Dec. 23, 1930. H. ADAMS 1,785,803

ATOMIZING MIXING NOZZLE

Filed Dec. 6, 1923

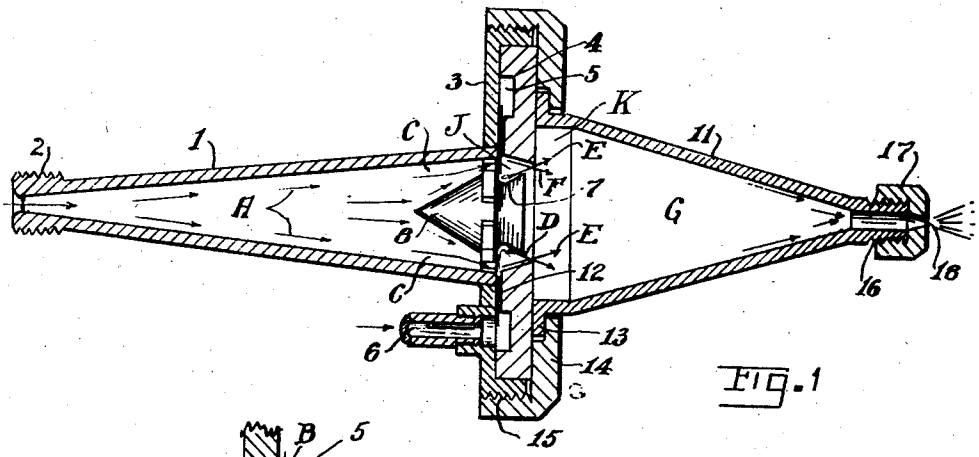


Fig. 1

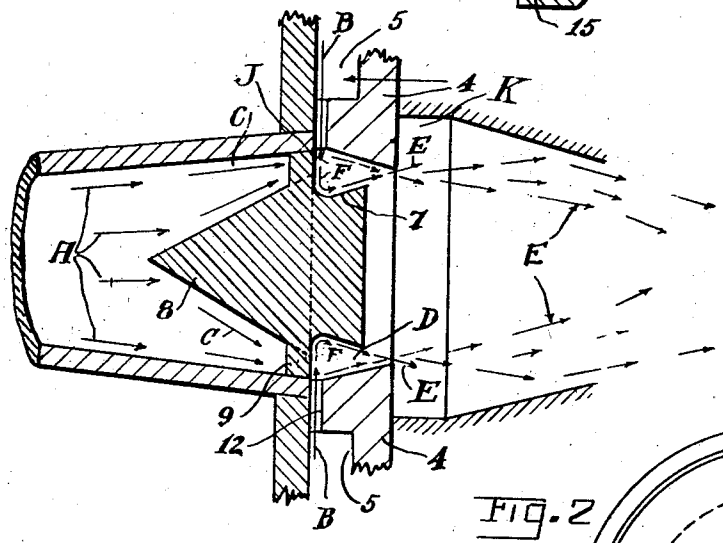


Fig. 2

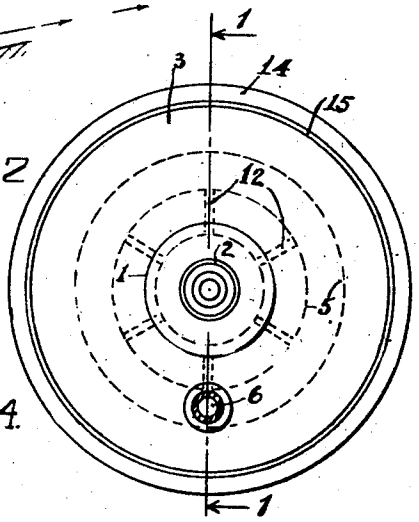


Fig. 4

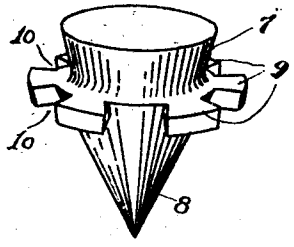


Fig. 3

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UNITED STATES PATENT OFFICE

HENRY ADAMS, OF PLAINFIELD, NEW JERSEY

ATOMIZING MIXING NOZZLE

Application filed December 6, 1923. Serial No. 678,977.

My present invention relates to an improvement in methods and apparatus for mixing and atomizing liquids or dry colloids, and has for its main object that improvement in the art as to treat fuel oils and other liquids and combinations so that they may be finely divided and atomized for creating fuel, and for other purposes where such fine atomization or mixing of liquids or dry colloids is necessary and desirable.

One of the main advantages of my construction is the simplicity and accessibility of the component parts.

One particular advantage of my improved nozzle is that the steam is not used for the breaking or the atomizing of the oil when the steam is at high velocity, and this is accomplished by means of a nozzle designed for complete expansion.

By this high velocity, the liquid fuel is more finely divided and broken down, so that it will be in the finest divided state possible when it is mixed with oxygen for combustion.

Another advantage of this invention is that this burner will take very little steam consumption to atomize or break down the oil, thereby making a great saving in the steam used.

The present modern burners require from .2 of a pound of steam upward to atomize one pound of oil under ordinary conditions. My type of burner reduces the steam consumption so that I use less than .05 of a pound of steam per pound of oil atomized.

Another important advantage is the addition of means, in the form of a liquid heating chamber wherein the liquid desired to be atomized is subjected to mixing-forces and a heating within a special chamber devised therefor, after it has been atomized in previous steps, and is then re-atomized in its advance from the mixing chamber to atmosphere where it is again finely divided.

In some respect a portion of the structure herein is similar to my copending application, Serial No. 675,150 filed on November 16th, 1923, for improvements in burner jet nozzles, and also the following copending United States application: Serial No. 665,454 filed Sept. 28, 1923.

In the present instance however, I have made an addition to the jet nozzle herein disclosed over that nozzle shown in the first noted application whereby a mist is created when a liquid is utilized in conjunction with steam or air under pressure and the mist is so finely divided and admixed as to float in the atmosphere, exactly like smoke.

Other advantages will appear as the description proceeds.

In the drawings accompanying, Figure 1 is a longitudinal sectional view, partly in elevation, of my device, the section being taken on the line 1—1, Fig. 4,

Fig. 2 is an enlarged portion thereof,

Fig. 3 is a perspective view of one of the coacting elements, and

Fig. 4 is a rear elevation.

In my present device, the structure herein is somewhat modified over the above noted copending application and while the details of structure hereinafter to be outlined are somewhat variant with the above noted prior disclosure, nevertheless the functions performed are entirely similar up to a certain point.

By referring to Fig. 1, the casing 1, is noted as being tapering toward the rear at which end it is provided with a threaded end 2 whereby it may be attached to a suitable steam piping, not shown. By this piping means, steam or air under desired pressures may be conducted to and will travel in the direction of the arrows A, interiorly shown. The taper casing 1 is provided at its outer end, either integral or otherwise, with a flange and threaded disk 3, this said disk being rigidly affixed to the said casing 1 in such a manner as to prevent loosening and leaks.

Inside the chamber formed therein by this annular flange disk 3, is located an annular fuel-distributing ring or disk 4 which is provided with an annular oil port or groove 5 therein, the said distributing ring 4 snugly fitting the interior of the flange disk 3 so that when assembled as shown in Fig. 1, an annular oil distributing ring is formed between the disk groove 5 and the front wall of the

flange disk 3, which permits oil or other liquid to travel around in the groove 5 in a circular manner.

The fuel or liquid distributor ring 4 is provided as shown in Fig. 4 with a plurality of radially cut liquid jets 12, so that when the oil or other liquid is introduced into the pipe or duct 6, and which duct communicates with the annular fuel port 5, the liquid is forced to travel forwardly in the direction of the arrows B, as indicated in Fig. 2, and passing through the radial slots or jet grooves 12 in this manner, under pressure, the liquid passes into the chamber J formed in the disk 4 and strikes into a curved deflector face 7, which is arranged at the outer end of a cone like deflector, generally denoted by 8, Fig. 3, and which is in position as indicated in the large end of the tapering casing 1 and in said chamber J.

This cone like deflector, as shown in Fig. 3, is provided with a plurality of spaced arms or lugs 9 thereabout near its front face, which are suitably fitted to the interior terminal opening of the casing 1, as shown in Figs. 1 and 2, and there held in operative position by any desired means not shown, whereby the steam may be deflected between the lugs 9, through the ports 10, formed therebetween and as indicated by the arrows C, Figs. 1 and 2, into said chamber J.

The steam discharged from the ports 10 travels in a path indicated by the arrow F and is maintained separate from the atomized oil deflected by the face 7 until the intersection of the paths of the oil and steam indicated by the crossed arrows E and F.

Immediately in front of the emission port D formed between the deflector 8 and the wall of the chamber J is located a second tapered casing 11 which is provided with an annular flange, generally denoted by 13, which rests against the back face of the liquid distributing ring 4 and is held thereto in opposition by means of an annular flange retainer disk 14 which is threadedly engaged with the threads 15 upon the annular flange disk 3, the casing 11 at its end adjacent to the disk 4 having the straight sided chamber K constituting an expansion chamber communicating with the chamber J of the disk 4 and the chamber G of the casing 11. The front reduced end of this casing 11 is provided with threads as at 16 upon which it receives a jet cap, generally denoted by 17, which is provided with an orifice 18, of proper reduction or bore to accentuate the development of a finely divided spray and this cap is made in a manner shown so that it may be removed for cleaning or to be substituted by needle jets or jet nozzles, of any desired sizes, or styles, as may be indicated by the required use of the atomized liquid.

From the construction above noted, it will be seen that the pressure medium, preferably steam, is permitted to travel in a longitudinal path from the admission or coupling end 2, through to the emission or nozzle end 18.

The first expansion of the steam occurs when it is admitted at end 2, wherein the first expansion of the, as yet, uncombined steam, expands as it travels to and over the deflector 8.

Upon emitting from the throttling ports 10, on the deflector 8, the steam carries along with it the liquid taken up from the right angularly located fuel-ports 12, and during this action of the forwardly travelling steam-stream, generally denoted by the arrow E, Figs. 1 and 2, the fuel or other liquid is thoroughly divided, admixed and heated in the second or mixing casing 11, whereupon the heated, atomized and mixing fuel charge emits from the nozzle port or jet 18, to expand in a final action, creating an extremely fine smoke-like vapor travelling from the nozzle at a high speed.

During the travelling action of the steam-stream through the atomizer, as described in the foregoing, the liquid or fuel oil stream is inducted into the steam-stream, and the oil is itself subjected to a plural sequence of atomizing actions, in a manner that causes it to rapidly divide and combine with the actuator steam-stream and finally emit to atmosphere. To this end, the oil or liquid is admitted into the duct 6, and filling the annular oil duct 5, it is forced out through the plurality of the radial jets 12, being thereby atomized, passing across the face of the lugs 9, as shown by arrows F, where the atomized oil is intersected in its path and picked up by the steam, atomized, heated, expanded in chamber K and mixed and compressed in the chamber G, and then passed to atmosphere, through the nozzle 18, and again atomized.

In many forms of use, wherein it is desirable to cause intimate mixtures of various liquids, air may be substituted for the steam, when desirable and any reference throughout this description to steam, is intended to include air as an equivalent therefor, insofar as air can carry out the main functions and features of my device.

In the creation of some forms of intimate liquid mixtures it is only desirable to atomize them to cause admixture after which these atomized intimate mixtures are permitted to condense back to liquid form.

What I claim is:

1. In a device of the character described, in combination, a duct for gradually expanding fluid under pressure passing therethrough, a mixing chamber communicating with said duct, means for compressing the fluid expanding in said duct and discharging the fluid into said chamber, means for atomizing fuel and discharging the atomized fuel into said chamber, means for further atomizing the fuel and

causing the fuel to mingle with the high velocity fluid discharged into said chamber whereby the fuel and fluid are mixed and the fuel is still further atomized by the fluid, an expansion chamber communicating with the first mentioned chamber for receiving the mixture of fluid and fuel, and a duct communicating with the expansion chamber for gradually compressing said mixture for discharge and burning.

2. In a device of the character described, in combination, a duct for gradually expanding fluid under pressure passing therethrough, a mixing chamber communicating with said duct, means for compressing the fluid expanding in said duct and discharging the fluid into the said chamber, means for atomizing fuel and discharging the atomized fuel into said chamber, means for further atomizing the fuel and causing the fuel to travel in a path which intersects the path of the high velocity fluid discharged into said chamber whereby the fuel and fluid are mixed and the fuel is still further atomized by the fluid, the fluid and fuel being maintained separate in said mixing chamber until said intersection of the paths of the fuel and fluid, an expansion chamber adjoining the first mentioned chamber for receiving the mixture of fluid and fuel, and a duct communicating with the expansion chamber for gradually compressing said mixture for discharge and burning.

3. In a device of the character described, in combination, a tapering duct for passage therethrough from its end of least diameter to its end of greatest diameter of steam under pressure, a chamber communicating with said duct at its end of greatest diameter, a member in said duct at its end of greatest diameter having ports for compressing the steam expanding in the duct and discharging the steam into said chamber and having an abutment face located in said chamber, means for wire-drawing fuel oil and discharging the wire-drawn oil into said chamber and against said face for further atomizing the oil and whereby the oil is directed into the path of the high velocity steam discharged into said chamber by said ports and is mixed therewith and still further atomized by the steam, an expansion chamber communicating with the first mentioned chamber for receiving the mixture of steam and oil, and a tapering duct communicating at its end of greatest diameter with the expansion chamber for gradually compressing said mixture for discharge and burning.

4. In a device of the character described, in combination, a tapering duct for passage therethrough from its end of least diameter to its end of greatest diameter of steam under pressure, a chamber communicating with said duct at its end of greatest diameter, a member in said duct at its end of greatest diameter having ports for compressing the steam expanding in the duct and discharging the steam into said chamber and having an abutment face located in said chamber, means for wiredrawing fuel oil and discharging the wiredrawn oil into said chamber and against said face for further atomizing the oil and whereby the oil is directed into the path of the high velocity steam discharged into said chamber by said ports and is mixed therewith and still further atomized by the steam, said ports discharging the steam into said chamber in a path separated from the atomized oil until said mixing, an expansion chamber communicating with the first mentioned chamber for receiving the mixture of steam and oil, and a tapering duct communicating at its end of greatest diameter with the expansion chamber for gradually compressing said mixture for discharge and burning.

5. In a device of the character described, a casing having a duct for fluid under pressure and tapering to an end of greatest diameter, the fluid under pressure flowing towards said end, a chamber adjacent to the end of greatest diameter of said duct, means in the end of greatest diameter of said duct providing constricted passages for the fluid from said duct into said chamber, means providing constricted passages for fuel oil into said chamber, means for atomizing the oil after passage thereof through said oil passages and deflecting the atomized oil so that the paths of travel of the fluid and atomized oil intersect in said chamber for commingling the fluid and oil, an expansion chamber communicating with the first mentioned chamber for receiving the commingled fluid and oil, and a casing having a tapering duct communicating at its end of greatest diameter with the expansion chamber for receiving the commingled fluid and oil and compressing the same for discharge at its end of least diameter.

6. In a device of the character described, in combination, a casing for fluid under pressure having an interior of increasing diameter towards one of its ends, a second casing adjacent to the end of greatest diameter of the first casing and having an interior of decreasing diameter from said end terminating in a nozzle, means located between the casings at their adjacent ends extending transversely thereof having a port communicating between the interiors of the casings and having fuel discharging means communicating with said port, and means arranged in said port for constricting the port and provided with means extending into the first casing for restricting the fluid in its flow and deflecting the fluid towards said port for commingling the fluid and fuel and passage of the commingled fluid and fuel through said port into the second casing for expansion and subsequent compression therein and discharge from said nozzle.

7. In a device of the character described, in combination, a casing for fluid under pressure having an interior of increasing diameter towards one of its ends, a second casing adjacent to the end of greatest diameter of the first casing having an interior of decreasing diameter from said end terminating in a nozzle, a member between the casings at their adjacent ends extending transversely thereof and having a central port communicating between the interiors of the casings and having an annular fuel duct and a series of ducts communicating between the fuel duct and said port, and a member arranged in said port having a circular base portion for constricting the port, said base portion having a flow deflecting groove on its periphery and having means for restricting the flow of said fluid from the first casing and having a cone-shaped portion extending into the first casing for deflecting the fluid towards said port for commingling the fluid and fuel and passage of the commingled fluid and fuel through said port into the second casing for expansion and subsequent compression therein and discharge from said nozzle.

8. In a device of the character described, in combination, a first casing having an interior increasing in diameter from its inlet end to its opposite end for passage of fluid therethrough under pressure, a member adjoining said casing at the end of greatest diameter thereof and having means for receiving fuel oil and having a chamber spaced away from said oil receiving means, constricted passages communicating between the interior of said casing at the end of greatest diameter thereof and said chamber, constricted passages communicating between said oil receiving means and said chamber, an expansion chamber adjoining said member on the side thereof opposite the first casing and communicating with the chamber of said member, and a second casing having a tapering interior adjoining at its end of greatest diameter the expansion chamber and communicating therewith, the interior of the second casing tapering to a discharge end of least diameter of the casing.

9. 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 having a rear face transverse to the axis of the member, a forwardly flaring forward face and an intermediate inwardly curved abutment face merging into the forward and rear faces; disk means around the discharge end of the duct having a forwardly tapered inner peripheral face forward of said lugs and cooperating with said groove to form a mixing chamber; said means having inwardly pointed radial fuel ports staggered with said passages and pointed along said rear face; and a forwardly tapering combining duct having a fine nozzle on the forward end, said duct having an inner end engaging said disk means.

10. A nozzle comprising means for forming a stiff stream of atomizing fluid; means including a disk having an exteriorly threaded flange for directing fuel into said stiff stream; a forwardly tapering combining duct forward of said directing means and having a fine nozzle on its forward end and a flange at its rear end, said duct having a gradually tapering smooth inner face of larger inner diameter than the diameter of said directing means and serving to abruptly expand the atomizing fluid and vapor issuing from the directing means, whereby they are further combined; said combining duct further converging and increasing the velocity of the mixture and discharging and expanding them at the nozzle in the form of a fine mist, and a retaining collar engaging said disk and the flange of the combining duct and having an interiorly threaded flange engaging said exteriorly threaded disk flange.

11. A burner comprising means for contracting a stream of atomizing fluid to a narrow annular cross section; means including a disk having a forwardly extended flange; a ring against said disk having passages for directing fuel into said stream near said cross section; and a forwardly extending combining duct having a nozzle on its forward end and a flange at its rear end, and a retaining collar engaged with said flanges of said disk and combining duct.

12 An apparatus comprising means forming high velocity streams of atomizing fluid; structure means having an annular groove therearound having a rear face transverse to the streams, a forwardly flaring forward face and an intermediate inwardly curved abutment face merging into the forward and rear faces; means for directing fuel inwardly along the plane of said rear face, said forward face directing fuel into said streams.

Signed at Plainfield, in the county of Union and State of New Jersey, this 4th day of December, A. D. 1923.

HENRY ADAMS.