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W. O. BEHRENS

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OIL BURNER

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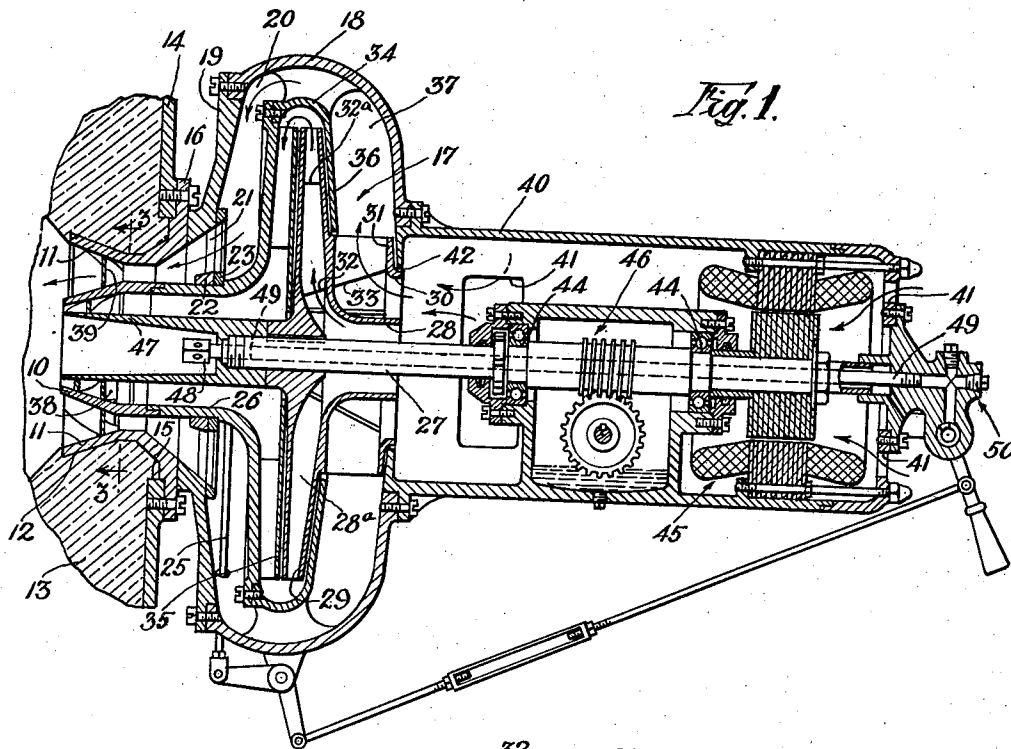


Fig. 1.

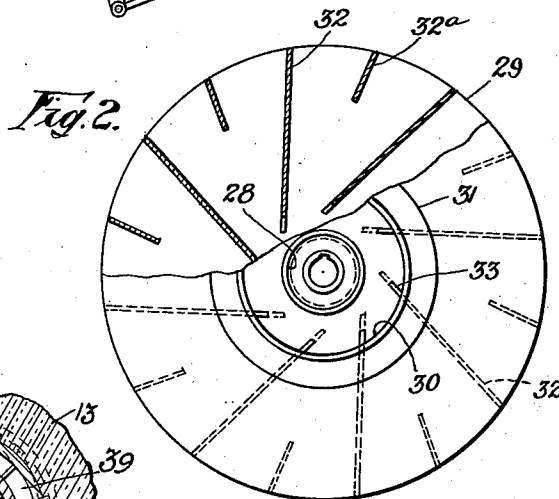


Fig. 2.

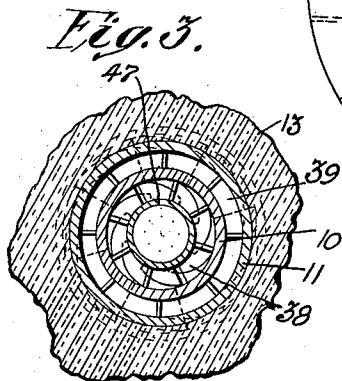


Fig. 3.

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OIL BURNER

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Application June 25, 1937, Serial No. 150,279

7 Claims. (Cl. 158-77)

The invention relates to oil burners and more particularly to the type of oil or liquid fuel burner in which all of the air necessary for combustion, both primary and secondary, is supplied by forced draft to the primary and secondary air nozzles.

The present application is a continuation in part of my copending application, Serial No. 90,232, filed July 11, 1936.

An object of the invention is to provide an improved burner of this type in which the primary and secondary air nozzles are so constructed and arranged as to produce an extremely turbulent air discharge at the nozzles and, consequently, a complete and thorough mixing of fuel oil and air for more efficient combustion than has been possible heretofore.

Other objects and advantages will become apparent in the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view of an oil burner embodying the features of the invention.

Fig. 2 is an end view in elevation of a rotary blower with a section of the blower broken away to show the underlying construction.

Fig. 3 is a transverse sectional view taken substantially along line 3-3 of Fig. 1.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and will herein describe in detail, the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

The oil burner shown in the drawing for purposes of disclosure is of the type adapted to discharge a turbulent mixture of atomized fuel and air conditioned for efficient combustion, preferably into a sealed furnace. The present invention is embodied in a burner having a primary air nozzle 10 coaxially aligned with a circumscribing secondary air nozzle 11 of generally Venturi shape rigidly secured in and adapted to discharge into an end opening 12 in a refractory furnace wall 13. A burner front plate 14 is secured against the exterior of the wall 13 and has an opening 15 to receive the nozzles. An annular flange portion 16 of the nozzle 11 is secured to the plate 14 to hold the nozzles in place.

Low pressure high volume air is supplied to the secondary air nozzle and relatively high pres-

sure low volume air is supplied to the primary nozzle by means of a compound rotary blower (indicated generally at 17) enclosed within a housing 18. The housing 18 together with a cover 19 is suitably supported to form the outer wall of an air passage 20 opening to the nozzle 11 and to the source of secondary air supply. The cover 19 is formed with a suitably apertured plate member 21 extending transversely of the axis and terminating in an inner ring 22 to provide the stationary element of a damper for throttling the secondary air supply from the blower. A rotary damper member 23, similarly apertured, is operatively disposed against the plate member 21 and is adjustable by means of a rod 25 pivotally connected to one side thereof and extending out of the housing.

The primary air nozzle is mounted on the end of a tube 26 which constitutes the outlet from the source of primary high pressure air. The tube 26 is supported on the ring 22 in spaced relation to the cover plate 19 to provide an inner wall for the secondary air passage 20.

The secondary air nozzle 11, having substantially the shape of a Venturi tube, comprises, in the present instance, an inlet cone, an intermediate straight throat and an expanding outlet cone. The primary air nozzle 10 extends substantially through the secondary air nozzle 11 and coacts therewith to define an annular secondary air passage. The primary air nozzle is tapered toward its discharge end within the outlet cone of the secondary air nozzle to expand the outer end of the secondary air passage. An atomizing cup 47, mounted for rotation, as hereinafter described, extends coaxially substantially through the primary nozzle 10 and coacts therewith to define an annular primary air passage restricted in the region of taper of said primary air nozzle.

Thus it will be apparent that the primary and secondary air nozzles coact to define an intervening annular air passage for the secondary air having substantially a Venturi shape in cross section taken longitudinally of said passage, resulting in an increased turbulence of the air discharged at the nozzle and, consequently, more thorough mixing of the fuel and air and more effective combustion. Likewise the opposed walls of the atomizing cup and the primary air nozzle being relatively inclined to each other progressively restrict the flow area of the outer end portion of the primary air passage to increase the speed of discharge of the primary air for more efficient combustion.

The blower construction 17 supplies both primary and secondary air to the nozzles from a unitary compound disk fan. In the present instance, the blower is mounted for rotation on a horizontally disposed drive shaft 27 and has the form of a double disk fan with an axial inlet 28 gradually enlarging radially to communicate with a radially extending annular air passage 28^a having a peripheral discharge 29 for high pressure air and an annular inlet 30 circumscribing the axial inlet 28 and communicating with a peripheral discharge 31 for low pressure air. Since the air pressure delivered by a disk fan is a function of the tip speed of the blades, the diameter of the peripheral discharge 29 for high pressure air is greater than that for low pressure air and I employ fan blades (illustrated at 32) of considerably greater length in the former than the blades (indicated at 33) in the latter. Likewise the blades in the low pressure side are broader than those on the high pressure side since a greater volume of air is desired in the former. Peripherally disposed supplementary blades 32^a may be provided for the high pressure stage as auxiliary air impellers.

An internal housing 34 encloses the high pressure side of the fan and together with a circular baffle or guide plate 35 serves to direct air from the primary discharge inwardly to the tube 26. The housing 34 has an inner end wall 36 which together with the housing 18 forms an air passage 37 between the low pressure discharge and the passage 20 to the secondary air nozzle. The low pressure side of the blower, although smaller in diameter than the high pressure side, discharges substantially parallel thereto into the housing 18 and the secondary air is directed into the passage 37 between said housings and hence into the passage 20 to the secondary nozzle.

To promote an intimate fuel mixture and fine atomization of the fuel, two sets of peripherally spaced helical vanes 38 and 39 are disposed respectively within the nozzles 10 and 11 in the high pressure and low pressure air discharge passages. These sets of vanes are oppositely inclined and rigid with respect to the nozzles. Nozzles with vanes of different inclination may be substituted depending on the nature of the flame desired. Thus, the flame may be long and narrow or short and wide. The vanes are so orientated that, assuming the atomizing cup 47 is rotating clockwise when viewed from the left in Fig. 1, the high pressure primary air is discharged counterclockwise, and the low pressure secondary air is discharged clockwise.

Enclosing the inlet side of the housing 18 is a cylindrical housing 40 having a plurality of air inlets 41 opening from the atmosphere. The inner end wall of the housing 40 is formed with an axial outlet opening 42 communicating with the blower intakes 28 and 30, and which is in direct registration and closely interfitting relation therewith.

The shaft 27 extends into the housing 40 where it may be suitably journaled in spaced bearings 44 and driven by any desired driving means, as an electric motor 45. A suitable fuel pump (not shown) may be provided and driven from a worm gear mechanism (indicated at 46).

The atomizing cup 47 is mounted on the inner end of the shaft 27 for rotation therewith, and is flared internally toward the open end. Extending longitudinally through the shaft 27, which is hollow for this purpose, is an elongated fuel supply tube 49. A fuel nozzle 48 is mounted

on the outlet end of the tube 49 within the atomizing cup 47. The other end of the tube 49 is adapted to be connected through a valve mechanism 50 to the source of fuel. The valve 50 is interconnected with the rod 25 for jointly controlling the supply of fuel and secondary air.

I claim as my invention:

1. In an oil burner, the combination comprising a secondary air nozzle having the shape of a Venturi tube with an inlet cone, a throat and an expanding outlet cone, a primary air nozzle extending through said secondary air nozzle in peripherally spaced relation thereto, said primary air nozzle being tapered toward its discharge end from a point adjacent the minimum diametral throat section of the secondary air nozzle, to provide therewith an annular air passage of Venturi shape, means for supplying fuel oil axially through said primary air nozzle, and means for supplying air under superatmospheric pressure to said primary nozzle and to said secondary nozzle.

2. In an oil burner, the combination comprising, a secondary air nozzle adapted to be supported on and to discharge through a furnace wall, said nozzle having the shape of a Venturi tube with an inlet cone and an expanding cone, a primary air nozzle extending into said secondary air nozzle, said primary air nozzle being tapered from the region of minimum lateral flow area of said secondary nozzle toward its discharge end to provide with said secondary air nozzle an annular air passage of Venturi shape, means for supplying air under superatmospheric pressure to said primary nozzle, means for supplying air under superatmospheric pressure to said secondary air nozzle, a fuel nozzle mounted coaxially of and extending into said primary air nozzle, and means for supplying fuel oil to said fuel nozzle.

2. In a fuel oil burner, in combination, a secondary air nozzle having substantially the shape of a Venturi tube, a primary air nozzle extending into said secondary air nozzle and coacting with said secondary nozzle to define an intervening annular air passage having substantially a Venturi shape in cross section taken longitudinally of said passage, a shaft extending axially of said nozzles, an atomizing cup on said shaft and extending into said primary air nozzle, a fuel supply tube extending through said shaft, a fuel nozzle on said tube to discharge fuel oil within said cup, and means for supplying combustion air under forced draft to both of said air nozzles.

4. In an oil burner, the combination comprising, a secondary air nozzle with an inlet cone, an intermediate straight throat and an expanding outlet cone, a primary air nozzle extending coaxially substantially through said secondary air nozzle and coacting therewith to define an annular secondary air passage, said primary nozzle being tapered toward its discharge end within said outlet cone to expand the outer end of said passage, a plurality of peripherally spaced helical vanes in said outlet cone inclined in one direction to impart a swirling motion to the air flowing through said passage, an atomizing cup extending coaxially substantially through said primary nozzle and coacting therewith to define an annular primary air passage restricted in the region of taper of said primary nozzle, a drive shaft rotatably supporting said cup, a plurality of helical vanes fixed in the tapered portion of said primary nozzle in peripherally spaced rela-

tion about said cup and inclined oppositely to said first mentioned vanes to impart a swirling motion to the air flowing through said primary air passage, a fuel nozzle to discharge fuel oil in said cup, means for supplying fuel oil to said fuel nozzle, and means for supplying air under forced draft to said air nozzles.

5 5. In an oil burner, the combination comprising, a secondary air nozzle with an expanding outlet cone, a primary air nozzle extending coaxially substantially through said secondary nozzle and coacting therewith to define an annular secondary air passage, said primary nozzle being tapered toward its discharge end within said outlet cone, a plurality of peripherally spaced vanes in said outlet cone, an atomizing cup extending coaxially substantially through said primary nozzle and coacting therewith to define an annular primary air passage restricted in the region of taper of said primary nozzle, a drive shaft rotatably supporting said cup, a plurality of helical vanes fixed in the tapered portion of said primary nozzle in peripherally spaced relation about said cup, a fuel nozzle to discharge fuel oil in said cup, means for supplying fuel to said fuel nozzle, and means for supplying air under forced draft to said air nozzles.

6. In a fuel oil burner, in combination, two spaced concentric air nozzles terminating substantially in a common transverse plane and defining an intervening annular air passage, the opposed walls of said nozzles being relatively longitudinally inclined to each other to impart to said passage a shape flaring from a transverse plane of minimum flow area intermediate the

ends of said nozzles to the discharge end, an atomizing cup extending coaxially and in peripherally spaced relation substantially through the inner nozzle and coacting therewith to define an intervening annular air passage, the opposed walls of said inner nozzle and said cup being relatively longitudinally inclined to each other to progressively restrict the flow area of the outer end portion of said last mentioned passage, means for rotating said cup, a fuel nozzle to discharge fuel oil in the inner end of said cup, means for supplying fuel to said fuel nozzle, and means for supplying air under forced draft to both of said air passages.

7. In a fuel oil burner, in combination, a secondary air nozzle having substantially the shape of a Venturi tube, a primary air nozzle extending into said secondary air nozzle and coacting with said secondary air nozzle to define an intervening annular air passage having a shape flaring longitudinally to the discharge end from a transverse plane of minimum flow area intermediate the ends of said nozzles, a tubular shaft extending axially of said nozzles, an atomizing cup on said shaft and extending into said primary air nozzle and coacting with said primary air nozzle to define an intervening annular air passage, a fuel nozzle mounted in the inner end of said atomizing cup and connected to receive fuel axially through said shaft and to discharge the fuel within said cup, and means for supplying combustion air under forced draft to both of said nozzles.

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