

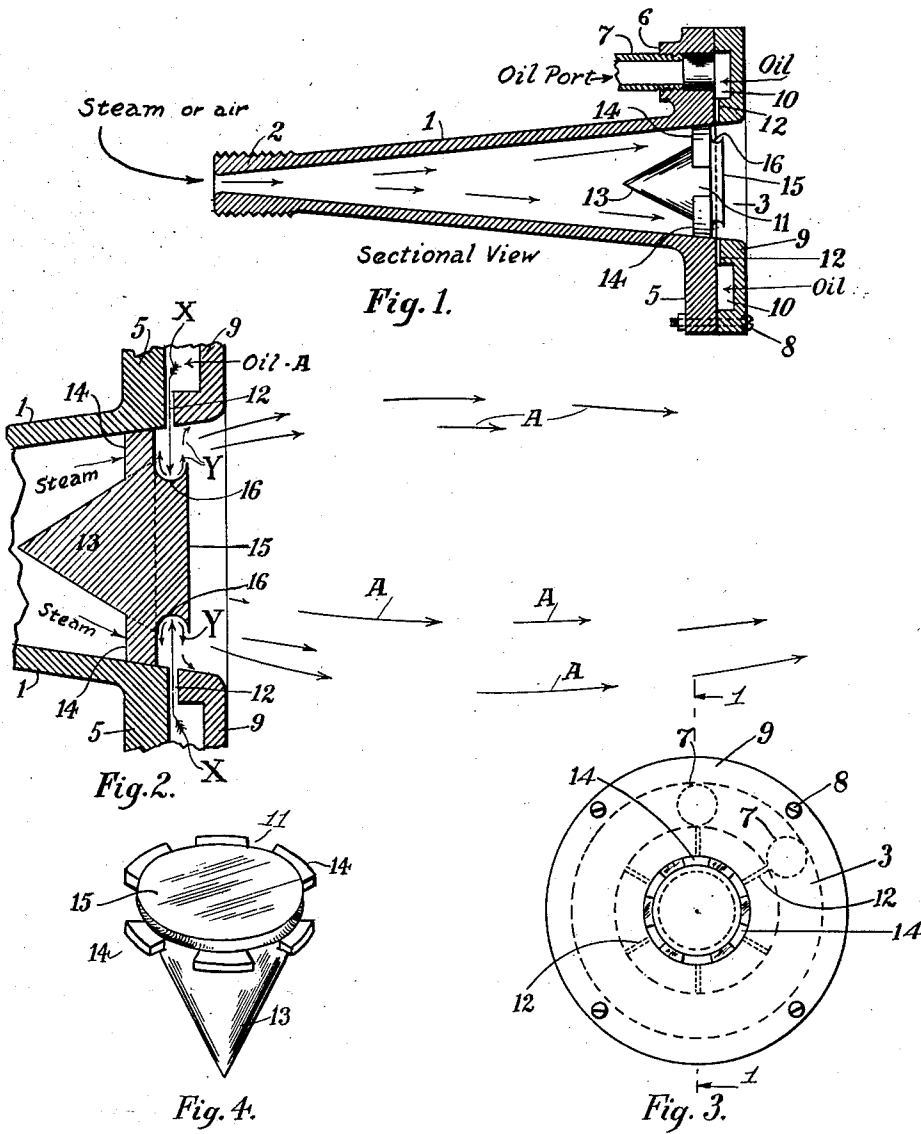
Dec. 23, 1930.

H. ADAMS

1,785,802

ATOMIZING JET NOZZLE

Filed Nov. 16, 1923



Inventor:
Henry Adams,
By his Attorney
Harold O. Penney

UNITED STATES PATENT OFFICE

HENRY ADAMS, OF PLAINFIELD, NEW JERSEY

ATOMIZING JET NOZZLE

Application filed November 16, 1923. Serial No. 675,150.

My present invention relates to a new method of atomization of fuels, and that improvement involved in a burner apparatus therefor, and has for its special object the attainment of a more efficient atomization of flowable fuels, such as liquid or dry colloidal materials of any combustible nature.

This burner is very efficient in its operation when utilized as a jet-nozzle in burners of the types disclosed in my co-pending United States applications, Serial No. 614,419 filed Jan. 23, 1923 Serial No. 622,335 filed March 2nd, 1922, and No. 665,454 filed Sept. 28, 1923.

One particular advantage of my improved nozzle, is the means whereby the fuel, liquid or pulverulent, is subjected, during its flow through and from the nozzle, to a plurality of sequential mechanical atomizations whereby the fuel is more finely divided, than where only one atomization takes place before combustion, thereby creating a more intense heat than heretofore encountered with a great saving of fuel.

In the operation of my nozzle, steam is the preferred atomizing medium, at about 100 pounds per square inch pressure, and while air may also be used under the same conditions, preferably in some usages, superheated steam is desirable. The disruptive, expanding action of steam in passing to atmospheric pressures makes it the more desirable medium for atomizing the fuel, than air.

In the preferred form of use, my jet-nozzle is well adapted to hydrocarbon burners, and while it operates well in this regard, I do not desire to be understood as limiting my nozzle to this single industrial purpose. A large field of utility is available in which the atomization of liquids for various purposes, and the creation of finely divided colloids are essential.

The function of the so-called hydrocarbon burner, however, is simply one of atomization and the term usually implied is therefore a misnomer. It has been experimentally determined that oils of a relatively high Baumé 25.28, require more air for a reasonable degree of atomization than is necessary for sup-

porting combustion. For this reason a mechanical atomizing burner is continually gaining prestige.

The general principle applied in mechanical burners is the application of heat and pressure upon the oil, whereby the same is caused to wire-draw through an orifice. The latent heat in the oil, and, to a greater or lesser extent, the energy represented above the critical temperature of hydrocarbon causes it to flash into a mist, with a tendency to burn the less volatile constituents that are present in the air, causing exothermic heat reaction, the resulting fractionation thus fixing of a portion of the carbon contents of the oil.

I have found that the ideal combustion of oil results when the oil can be finely divided, then intimately mixed with oxygen, and the combustion delayed until the vapor has developed into a reasonable volume. This I have been best able to accomplish by generating mist by means of my nozzle, delaying combustion and diffusing the hydrocarbon vapors by means of a blast from an atomizing nozzle from which superheated steam issues to atmospheric expansion.

Another object of the invention is to reduce the cost of operation to a minimum. This is done by using a nozzle which is designed for the complete expansion of the atomizing steam stream, thereby obtaining the greatest velocity possible of the steam, just as it is being used for re-atomizing the fuel.

In the drawings accompanying, Fig. 1 is a longitudinal sectional view partly in elevation of my device; the section being taken on the line 1—1 of Fig. 3.

Fig. 2 is a fragmentary enlargement of the coating atomizer elements;

Fig. 3 is a front view; and

Fig. 4 is a perspective view of the atomizer deflector.

My device is so constructed so as to permit it to be readily attached by ordinary pipe fittings at its desired operative point, and to this end, the body, which is in the form of an expanding duct casing 1, has at its rear end a

threaded extension 2, whereby to be affixed to a steam connection, not shown.

The outer, or nozzle end generally denoted by 3, is larger in diameter than the end 2, and the tapering expansion chamber 4, extends from the end 2, through the body in progressive increasing area to atmosphere at the end 3. This last noted end of the body 1, is provided with an integral annular flange 5, which has a threaded pipe boss 6 located therein, into which is mounted one or more fuel feed pipes 7, fragmentally shown in section; see also Fig. 3.

Upon the front face of the flange 5, there is affixed, by means of bolts or studs 8, Figs. 1 and 3 a chambered fuel distributor ring 9, this ring being provided with an annular fuel port 10, which is fuel-fed by the fuel pipes 7, so that the front of the device is surrounded by an oil-fuel duct in which oil, under pressure, is fed radially past the jet orifices 11, through a series of radially arranged oil jets 12, which are preferably cut into the inside face of annular fuel distributing ring 9 and which jets communicate between the fuel port 10, and the jet orifices 11.

Located within the wide mouth 3, of the expander nozzle body 1, is a cone-like deflector baffle 13, the function of which is to direct the steam, after it has attained its greatest expansion, to the jet orifices 11, so that at these various points, see Figs. 2 and 3, the steam issues to atmosphere at very high velocities, in the direction of the arrows A, Fig. 2.

This deflector-baffle 13, as shown in Figs. 1, 3 and 4 is provided near its larger outer diameter with a series of peripheral lugs 14, which when the baffle is in operative position as shown in Figs. 1 and 2, space said baffle in position and simultaneously form the plurality of jet-orifices 11, said orifices 11 preferably spaced between adjacent fuel orifices (12).

The outer larger end of the deflector-baffle 13 is provided just beyond the spacing lugs 14, with an annular grooved atomizer disk 15, preferably integral, and this is so spaced or set as to be located substantially axially opposite the series of jet-orifices 12, so that when the fuel oil, under pressure, impinges, at high speed and pressure, into the groove 16, it is thrown back in a finely divided condition there to be caught up by the issuing high velocity steam, and carried outwardly as indicated by the arrows A, in a highly atomized condition, and to this extent the baffle re-directs two streams, one of steam and one of liquid fuel, both travelling at right angles to one another.

Although not shown, the deflector-baffle 13 may be affixed in its operative position indicated in Fig. 1, by any obvious suitable means.

In use, having been connected into a steam line by the threaded end 2, and a fuel line by

the ducts or pipes 7, and steam being supplied under pressure thereto, my device causes a plurality of sequential atomizations to occur to the fuel, as will now be described.

The fuel, under pressure, as it issues from the jet orifices 12, is atomized as is usual in this type of jet action, and this constitutes the first atomization. The fuel then passes across the jet orifices 11 and impinges against the grooved surface 16, and rebounds therefrom, see arrows Y, Fig. 2, and is further broken up, which constitutes a second atomization. Then the fuel which has spread out and rebounded is caught up by the issuing high speed steam jets and is again and finally broken up in transit, in the atmosphere into a final, finely divided mist and is carried thence to combustion, in burners such as are shown in my previously noted pending patent application.

The impinging action of the fuel, as it passes from the jet orifices 12, to the groove 16, of the reflector-baffle 13, is indicated by the arrows X, and the rebound action is indicated by the arrows Y, in Fig. 2. The final passage of the highly atomized fuel stream consisting of the mixture of steam and fuel is indicated by the arrows A, in the same figure.

I have also discovered that the sharp edges formed on both sides of the atomizing groove 16, also tend to greatly aid in the final atomization of the fuel, due to their co-operative action with the expanding steam stream, which tends to greatly increase the disruptive turbulence at the point of issuance of the stream.

In practice, the steam and fuel entering devices of the nature herein disclosed, are ordinarily controlled by the usual valves whereby the pressures and volume of steam and fuel may be variably controlled to suit conditions, but such valves are not shown, as this method is well understood.

It is obvious that various modifications may be made in the detailed structures herein outlined without departing from the scope of the claims.

What I claim is:

1. In combination, a duct gradually tapering toward its inlet end; an abutment member in the discharge end of the duct comprising a conical portion pointing toward the inlet end and peripherally spaced lugs around the periphery of the conical portion extending to the wall of the duct to provide atomizing fluid passages; said member being provided forward of said lugs with an annular groove therearound and means for injecting fuel into said groove.

2. A burner comprising means for contracting a stream of atomizing fluid to a narrow annular cross section thereby increasing its velocity to a maximum; spaced baffles around said cross section to provide stiff streams of atomizing fluid and low pressure spaces be-

tween adjacent streams, means for directing jets of fuel radially inward between said streams into said spaces there to be expanded; and means for directing the expanded fuel to the streams.

5 3. A burner comprising means for contracting a stream of atomizing fluid to a narrow annular cross section; spaced baffles around said cross section to provide stiff
10 streams of atomizing fluid; means for directing jets of fuel radially inward forward of said baffles; and means having an abutment face substantially perpendicular to and receiving said jets for violently jarring and
15 disrupting the fuel of the jets, said face being shaped for then directing the disrupted fuel into said streams.

4. A burner comprising means for contracting a stream of atomizing fluid to a
20 narrow annular cross section; spaced baffles around said cross section to provide stiff streams of atomizing fluid; means for directing jets of fuel inward forward of said baffles substantially at the baffles; and means
25 for violently jarring and disrupting the fuel of the jets and then directing it into said streams.

5. A burner comprising means for contracting a stream of atomizing fluid to a narrow
30 annular cross section thereby increasing its velocity; spaced baffles around said cross section to provide stiff streams of atomizing fluid and low pressure spaces between adjacent streams; means for directing jets fuel
35 radially inward forward of said cross section; and means for heating and violently jarring and disrupting the fuel and directing the disrupted fuel forwardly and radially outwardly into said stiff streams thereby to
40 be further atomized and mixed with the stream.

6. A burner comprising means for gradually expanding a stream of atomizing fluid; means for contracting the stream to a narrow
45 annular cross section thereby increasing its velocity; spaced baffles around said cross section to provide stiff streams of atomizing fluid and low pressure spaces between adjacent streams; means for directing jets fuel
50 radially inward forward of said cross section; and means for heating and violently jarring and disrupting the fuel and dividing and directing the divided fuel forwardly and rearwardly and then substantially radially
55 outwardly into said stiff streams thereby to be further atomized and mixed with the stream.

7. A burner comprising means for contracting a stream of atomizing fluid to a narrow
60 annular cross section; spaced baffles around said cross section to provide stiff streams of atomizing fluid; means for directing jets of fuel radially inward forward of said baffles; and means for violently jarring
65 and disrupting the fuel of the jets and then

directing it into said streams to form a fuel mixture; said last named means having sharp edges over which said stream and mixture pass for further disrupting the mixture.

8. In combination, a duct having a discharge end; an abutment member in the discharge end comprising a body portion peripherally spaced from the walls of said duct to provide therebetween a passage for a stream of atomizing fluid; said member being
70 provided therearound forward of said passage with an annular groove; and a fuel distributing means having inwardly pointed radial fuel ports directing fuel radially
75 against the face of the groove at the deepest part.

9. In combination, a duct having inlet and discharge ends; an abutment member in the discharge end of said duct comprising a conical portion pointing toward said inlet end and peripherally spaced lugs disposed around the periphery of the conical portion and extending to the walls of the duct to provide passages for streams atomizing fluid therebetween at the discharge end, said lugs being
80 approximately as wide as said passages; said abutment member being provided therearound forward of said lugs with an annular groove close to said streams; and means for directing fuel into said groove cause the fuel
85 to rebound into said streams.

10. In combination, a duct having inlet and discharge ends and gradually tapering toward its inlet end; an abutment member in the discharge end of said duct comprising
100 a peripheral portion at all parts spaced from the walls of the duct to provide a constricted annular passage for the stream of atomizing fluid at the discharge end; means for directing jets of fuel radially inward just forward
105 of said passage; and means for violently jarring and disrupting the fuel of the jets and then directing it into said stream.

11. In combination, a duct having inlet and discharge ends and gradually tapering
110 toward its inlet end; an abutment member in the discharge end of said duct comprising a conical portion pointing toward said inlet end and peripherally spaced lugs disposed around the periphery of the conical portion
115 and extending to the walls of the duct to provide passages for streams of atomizing fluid therebetween at the discharge end; said member being provided therearound forward of said lugs with an annular groove having sharp side edges; a flange disk around the discharge end of the duct having an intramarginal fuel inlet port; a fuel distributing disk secured flat against said flange disk and
120 having a forwardly flared inner peripheral face; said distributing disk having an annular oil port adjacent to said flange disk communicating with said inlet port and inwardly pointed radial fuel ports directing
125
130

fuel against the face of the groove at the deepest part of said groove.

12. A fuel burning process comprising gradually expanding a stream of atomizing fluid; contracting the stream to a narrow annular cross section thereby increasing its velocity; baffling spaced portions of said cross section to provide stiff streams of atomizing fluid therearound; directing jets of fuel inwardly just forward of said cross section; and violently jarring and disrupting the fuel and dividing and then directing the fuel radially outwardly and into said stiff streams thereby to be further atomized by, and mixed with, the stream.

13. A fuel burning process comprising contracting a stream of atomizing fluid to a narrow annular cross section thereby increasing its velocity; baffling spaced portions of said cross section to provide stiff streams of atomizing fluid; directing jets of fuel radially inward just forward of said cross section; and violently jarring and disrupting the fuel and dividing and directing the divided fuel forwardly and rearwardly and then radially outwardly into said stiff streams thereby to be further atomized by, and mixed with, the stream.

14. A fuel burning process comprising contracting a stream of atomizing fluid to a narrow annular cross section thereby increasing its velocity; baffling spaced parts around said cross section to provide stiff streams of atomizing fluid; directing jets of fuel radially inward just forward of said cross section; violently jarring and disrupting the fuel directing the disrupted fuel into said stiff streams thereby to be further atomized by, and mixed with, the stream to form a fuel mixture; and then inducing disruptive turbulence in the mixture to further atomize it.

15. A fuel burning process comprising gradually expanding a stream of atomizing fluid; contracting the stream to a narrow annular cross section thereby increasing its velocity; baffling spaced portions of said cross section therearound to provide stiff streams of atomizing fluid; directing jets of fuel radially inward just forward of said cross section; heating and violently jarring and disrupting the fuel and dividing and directing the divided fuel forwardly and rearwardly and then radially outwardly into said stiff streams thereby to be further atomized by, and mixed with, the stream to form a fuel mixture; and inducing disruptive turbulence in said mixture to further atomize the mixture.

16. A burner comprising means for contracting a stream of atomizing fluid to form an annular series of spaced steam passages of limited cross section thereby increasing its velocity to provide stiff streams of atomizing fluid and low pressure spaces between adjacent streams; means for directing jets fuel

radially inward between said streams into said spaces there to be atomized; and means for directing the atomized fuel to the streams.

17. In a device of the character described, in combination, a tapering duct for gradually expanding steam under pressure, a mixing chamber adjacent to the end of greatest diameter of said duct, an abutment member embodying a conical portion located in the end of greatest diameter of said duct and pointing counter to the flow of steam through said duct and having around the periphery of the base of said conical portion spaced lugs providing ports therebetween for passage of the steam into said chamber, said member further embodying a portion located in said mixing chamber and consisting of an end face and an inwardly curved surface between said end face and the base of said conical portion whereby fuel oil under pressure discharged against said curved surface is atomized and caused to travel in a path in said mixing chamber which intersects the path of the steam discharged from said ports, said lugs serving to support said abutment member in said duct and said ports discharging the steam so that the paths of the oil and steam are maintained separate in said mixing chamber until the above stated intersection of said paths.

Signed at Plainfield in the county of Union and State of New Jersey, this 13th day of November, A. D. 1923.

HENRY ADAMS.