May 11, 1926. 1,583,996

E. A. REID

VERTICAL FUEL OIL BURNER

Filed Oct. 22, 1924

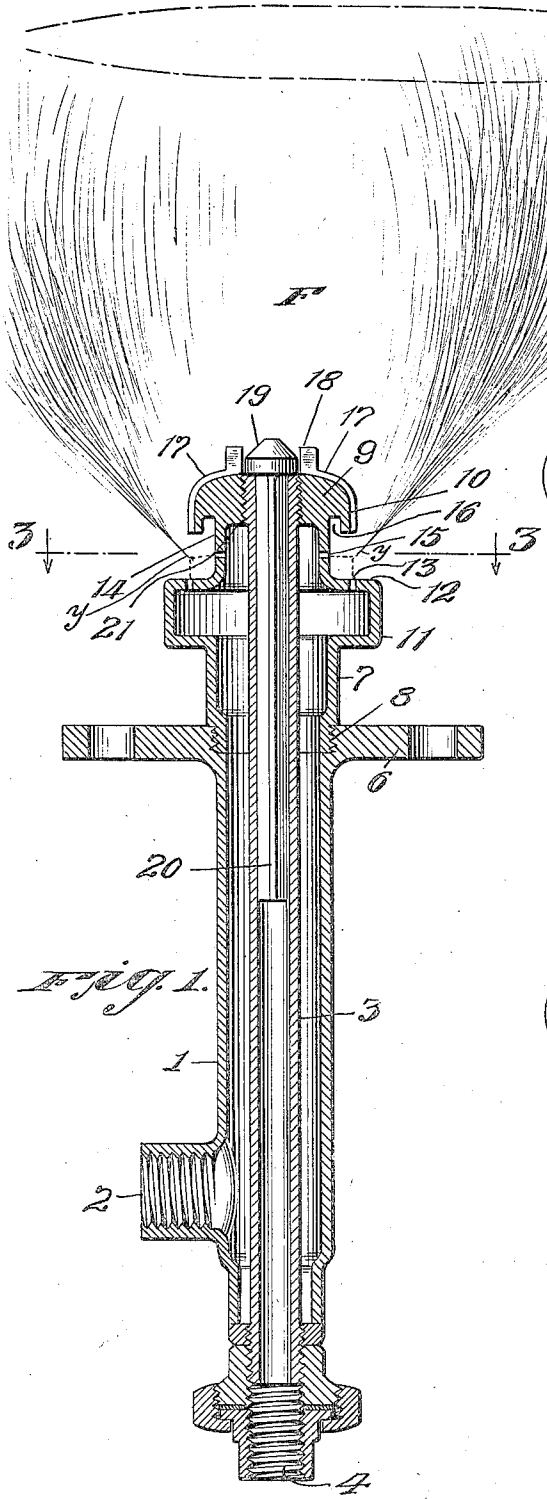


Fig. 1.

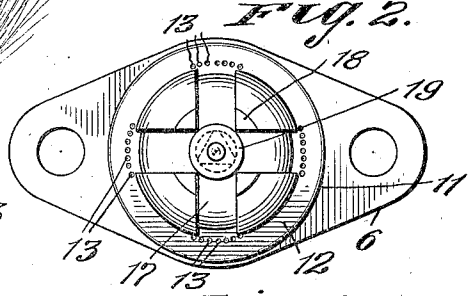


Fig. 2.

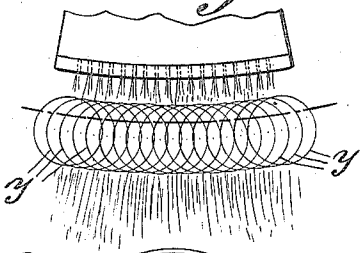


Fig. 4.

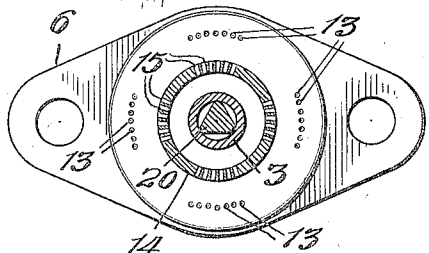


Fig. 3.

INVENTOR.

Ernest A. Reid

BY Ernest S. Reed

ATTORNEY

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UNITED STATES PATENT OFFICE.

ERNEST ANDREW REID, OF LONDON, ENGLAND.

VERTICAL FUEL-OIL BURNER.

Application filed October 22, 1924. Serial No. 745,062.

This invention relates to vertical fuel oil burners. Its object is to produce a simple and efficient vertical apparatus for atomizing and burning fuel oil according to the broad method set forth in my United States Patent No. 1,478,255 of Dec. 18, 1923.

By the present invention, an upright, continuous annular flame is effected. My new fuel oil burner is useful in a great variety of heating installations, wherein, for one reason or another, a compact, vertical burner yielding an annular flame is desired.

In the accompanying drawings illustrating the invention and forming a part hereof,

Fig. 1 is a vertical central section of a vertical burner embodying the invention, at line 1—1 of Fig. 2.

Fig. 2 is a top plan view of said burner.

Fig. 3 is a horizontal, cross-sectional plan of the burner at line 3—3 of Fig. 1.

Fig. 4 is a diagrammatic plan view illustrative of the jetting operation of my improved burner.

In the illustrated form of the burner, 1 indicates an upright, tubular conduit for atomizing fluid. It is provided at its lower part with an intake port 2 for either steam or compressed air. Within and concentric with the atomizing fluid conduit, there is mounted an upright fuel oil conduit 3 the under end of which has a port 4 for intake of the fuel oil. Conduit 3 has an exterior diameter less than the interior diameter of the outer tube 1 forming an atomizing fluid chamber between the ends of the burner. The upper end of the outer tube 1 is provided with a horizontal flange 6 for positioning the atomizing burner in an upright position on a support, not shown. An atomizing burner head 7 is threaded into the flange at 8, the head 7 being chambered from its under end to its solid, upper end 9 which is annular in cross section, forming downwardly sloping walls which serve as oil film forming surfaces 10 Between its ends the chambered head 7 is formed with an annular, horizontal chambered enlargement 11 the upper wall 12 of which is annular and provided with four equally spaced apart series of vertical jet orifices 13. Above the chambered enlargement 11 the diameter of the head is reduced into an upstanding tube 14, the vertical wall of which is provided with four spaced apart series of horizontal jet orifices 15. These jet orifices 13 and 15 are arranged in pairs in a vertical plane, so that a jet issuing through an orifice impinges directly on a jet through another orifice in the same plane and being a member of the same pair. The solid, upper end of the head is annularly grooved at 16 forming a recess between the dependent annular lip 10^a and the opposed wall 14, whereby oil creeping down the film forming surfaces 10 and falling from the lip 10^a upon the intersection of the jets is prevented from creeping backwardly and flowing down the wall of the head. As shown, the downward sloping film forming wall surface 10 of the solid upper end of the head is divided into a series of film-ways by upstanding film guides 17, which may or may not be dispensed with; the width of which may be varied and which may or may not be integral with the solid end 9 of the head. They are shown integral. And their purpose is to guide the films edgewise in the downward flow of the films severally towards a group of jet orifices 13. The lip 10^a is positioned to discharge the film as a thin curtain downwardly through the atmosphere upon the intersections of the jets of atomizing fluid, as described in my said patent and in my said pending application. The upper ends of the film guides are provided with upstanding lugs 18 which form vertical guides for the head 19 of the triangular valve stem 20, which is slidable in the upper end portion of the fuel oil receiving conduit 3. The upper end of conduit 3 is threaded into a central, vertical aperture in the solid end 9, as at 3^a. The upper end of tube 3 is flush with the upper surface of the solid head 9 and as the fuel oil is delivered into conduit 3, under pressure, it will lift the valve head 19 and permit oil to flow out over the film forming surfaces 10 and drop as a thin curtain upon the intersections of jets of atomizing fluid. If desired, the jet orifices 13 may be extended entirely around the horizontal wall 12 and the jet orifice 11 may be extended entirely around the burner head wall 14. But this is unnecessary to produce a tubular flame. Four equally spaced apart sets of jet orifices serve to effect a tubular flame F, as indicated in Fig. 1, for the upward draft exerted on the ignited mixture, when the burner is in use, sucks the flame into an annular form at a point above the upper end of the burner.

The jetting orifices being arranged in

pairs having their axes in a vertical plane, establish an approximately slanting series of overlapping zones y of atomization, free from interstices, through which oil from the oil curtain can drop and result in carbonization, as illustrated in Fig. 4.

In the burner shown in said earlier patent and also according to the present invention, the fuel oil is distributed in the form of a film which falls over a transverse lip as a thin curtain, in front of a plurality of converging jets of atomizing fluid under pressure, the oil film or curtain extending theoretically and generally in practice, the whole transverse width of the burner lip.

An advantage of said patented burners and of the present improved burner is that, owing to the fact that the velocity of the atomizing fluid is minimized by the impinging of one jet on the other, and further by the dropping of the film of fuel oil on the point of collision of the jets, the atomized mixture of fluid and fuel or combustible product enters a furnace on which the burner is installed with a very low velocity, providing thereby the necessary element of time for a thorough and early admixture of the necessary oxygen to insure immediate and perfect combustion of the atomized fuel to CO_2 with the result that a short and intense, well-distributed and even flame is produced. The time element which this burner introduces is one of the features characterizing the working of this burner. It is found in practice that practically smokeless combustion is produced if the fuel oil and atomizing fluid supply are correctly adjusted.

It has been found in actual practice that with burners provided with the atomizing jets with their axes of impingement in a vertical plane instead of in the horizontal plane that dripping of oil is minimized. This is owing to the fact that the zone of dispersed atomization, due to each pair of jets, is at right angles to their axes of impingement, the dispersion zone formed by one pair overlapping that produced but the neighboring pair of jets and forming thereby a complete and continuous zone of dispersed atomization, which does not permit the dropping through the zone of dispersed atomization of the fuel. If this occurred, it would cause trouble in operation by the oil dropping on to the floor of the furnace and carbonizing there. In order to effect this action, it will be noted that with jets impinging with their axes horizontally the zones of dispersion will be vertical, and it is practically inevitable that in this way interstices will be formed between adjacent zones of dispersion, and fuel will be apt to drop through. The complete and satisfactory combustion of the fuel oil in a burner with the atomizing jets, located one above the other and with their axes of impingement vertical, is further assured by the construction given to the lower edge of the lip of the burner which is formed with an irregular edge, so that the oil, due to its viscosity and surface tension produced, maintains a film of practically even thickness the whole width of the burner, insuring thereby the even working of the atomizing fluid and the production of an entirely even and well dispersed flame; securing also a uniform distribution of heat in the boiler or furnace or object to be heated.

The overlapping zones y of atomization slant upwardly at the base of the tubular flame F.

What I claim is:

1. As a new article of manufacture, a vertical, fuel oil burner comprising an upstanding, atomizing fluid conduit provided with upwardly discharging jet orifices and with laterally outward, discharging jet orifices spaced apart from the upwardly discharging jet orifices; an upstanding, fuel oil conduit having its discharge end in the upper surface of a top wall of the burner top; said burner top having a wall sloping downwardly and forming an oil film supporting surface, said surface being provided at its bottom with an oil film delivering lip located to discharge the same as a thin oil curtain at the points of intersection of said jets; and for the upward discharge end of the fuel oil conduit, a valve automatically unseatable by the upward pressure of fuel oil in said fuel oil conduit; said jet orifices being arranged in pairs, the axes whereof are in a vertical plane.

2. As a new article of manufacture, a vertical, fuel oil burner comprising an upstanding, atomizing fluid conduit provided with upwardly discharging jet orifices and with laterally outward, discharging jet orifices spaced apart from upwardly discharging jet orifices; an upstanding, fuel oil conduit having its discharge end in the upper surface of a top wall of the burner top; said burner top having a top wall sloping downwardly and forming an oil film supporting surface, said surface being provided at its bottom with an oil film delivering lip located to discharge the same as a thin oil curtain at the points of intersection of said jets; and for the upward discharge end of the fuel oil conduit, a valve automatically unseatable by the upward pressure of fuel oil in said fuel oil conduit; said fuel oil conduit extending upwardly through the atomizing fluid receiving conduit and said atomizing fluid receiving conduit having a horizontal chambered enlargement the upper wall whereof is provided with a series of upwardly discharging jet orifices and the atomizing fluid receiving conduit thereabove having a series of laterally discharging jet

orifices and terminating upwardly in a top, circular in cross section and formed with an annular and downwardly sloping wall on which an oil film is formed, such annular wall terminating in an annular film discharging lip; and the upper end of said fuel oil receiving conduit discharging oil upon the upper surface of said head.

3. As a new article of manufacture, a vertical, fuel oil burner comprising an upstanding, atomizing fluid conduit provided with upwardly discharging jet orifices and with laterally outward, discharging jet orifices spaced apart from the upwardly discharging jet orifices; an upstanding, fuel oil conduit having its discharge end in the upper surface of a top wall of the burner top; said burner top having a wall sloping downwardly and forming an oil film supporting surface, said surface being provided at its bottom with an oil film delivering lip located to discharge the same as a thin oil curtain at the points of intersection of said jets; and for the upward discharge end of the fuel oil conduit, a valve automatically unseatable by the upward pressure of fuel oil in said fuel oil conduit; said fuel oil conduit extending upwardly through the atomizing fluid receiving conduit and said atomizing fluid receiving conduit having a horizontal chambered enlargement the upper wall whereof is provided with a series of upwardly discharging jet orifices and the atomizing fluid receiving conduit thereabove having a series of laterally discharging jet orifices and terminating upwardly in a top, circular in cross section and formed with an annular and downwardly sloping wall on which an oil film is formed, such annular wall terminating in an annular film discharging lip; and the upper end of said fuel oil receiving conduit discharging oil upon the upper surface of said head; said discharge orifices being grouped in four series equally spaced apart and the upper surface of said head being provided with film guides positioned to direct an oil film relatively to each group of the jet orifices.

Signed at New York city, in the county of New York and State of New York, this 16" day of October A. D. 1924.

ERNEST A. REID.