwardly from the face of said plate and being provided with a downwardly projecting tip, said plate having a second elongated horizontally extending slot-like opening located below said central orifice through which a stream of air is supplied for combustion of said fuel, a lip member extending outwardly and upwardly from below said last-mentioned opening to direct the air stream emerging therefrom so that it impinges upon said fuel spray, said plate having openings located on opposite sides of said central orifice and disposed at an angle to the axis thereof to deliver a plurality of forwardly converging streams of air which impinge upon said fuel spray.

4. An air directing device for use in fuel burners comprising a plate having a relatively large central orifice through which a substantially conical spray of fuel is delivered to a combustion zone, said plate having an elongated horizontally extending slot-like opening located above said central orifice and axially parallel thereto through which a relatively broad sheet-like stream of air is delivered above said fuel spray, said plate having a second elongated horizontally extending slot-like opening located below said central orifice through which a stream of air is supplied for combustion of said fuel, a lip member extending outwardly and upwardly from below said last-mentioned opening to direct the air emerging therefrom so that it impinges upon the said fuel spray at a point relatively near the face of said plate, said plate having two openings located on opposite sides of said central orifice and disposed at an angle to the axis thereof to deliver two forwardly converging streams of air which impinge upon the said fuel spray at a point spaced forwardly from the face of said plate.

5. An air directing device for use in fuel burners comprising a plate having a relatively large central orifice through which a substantially conical spray of fuel is delivered to a combustion zone, said plate having an elongated horizontally extending slot-like opening located above said central orifice and axially parallel thereto through which a stream of air is delivered above said fuel spray, a deflector member located above said elongated opening and extending outwardly from the face of the said plate and being provided with a downwardly projecting tip, said plate having a second elongated horizontally extending slot-like opening located below said central orifice through which a stream of air is supplied for the combustion of said fuel, a lip member extending outwardly and upwardly from below said last-mentioned opening to direct the air stream emerging therefrom so that it impinges upon said fuel spray, said plate having two circular openings located on opposite sides of the said central orifice and axially parallel thereto, a strip member extending transversely across the front face of said plate and removably attached thereto, said strip member having a central orifice matching said central orifice in said plate, said strip member having also two orifices disposed on opposite sides of the central orifice and spaced to match the two circular side openings in said plate, the side orifices within said strip member

being disposed at an angle to the axis of the central orifice of said plate, to deliver two forwardly converging streams of air which impinge upon said fuel spray at a point spaced forwardly from the face of said plate, said strip member having also a recess in the inner face thereof extending laterally from the central orifice to the side orifices therein.

6. In combination with a fuel burner having an air blast tube and burner nozzle which delivers a fuel spray, an air directing device comprising a plate which is adapted for mounting over the discharge end of said air blast tube, said plate having a relatively large circular orifice located centrally of said plate in axial alignment with said nozzle, said plate having an elongated horizontally extending slot-like opening located above said central orifice and means within said plate including a plurality of orifices surrounding said central orifice having their axes disposed at an angle to the axis of said central orifice for delivering a plurality of forwardly converging streams of air which impinge upon the said fuel spray.

7. In combination with a fuel burner having an air blast tube and burner nozzle which delivers a fuel spray, an air directing means comprising a plate mounted over the discharge end of said air blast tube, said plate having a relatively large circular orifice located centrally of said plate in axial alignment with said nozzle, said plate having an elongated horizontally extending slot-like opening located above said central orifice through which a stream of air is delivered above said fuel spray, said plate having a second elongated horizontally extending slot-like opening within said plate located below said central orifice through which a stream of air is supplied for combustion of the fuel, a lip member extending outwardly and upwardly from said plate below said last-mentioned opening to direct the air emerging therefrom so that it impinges upon the said fuel spray, said plate having openings located within said plate on opposite sides of said central orifice and disposed at an angle to the axis thereof for delivering a plurality of forwardly converging streams of air which impinge upon the said fuel spray.

8. In combination with a fuel burner having an air blast tube and burner nozzle which delivers a fuel spray, an air directing means comprising a plate mounted over the discharge end of said air blast tube, said plate having a relatively large circular orifice located centrally of said plate in axial alignment with said nozzle, said plate having an elongated horizontally extending slot-like opening located above said central orifice and axially parallel thereto through which a stream of air is delivered above said fuel spray, a deflector member located above said elongated opening and extending outwardly from the face of said plate and being provided with a downwardly projecting tip, said plate having a second elongated horizontally extending slot-like opening within said plate located below said central orifice through which a stream air is supplied for combustion of said fuel, a lip member extending outwardly and upwardly from below said last-mentioned opening to direct the air stream emerging therefrom so that it impinges upon the said fuel spray, said plate having openings located within said plate on opposite sides of said central orifice and disposed at an angle to the axis thereof to deliver a plurality of forwardly converging streams of air which impinge upon said fuel spray.

9. In combination with a fuel burner having an air blast tube and burner nozzle which delivers a fuel spray, an air directing means comprising a plate mounted over the discharge end of said air blast tube, said plate having a relatively large circular orifice located centrally of said plate in axial alignment with said nozzle, said plate having an elongated horizontally extending slot-like opening within said plate located above said central orifice and axially parallel thereto through which a stream of air is delivered above said fuel spray, a deflector member located above said elongated opening and extending outwardly from the face of the said plate and being provided with a downwardly projecting tip, said plate having a second elongated horizontally extending slot-like opening within said plate located below said central orifice through which a stream of air is supplied for the combustion of said fuel, a lip member extending outwardly and upwardly from said plate below said last-mentioned opening to direct the air stream emerging therefrom so that it impinges upon said fuel spray, said plate having two circular openings located on opposite sides of the said central orifice and axially parallel thereto, a strip member extending transversely across the front face of said plate and removably attached thereto, said strip member having a central orifice matching said central orifice in said plate, said strip member having also two orifices disposed on opposite sides of the central orifice and spaced to match the two circular side openings within said plate, the side orifices within said strip member being disposed at an angle to the axis of the central orifice of said plate, said strip member having also a recess in the inner face thereof extending laterally from the central orifice to the side orifices therein.

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