

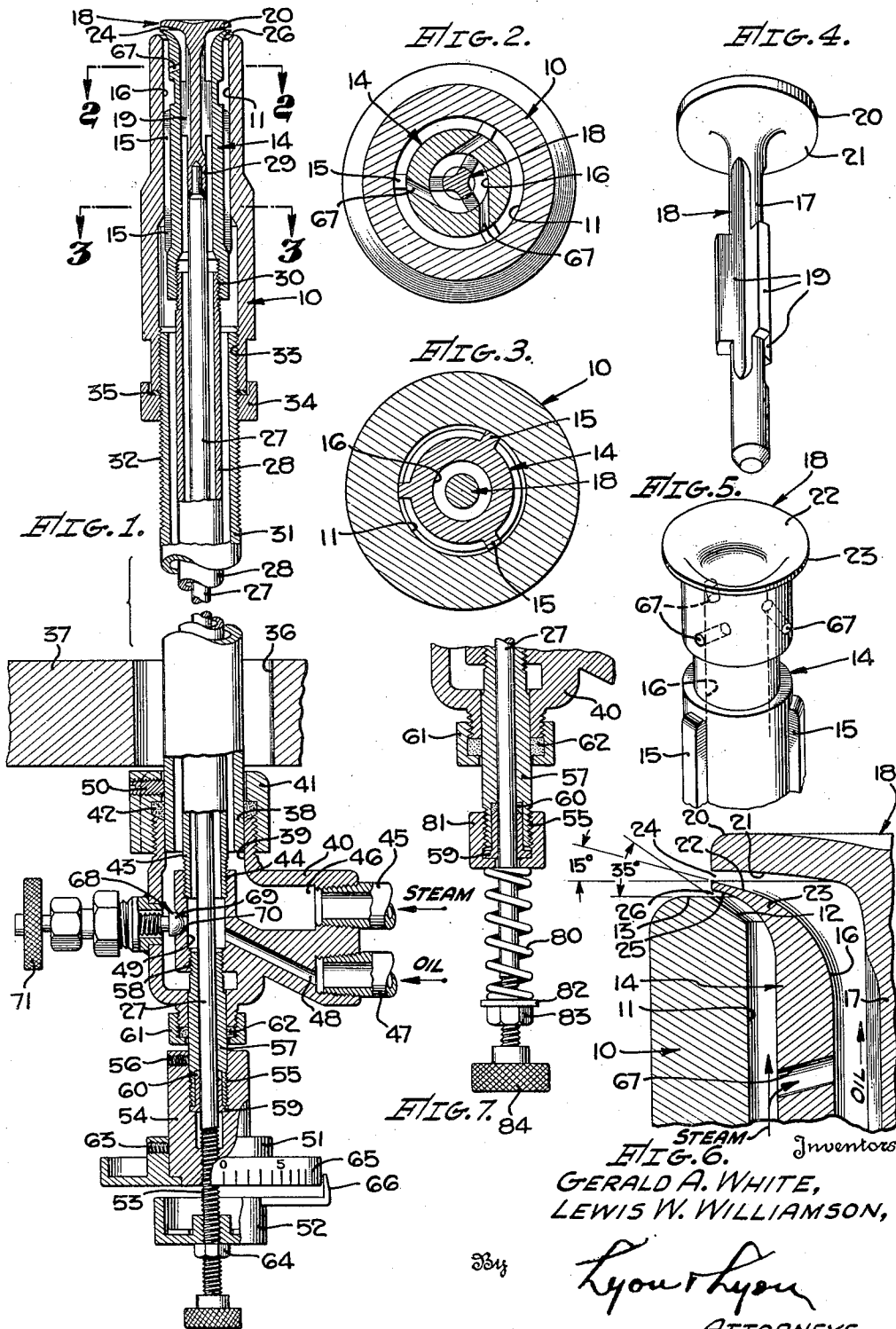
June 30, 1953

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2,643,916

FUEL BURNER

Filed April 25, 1949



UNITED STATES PATENT OFFICE

2,643,916

FUEL BURNER

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Application April 25, 1949, Serial No. 89,418

1 Claim. (Cl. 299—141)

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This invention relates to fuel burners and is particularly directed to improved apparatus for efficient burning of liquid fuel, such as oil.

Present day oil fired heaters suffer from poor fuel utilization, high maintenance cost, and operating difficulties brought about by relatively inefficient oil burners. Consequently, the heater unit itself must be made larger and more expensive because of the larger fuel volumes required for heat release from the fuel oil as compared with gaseous fuel.

The principal objects of this invention are to provide a novel form of steam-atomizing oil burner of the external mixing type which (a) burns cleanly with a minimum of residue, (b) accommodates itself automatically to varying loads within a wide range, (c) provides excellent atomization throughout this range, (d) burns with a confined efficient flame with a short wide pattern, and (e) may be quickly and readily cleaned in the event foreign matter should lodge near the fuel orifice.

More specifically it is an object of this invention to provide a steam-atomizing oil burner incorporating a novel form of nozzle having adjacent ring-type orifices for fuel and steam.

A related object is to provide adjacent orifices for steam and fuel oil arranged so that the burner tip is kept clean in operation and so that oil drips do not form.

Other more detailed objects and advantages will appear hereinafter.

In the drawings:

Figure 1 is a longitudinal sectional view showing one embodiment of our invention.

Figure 2 is a transverse sectional view taken substantially on the lines 2—2 as shown in Figure 1.

Figure 3 is a transverse sectional view taken substantially on the lines 3—3 as shown in Figure 1.

Figure 4 is a perspective view of a burner tip member employed in connection with our invention.

Figure 5 is a perspective view partly broken away showing a deflector element employed in connection with our invention.

Figure 6 is a longitudinal sectional detail on an enlarged scale and partly broken away showing a preferred arrangement for adjacent ring orifices for steam and fuel.

Figure 7 is a sectional detail partly broken away showing a modified form of mechanism for automatically varying the width of the fuel ring orifice during operation.

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Referring to the drawings, a shell 10 is provided with a central bore 11 which terminates at a conical face 12 adjacent the outer end 13. A deflector member generally designated 14 is provided with axially extending angularly spaced guide fins 15 which are slidably received within the bore 11 of the shell 10. The deflector member 14 is provided with an axial bore 16 which receives the stem portion 17 of the burner tip member generally designated 18. Angularly spaced fluted guides 19 extend axially on the stem 17 and are received in sliding relationship within the axial bore 16 of the deflector member 14. A flanged head or tip 20 is provided on the outer end of the member 18. The underside 21 of the burner flange 20 cooperates with the outer surface 22 of the flared lip 23 formed on the outer end of the member 14 to provide a continuous ring orifice 24. The inner surface 25 of the flared lip 23 cooperates with the conical face 12 on the shell 10 to provide a second ring orifice 26.

The ring orifices 23 and 26 are formed as continuous circles and are separated only by the flared lip 23 on the member 14. Fuel oil passing through the axial opening 16 is sprayed in a forwardly directed cone outward from the orifice 24. This oil mixes with steam issuing in a forwardly directed cone from the orifice 26 so that atomization of the oil occurs exteriorly of the burner assembly between the intersecting cones of fuel and steam. The relationship of the flared lip 23 with respect to the surfaces 21 and 12 insures that the burner tip is kept clean and so that oil drips do not form. The steam adjusts the size of the flame by its impinging action exterior to the oil spray, and the burner tip is prevented from overheating and fouling. As shown in Figure 6 of the drawings the steam may emerge from the orifice 26 at about a 35° angle and the oil may emerge from the orifice 24 at about a 15° angle, so that the contact angle between the oil and steam is 20°. This is a preferred arrangement, but we have found that angles of 0 to 30° for the oil and 5 to 60° for the steam operate satisfactorily providing the contact angle between the steam and oil is at least 5°. Air for combustion is drawn inwardly through the opening 36 and passes around the shell 10 and axially thereof to supply oxygen for the flame. The velocity of the blast of air passing inwardly through the opening 36 affects the pattern of the flame: good distribution of air insures a good flame pattern.

The stem 17 of the burner tip member 18 is

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secured to a central control rod 27 which extends through the interior of the oil pipe 28. The member 18 may be connected at 29 to the control rod 27 by any convenient means such as, for example, by brazing. The burner tip member 18 may be connected to the outer end of the oil pipe 28 by means of the threads 30. The steam pipe 31 is provided with external threads 32 which engage internal threads 33 provided on the shell 10. A lock nut 34 serves to compress a sealing washer 35 against the end of the shell 10 and to anchor the shell in adjusted position with respect to the steam pipe 31.

The steam pipe 31, oil pipe 28 and control rod 27 extend through an opening 36 provided in the wall 37 of a heater. The inner end 38 of the steam pipe may be received within an opening 39 provided in the supporting body 40 and a threaded gland 41 and packing ring 42 provide a fluid-tight joint. A set screw 50 may be employed to secure the gland 41 to the steam pipe 31. The inner end 43 of the oil pipe 28 is connected by threads 44 to the body 40. The control rod 27 extends through the body 40. Steam supplied through pipe 45 enters the body cavity 46 and passes into the interior of the steam pipe 31. Fuel oil supplied by pipe 47 enters the body passage 48 and central cavity 49 and then passes around the control rod into the oil pipe 28.

Means are provided for adjusting the width of the fuel orifice 24 by moving the burner tip member 18 with respect to the deflector member 14. As shown in Figure 1 this means includes a stationary calibrated disk 51 and a pointer collar 52 secured for turning movement with the control rod 27. The outer end of the rod 27 is threaded as shown at 53, and is received in the threaded hub 54. This hub is fixed by means of threads 55 and set screw 56 to sleeve 57 which in turn is secured by threads 58 to the stationary body 40. A gland ring 59 encircles the control rod 27 within the hub 54 and engages a packing ring 60 to form a fluid-tight seal. Another gland ring 61 is threaded to the body 40 and serves to compress packing ring 62 to form a seal between the body 40 and sleeve 57. The calibrated disk 51 is fixed to the hub 54 by means of set screw 63. The pointer collar 52 is internally threaded to receive the threads 53, and a lock nut 64 is provided to secure the pointer collar in adjusted position on the rod 27. When the pointer collar 52 and consequently the control rod 27 are turned the threads 53 on the rod turn within the threaded hub 54 and thus the rod 27 and burner tip member 18 are moved axially. The calibrations 65 on the disk 51 may be so related to the pitch of the threads 53 that movement of the pointer 66 from one calibration to the next corresponds to axial movement of the control rod 27 for 0.001 inch. From this description it will be understood that the width of the fuel orifice 24 may be accurately regulated by turning the pointer member 52 and the total width of the orifice may be indicated by the pointer 66 and calibrations 65.

The width of the steam orifice 26 may be set at any desired value by turning the shell 10 with respect to the steam pipe 31 and then locking it in adjusted position by means of the lock nut 34.

It is highly advantageous that the oil passing through the orifice 24 be discharged in a continuous ribbon without breaks or gaps. In order to insure that the oil reaches the orifice in a con-

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tinuous ribbon, we prefer to provide steam-to-oil dilution ports 67 which extend through the wall of the deflector member 14 at a location near the outer end of the burner assembly. These ports 67 communicate tangentially with the axial passage 16 so that a swirling motion is imparted to the oil within the passage 16 by the steam which passes inwardly through the port 67. This swirling motion imparted to the oil causes the oil to cover all portions of the surfaces 21 and 22 so that the discharge from the fuel orifice 24 is in the form of a continuous ribbon. The thickness of this ribbon may vary from a few thousandths of an inch to a much larger value, depending on the quantity of oil required. The major portion of the steam passes through steam orifice 26, and only a minor portion passes through ports 67. The more steam which passes through the ports 67 in proportion to the steam passing through the steam orifice 26 has the effect of increasing the diameter of the flame.

Fuel burners made in accordance with our invention remain clean for a much longer period of time than do conventional oil burners, because fuel drips do not form or accumulate. Should foreign matter clog the fuel orifice, it may be flushed away readily by moving the rod 27 in a direction to increase the width of the fuel orifice. Furthermore, steam may be admitted into the interior of the oil pipe 28. This may be accomplished through the provision of the valve assembly 68 which operates a closure 69 for the bypass duct 70 within the body 40. When the valve 68 is opened by means of the operating knob 71, steam flows from the body cavity 46 inwardly through the bypass duct 70 into the central cavity 49 and then into the oil tube 28.

In the modified form of our invention shown in Figure 7, the calibrated disk 51 is not used and instead a coil spring 80 encircles the projecting end of the control rod 27 which extends from the exposed end of the sleeve 57. A gland 81 is threaded at 55 to the sleeve 57 and serves to move the ring 59 in a direction to compress the packing ring 60. One end of the spring 80 engages the gland 81 and the other rests against a collar 82. The collar 82 is held in position by a nut 83 threaded to the control rod 27. The action of the spring 80 is to move the rod 27 in a direction to reduce the size of the fuel orifice 24. This action of the spring is opposed by the pressure of the oil acting against the surface 21 on the burner tip flange 20. A higher rate of flow of oil causes the orifice 24 automatically to increase in width. This is a highly advantageous feature because the best atomizing action occurs at one flow rate for any given orifice size since the atomizing action depends upon the oil pressure producing it. From this description it will be understood that the burner tip member 19 floats with respect to the deflector member 14 so that the width of the fuel orifice 24 at any instant is determined by the spring 80 and the rate of flow of oil through the orifice.

The flame produced by either of the burner constructions described is relatively short with a wide pattern. The forward flame velocity drops rapidly. This is of decided advantage in connection with the installations in fired heaters, boilers, etc., where it is desired to prevent impingement of the flame on the far wall of the fire box.

Cleaning of the burner tip is accomplished very readily when that form of our invention shown in Figure 7 is employed. The operator need only

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press the knob 84 at the end of the rod 27 in a direction to compress the spring 89. The width of the fuel orifice is thereby increased, allowing any accumulation of foreign matter to be flushed away.

Having fully described our invention, it is to be understood that we do not wish to be limited to the details herein set forth, but our invention is of the full scope of the appended claim.

We claim:

In a fuel burner, the combination of: a tubular member having an outwardly and forwardly extending flared circular lip at one end, said member having a central axial bore and an external cylindrical surface, the flared lip having a curved outer surface merging with said external cylindrical surface and a curved inner surface merging with said central axial bore, the said outer and inner surfaces on the flared lip tapering to a thin edge, said surfaces being substantially parallel adjacent said thin edge, an axially extending rod slidably mounted within said bore, an outwardly extending head at one end of the rod cooperating with said outer surface on the tubular member to define a first ring orifice to emit a forwardly extending cone of

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atomizing fluid, a shell mounted for axial sliding movement with respect to said tubular member, the shell having a central bore, one end of the shell being shaped to cooperate with said inner surface on the tubular member to define a second ring orifice to emit a forwardly extending cone of fuel intersecting the cone of atomizing fluid, and means for supplying a fuel to one of said bores and an atomizing fluid to the other, whereby atomization of the fuel by the atomizing fluid occurs on a full circle exteriorly of the lip between the forwardly extending intersecting cones of fuel and atomizing fluid.

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