April 7, 1936. R. F. SOUTER ET AL 2,036,726

BURNER FOR FUEL OIL AND THE LIKE

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Fig. 1.

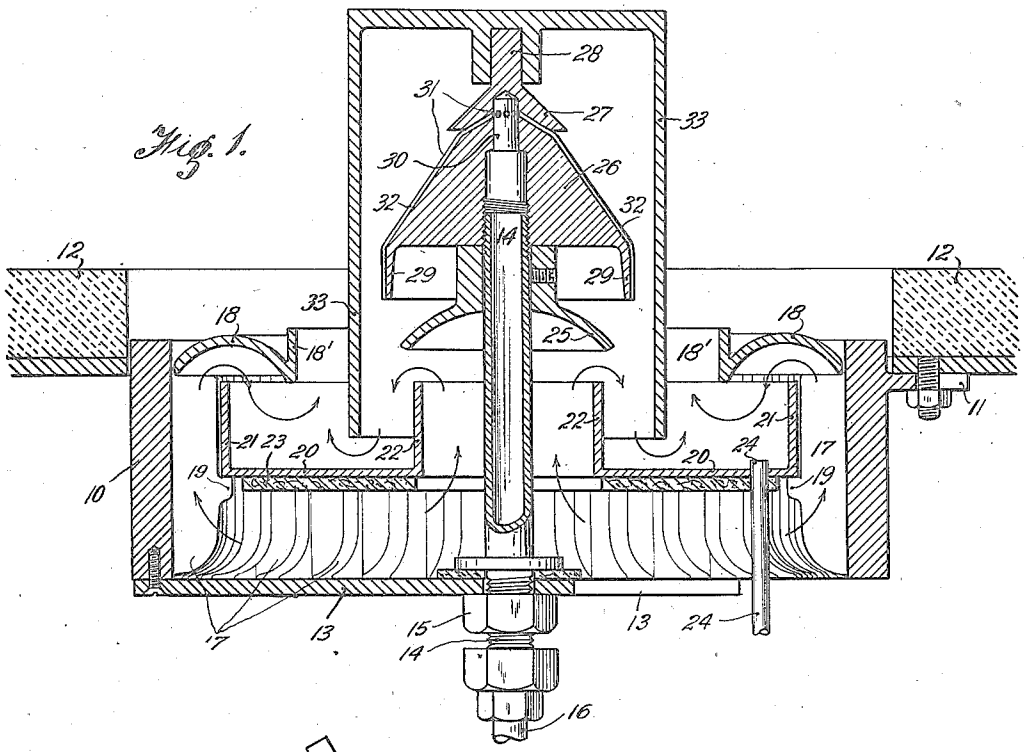
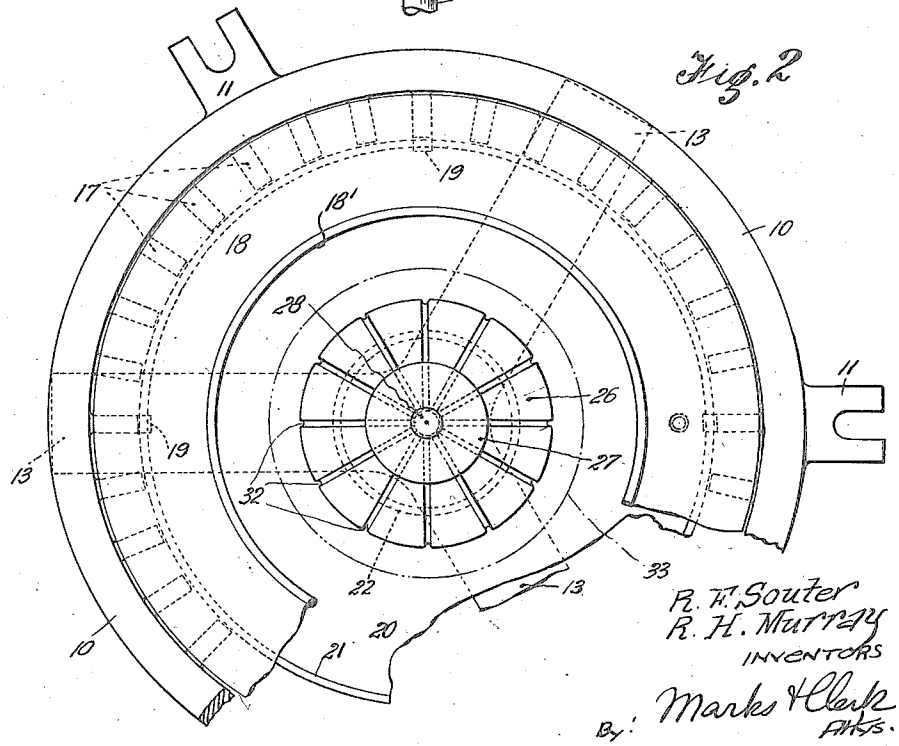


Fig. 2



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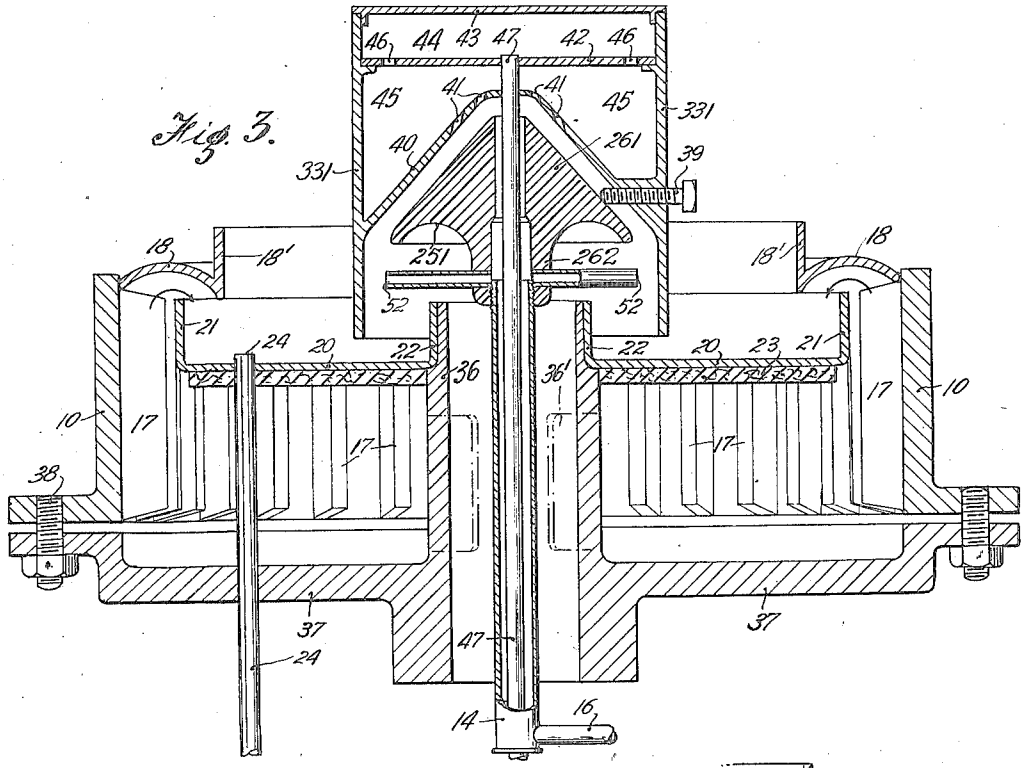
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Fig. 3.



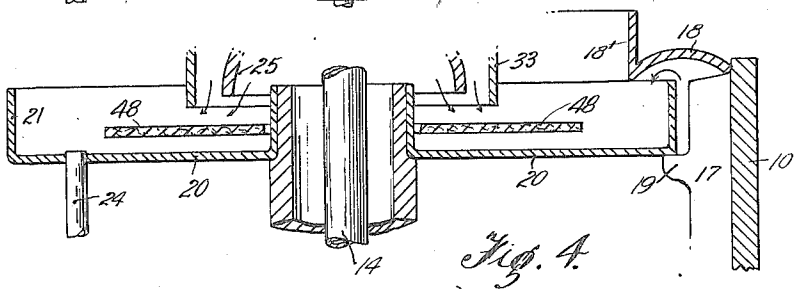


Fig. 4.

Fig. 5.

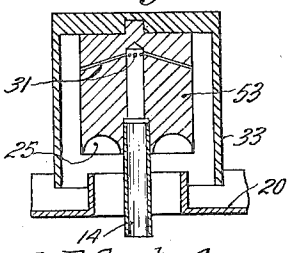
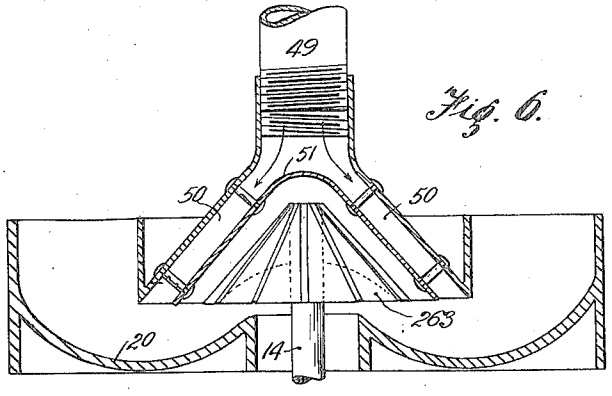


Fig. 6.



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UNITED STATES PATENT OFFICE

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BURNER FOR FUEL OIL AND THE LIKE

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Application October 5, 1932, Serial No. 636,396
In Australia October 9, 1931

9 Claims. (Cl. 158—53)

This invention relates to improvements in and connected with burners for fuel oil and the like and refers especially, but is not limited, to fuel oil burners adapted for burning heavy fuel oils, such e. g. as crude mineral oil, tar oils and like residuals.

The object of the invention is to provide improved apparatus for burning oil fuel.

A fuel oil burner in accordance with the invention comprises a central member (preferably of conical shape) a shield open at its lower end and enclosing the central member so as to form a vaporizing chamber having a substantially annular orifice at its lower end, means for delivering fuel to an upper portion of the vaporizing chamber, means for delivering air to the center of the annular stream of fuel discharged from said orifice, and means disposed exteriorly of the shield for directing additional air inwards to the combustion zone of the burner.

The fuel is preferably supplied to the upper end of the central member by means of a vertical supply pipe extending from therebelow and subjected to the heat of the combustion zone and, in one form of the invention, the supply pipe is provided below the inclined member with laterally disposed passages by means of which some of the fuel is discharged without passing above said inclined member.

The inventon also comprehends the provision of means for regulating the supply of air to the inner and/or outer air passages, means for minimizing loss of heat from the hot plate, and deflector means for controlling the shape of the flame of the burner.

A further important feature of the invention resides in the provision of means for preheating the fuel oil and means for supplying steam to an upper portion of the inclined member whereby it will assist in the discharge of oil vapor and in preventing any combustion of fuel above the surface of said conical member.

The surfaces of the downwardly inclined member are preferably provided with a plurality of grooves extending from adjacent the upper ends thereof to their lower ends in order to direct the flow of fuel therealong.

The fuel oil may be preheated by means of hot water passing through a tube disposed within a pipe for conveying the oil to the inclined member and this water pipe may extend above said member to a heated chamber in which the water is evaporated, the steam then passing from this chamber through suitable ports into the space above the inclined member and thence into the combustion chamber.

Alternatively, steam from any convenient source may be delivered to the burner for the purposes abovementioned.

Having set forth the objects and nature of the invention, reference will now be made to the accompanying drawings wherein:—

Figure 1 is a view in vertical section of a fuel oil burner constructed and arranged in accordance with the invention.

Figure 2 is a view in plan of the burner shown in Figure 1; a part thereof being removed for convenience of illustration.

Figure 3 is a view in vertical section of a modified form of burner; and

Figures 4, 5 and 6 are sectional views showing further modifications which hereafter are fully described.

Referring to the drawings, the reference numeral 10 designates a vertically disposed open ended tubular body member provided exteriorly with a plurality of slotted lugs 11 by means of which it is secured in position below the bottom 12 of a combustion chamber or furnace.

Secured to the lower end of the body member 10 is a three armed spider 13 which supports a centrally disposed vertical fuel pipe 14 which is secured thereon by means of a clamping nut 15. A fuel supply pipe 16 passing from an elevated or other suitably positioned fuel tank (not shown) is connected by a union nut to the lower end of said vertical fuel pipe 14.

The internal periphery of the body member 10 is provided with a plurality of integral longitudinally disposed guide ribs 17 which project radially of the frame member when viewed in plan, as clearly shown in Figure 2 of the drawings.

These guide ribs extend from the bottom to some distance from the top of the frame member and serve as a support for an annular deflector ring 18 the undersurface of which is concave in cross section.

This annular deflector ring 18 is provided at its inner periphery with a substantially parallel axial hole formed by an annular flange 18' which serves to properly direct the flame of the burner.

Certain of the ribs 17 are provided with inwardly projecting lugs 19 which serve to support a shallow annular container forming a hot plate and comprising a bottom portion 20, a circular outer flange 21 and a circular inner flange 22.

The underside of the bottom portion of the flanged hot plate is provided with a layer 23 of heat insulating material, such as asbestos, and

a vertical overflow pipe 24 extends through said hot plate and has its open upper end disposed somewhat thereabove.

A deflector member 25 having its undersurface of concave shape in cross section is adjustably mounted on the vertical fuel pipe 14 above the top of the circular inner flange 22 of the hot plate and a conical head 26 screwed to the upper end of the fuel pipe has its lower end bearing on the top of said deflector member.

The conical headpiece 26 is provided near its upper end with an integral conical protuberance 27, and an integral axially disposed stem 28 projects from the upper end thereof. The lower end of the conical headpiece 26 has an integral depending skirt portion 29 of cylindrical formation which is somewhat larger in diameter than the circular inner flange 22 of the hot plate.

A relatively small hole 30 disposed axially in the conical head 26 communicates with the screw-threaded hole therein which receives the upper end of the vertical fuel pipe 14 and a plurality of small inclined holes 31 are drilled underneath the shoulder formed by the conical protuberance 27 to meet the said axial hole 30.

The lower ends of these small inclined holes 31 communicate with corresponding grooves 32 formed on the outer surface of the conical headpiece 26 and of the skirt 29 formed integrally therewith.

The stem 28 on the upper end of the headpiece 26 supports a cylindrical shield 33 which is closed at its upper end and which has its lower and open end extending adjacent to the hot plate 20 of the burner.

In use a suitable pilot burner or other igniting means is caused to heat the conical headpiece 26 and/or the hot plate 20 whereby the fuel gravitating over the headpiece or passing on to the hot plate 20 is vaporized.

The fuel may be fed to the fuel pipe 14 by gravity or pressure from a suitably arranged tank (not shown) and a valve (not shown) is provided for accurately regulating the supply of fuel.

The combustion chamber is fitted with a flue for the discharge of the burnt gases and preferably the only means for the entrance of air to the combustion chamber is through the tubular body 10 of the burner.

It will thus be seen that part of the air supply passes through the annular passage formed by the fuel supply pipe 14 and the circular inner flange 22 of the hot plate and is deflected by means of the deflector member 25 on to the inside of the annular stream of vaporized fuel passing from the orifice formed by the skirt of the conical headpiece 26 and the adjacent inner surface of the shield member 33.

Combustion takes place underneath the lower end of the shield 33 (i. e. where the central air supply intermingles with the fuel) and the flames pass outwardly under the lower edge of said shield and meet the inwardly directed air supply.

This last mentioned air supply passes upwardly between the inner periphery of the tubular frame member 10 and the circular outer flange 21 of the hot plate, and is deflected downwards by means of the deflector ring 18.

The paths of flow of air and vapor are approximately indicated by the arrows in Figure 1 of the drawings.

The outer air supply is prevented from swirling by means of the above mentioned guide ribs 17 formed on the inner periphery of the tubular frame member 10, thus serving to produce a steady and even flame.

It will thus be understood that an annular flame extends through the space located between the shield 33 and the flange 18' at the inner periphery of the deflector ring 18.

It is believed that, when the burner becomes heated up, a substantial proportion of the fuel vaporizes in the vertical supply pipe 14—i. e. before issuing above the conical head 26; also that the vaporization of the lighter fractions of the fuel in this position assists in the discharge of those heavier fractions which may remain unvaporized when passing through the holes 31 in the conical headpiece.

When, however, the burner is being started, and when, for any reason, a sudden increase in the rate of supply of the fuel takes place, it appears that the fuel issues as a liquid through the holes 31 and flows downwards over the headpiece in the form of a thin film which is readily vaporized by the heat of the igniter or of the flame of the burner, as the case may be.

Under these conditions, the conical headpiece serves to evenly distribute the liquid fuel, thus ensuring the production of a uniform flame.

It will be clear that the shield 33 prevents the access of air to the space above the conical member 26 and prevents combustion taking place therein.

The hot plate 20 normally serves to vaporize any fuel which is still liquid on coming into contact therewith, but, in the event of liquid fuel accumulating on the plate, any undue excess thereof is discharged by means of the overflow pipe 24.

In the alternative form of the invention illustrated in Figure 3 of the drawings, the flanged hot plate 20 is supported on the upper end of a vertical tubular column 36 which is formed integrally with a plate or flange 37 adjustably connected to the lower end of the tubular frame member 10 by means of stud bolts 38.

In this construction, the main air supply enters the burner through the circumferential opening formed between the lower end of the tubular frame member 10 and the bottom plate 37 whilst the central air supply passes through the hollow column 36 and may be controlled by means of a suitable valve (not shown).

The ingress of air to the outer portion of the burner is regulated by adjusting the position of the plate 37 in relation to the lower end of the tubular frame member 10.

The conical head 261 is provided with a depending boss 262 the lower end of which is screwed on to the upper end of the fuel pipe 14 and the underside of the head is of curved formation 251 in order to deflect the central air supply on to the hot plate 20 and on to the inner surface of the annular stream of fuel passing from the lower end of the conical head.

The air impinging on the undersurface of the conical head 261 also serves to prevent the latter from becoming overheated.

A plurality of small laterally disposed discharge pipes 52 are fitted to a lower portion of the boss 262 whereby their outer ends project above the circular inner flange 22 of the hot plate. These discharge pipes 52 communicate at their inner ends with the axial passage in the boss 261, and preferably the upper end of the fuel supply pipe 14 extends somewhat above the lower ends of the lateral holes in the said boss, as shown in Figure 3.

By means of this construction, a substantially uniform flow of fuel is maintained through each of the pipes **52**, even if the axes thereof are not exactly in the same horizontal plane.

A shield **331** of cylindrical formation having its open lower end enclosing the head **261** is supported on said headpiece by means of adjustable screws **39** and said shield is provided above the headpiece **261** with an integral conical partition **40**. This partition is provided near its center with holes **41** which preferably incline in the same direction as the adjacent portions of the conical surface of the headpiece.

A second partition **42** preferably constructed of copper is arranged transversely within the shield **331** above the partition **40** and below a top cover plate **43**, thus forming an upper compartment **44** and a lower compartment **45** within said shield. The partition **42** is provided near its periphery with a regularly spaced series of holes **46**.

A water pipe **47** passing centrally through the fuel pipe **14** has its open upper end projecting through the partition **42** into the upper compartment **44** of the shield **331** whilst a lower portion thereof is sealed in the lower end of the fuel pipe **14**.

In starting up the burner, the supply of fuel is turned on and the fuel issues slowly from the lateral branches **52** of the vertical supply pipe **14**. This fuel is ignited by any suitable means. The rate of flow is then increased as desired and it appears that, when the burner becomes heated up, the lighter fractions of the fuel are vaporized in the supply pipe **14** and issue above the conical head **261**, while some of the liquid fuel (probably the heavier fractions) passes through the lateral discharge pipes **52** and is vaporized and burnt as it issues therefrom.

It is found that these lateral discharge pipes **52** minimize the formation of deposits on the conical head **261**.

After the burner has been started in the manner described, water is delivered to the central water pipe **47** from which it passes on to the top of partition **42** where it is evaporated. The steam then passes from the upper compartment **44** through the openings **46** to the lower compartment **45** and thence through the holes **41** into the space above conical head **261** and these jets of steam assist in discharging and vaporizing the fuel, and in keeping the said headpiece free of carbon deposits.

The steam delivered above the conical head **261** also serves to "blanket" the vaporized fuel and to assist in preventing the contact of air therewith, and it is found that the conical surfaces are quite clean and serviceable even after running on crude oil for lengthy periods.

The water delivered to the central pipe **47** may be preheated whereby the temperature of the liquid fuel in the pipe **14** will be raised prior to being subjected to the heat of the combustion zone of the burner.

Alternatively, steam from any convenient source may be delivered to the lower end of the central pipe for the purpose abovementioned though, in this case, the upper compartment **44** of the shield **331** may be dispensed with.

It will be clear that steam may be supplied to the construction of burner illustrated in Figures 1 and 2 of the drawings for the purpose abovementioned, and/or that lateral discharge pipes **52** may be incorporated therein.

In lieu of employing natural draught, as described above, air may be delivered under pressure to the burner, and, in one construction, this may be effected by delivering all the air to the central column **36** of the burner (Fig. 3) and allowing the major portion thereof to pass through lateral holes **36'** shown in broken lines) in the column into the chamber disposed below the hot plate **20** and above the bottom plate **37** and from which chamber the main supply of air passes upwardly between the guide projections **17** on the tubular frame member **10** in the manner previously described.

When this construction is adopted, the bottom plate **37** carrying the tubular extension is screwed up to form an airtight seal against the lower end of the tubular member **10**.

In the modification of the invention shown in Figure 4 of the drawings, an auxiliary hot plate **48** may be arranged a slight distance above the hot plate **20** previously described, and an annular space is provided around the periphery of the plate **48** for the escape of vapors which are liberated by oil fuel gravitating to the lower plate. This auxiliary hot plate **48** may be constructed of metal but is preferably formed of a suitable refractory material such as fire clay.

In the form of the invention shown in Figure 5, a cylindrical headpiece **53** is fitted to the upper end of the fuel pipe **14** in lieu of a conical head, as shown in Figures 1, 2 and 3.

In the further form of the invention shown in Figure 6, the outer supply of air may be delivered by means of a pipe **49**, to a conical passage **50** disposed above a shield member **51** surrounding the conical headpiece **263**.

When this construction is adopted, it will be clear that the vaporized fuel issuing from the headpiece **263** is disposed between inner and outer layers of air moving in substantially the same direction as said fuel.

Also, the oil fuel may be delivered to the apex of the cone by means of a supply pipe disposed thereabove instead of therebelow as previously described and illustrated.

In a still further modification of the invention (not illustrated) the fuel is delivered to the center of a chamber formed by two parallel and coaxially disposed circular plates arranged horizontally, one being disposed a short distance above the other.

The edges of these plates consequently form a circumferential orifice through which the fuel is discharged and air is supplied to both sides of the fuel stream by suitably arranged air passages.

It will be clear that, where the words "cone shaped member" are used herein, they are intended to embrace a member of pyramidal or like shape.

We claim:

1. A burner for fuel oil having a central member, a shield open at its lower end and enclosing the central member, said shield being spaced from the central member to form a vaporizing chamber having a substantially annular discharge orifice at its lower end, means for delivering fuel to an upper portion of the vaporizing chamber, means for delivering air to the center of the annular stream of fuel discharged from said orifice whereby said air passes outwards in intermixture with said fuel, and means for directing additional air radially inwards to combine with said outwardly moving mixture of air and fuel.

2. A burner for fuel oil comprising a vertically disposed cone shaped member, a shield open at

its lower end and enclosing the cone shaped member, said shield and cone shaped member forming therebetween an annular passage, means for delivering fuel to the upper end of the annular passage, means for directing air to the inside of the annular fuel stream discharged from the lower end of the annular passage, said air and fuel passing outwards below the shield, and means for directing air inwardly in opposition to the outwardly flowing mixture of air and fuel.

3. In a burner for fuel oil according to claim 2, a vertical fuel supply pipe having the cone shaped member mounted on its upper end and means for by-passing liquid fuel direct from the fuel supply pipe to the space below the cone shaped member.

4. A burner for fuel oil comprising a vertically disposed cone shaped member, a shield having an open lower end enclosing the cone shaped member to form a vaporizing chamber therebetween, means for supplying fuel to the upper end of the cone shaped member whereby it may gravitate down the outer surface thereof, an annular hot plate disposed horizontally below the cone shaped member and shield, the central opening of said annular hot plate forming a passage for supplying air to the interior of the annular stream of fuel discharged from the cone shaped member, said shield and hot plate forming therebetween a pasage through which said air and fuel pass outwards in intermixture, and means surrounding said shield for directing air radially inwards in opposition to said outwardly flowing mixture of air and fuel.

5. A burner for fuel oil comprising a vertically disposed conical headpiece having a passage therein for the supply of fuel to the upper end thereof, a shield surrounding the conical headpiece and spaced therefrom, said shield being open at its lower end, a hot plate disposed horizontally below the conical headpiece and shield and having a passage therein for delivering air into the lower end of the shield, an annular member surrounding the lower end of the shield and providing an annular space therebetween, and means for directing additional air radially inwards from said annular member towards the outer face of the said shield.

6. A fuel oil burner comprising a vertically disposed tubular body member open at its upper end, a vertical fuel supply pipe extending centrally through the tubular body member, a conical head fitted to the upper end of the fuel pipe and provided interiorly with a passage for directing fuel from the supply pipe to the upper surface of said conical head, a cylindrical shield open at its lower end and enclosing the conical head, a hot plate arranged horizontally within the body member and below the head and shield, said hot plate having therein an axial air passage of smaller diameter than the shield, and said hot plate and tubular body member forming therebetween an annular air passage, and guide means for directing inwardly the air passing through said annular air passage.

7. In a fuel oil burner according to claim 5, a vertical fuel supply pipe having its upper end communicating with the passage in the headpiece and means providing a plurality of laterally disposed fuel discharge passages having their inner ends communicating with the fuel supply pipe and having their outer ends disposed below said conical headpiece and adjacent to the combustion zone of the burner.

8. In a fuel oil burner according to claim 2, a water vaporizing chamber in the upper end of the shield above the cone shaped member, and means for delivering water to said chamber, said chamber communicating by passages with said annular passage whereby steam generated in said chamber is discharged into the annular passage.

9. A fuel oil burner having a vertically arranged tubular body member, a vertical fuel supply pipe extending centraly through the tubular body member, a headpiece on the upper end of the fuel supply pipe and having passages therein for directing fuel from the fuel supply pipe to the outer surface of an upper portion of said headpiece, a cylindrical shield open at its lower end and enclosing the headpiece to form a vaporizing chamber therebetween, the lower end of said shield extending below the headpiece, an annular hot plate disposed horizontally below the shield and within the tubular body member, upwardly directed concentric flanges at the inner and outer peripheral edges of the annular hot plate, said inner flange extending within the lower end of the shield and forming a central air supply passage and said outer flange being spaced from the tubular body member to form an annular air passage, and an annular deflector member arranged above the annular air passage and having its inner periphery spaced from the shield to form an annular orifice therebetween, said deflector member being arranged to direct inwardly the air passing from said annular air passage.

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