July 19, 1938. G. H. WOTRING 2,124,443

REGULATING NOZZLE

Filed May 29, 1935

Fig. 2.

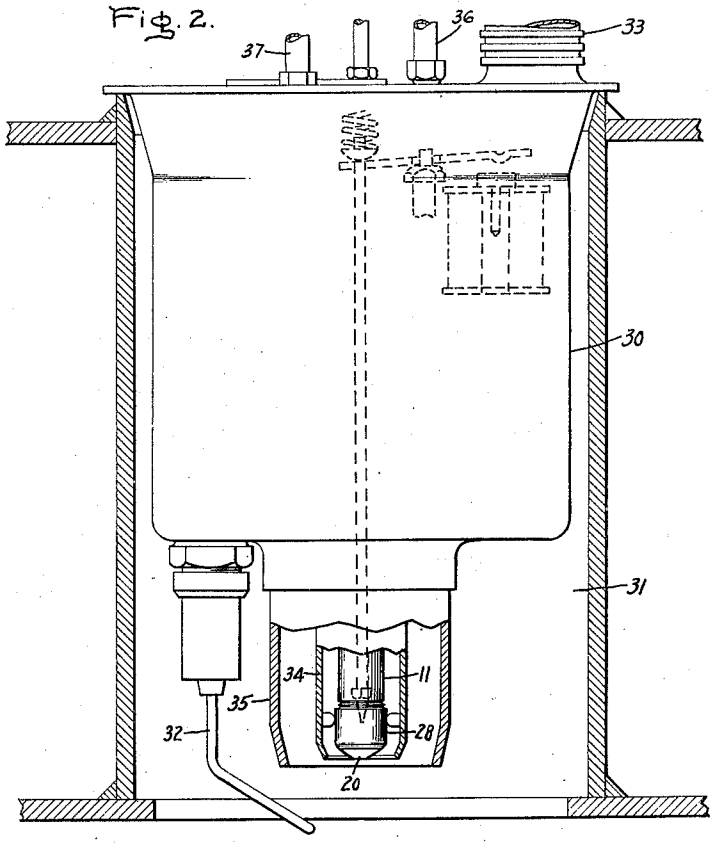


Fig. 3.

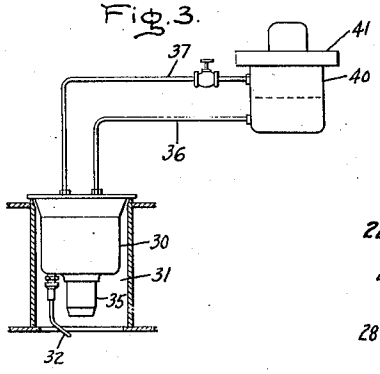
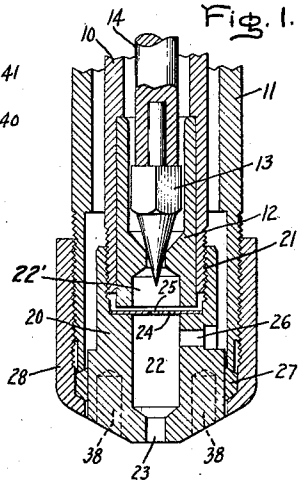


Fig. 1.



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REGULATING NOZZLE

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Application May 29, 1935, Serial No. 24,003

3 Claims. (Cl. 299—140)

The invention relates to nozzles, particularly fluid atomizing nozzles such as used in oil burners although the improved regulating nozzle construction of the present invention may be used in other service if desired.

One of the objects is to provide an improved fixed flow control orifice directly in the nozzle for regulating the rate of flow of fluid to the atomizing discharge orifice thereof.

Another object is to provide a nozzle having a chamber for mixing liquid and expansible fluid under pressure preparatory to atomization thereof through the nozzle discharge orifice with an improved flow control orifice arrangement for regulating the mixture.

A further object is to provide an improved concentric small sized tubular type of nozzle construction having a shutoff valve adjacent the nozzle tip and having the nozzle tip removable and provided with the regulating orifice arrangement so that different rates of fluid flow may be obtained by substituting another tip with different regulating control orifices provided therein.

While of general application in fluid atomizing service, the improved regulating nozzle construction of the present invention is particularly adapted for use in a viscosity compensated rate control for oil burners of the type described and claimed in the copending application of Walter O. Lum, Serial No. 19,268, filed May 1, 1935, and assigned to the assignee of the present invention. Hence the principle of the present invention and the best mode in which applicant has contemplated applying that principle will be set forth and explained in connection with a fuel oil atomizing nozzle for oil burners.

In the accompanying drawing Fig. 1 is a sectional view of a preferred form of fuel oil atomizing nozzle embodying the improvements of the present invention; Fig. 2 is a front view partly in section showing the nozzle in operative position in an oil burner combustion head and Fig. 3 is a schematic diagram indicating a preferred manner in which fuel oil and air under pressure may be supplied to the atomizing nozzle shown in Figs. 1 and 2.

In the preferred form shown in Fig. 1, the fuel oil atomizing nozzle has a pair of concentric tubular fluid supply conduits 10 and 11, oil under pressure being supplied through the inner conduit 10 and atomizing air under pressure being supplied between the inner conduit 10 and outer conduit 11. An oil cutoff valve seat 12 is located at the end of the oil supply conduit 10 with an enlarged recess 22' formed at the discharge end thereof and with the tapering cutoff valve element 13 mounted on the movable valve stem 14 in operating relation with the valve seat 12.

The atomizing nozzle tip 20 is removably secured to the end of the inner conduit 10 by means of suitable screw threads 21. The tip 20 has the chamber 22 formed therein in registering alinement with the enlarged recess 22' for mixing the oil and air under pressure preparatory to discharge thereof through the atomizing discharge orifice 23 located at the end of the tip. A thin-walled diaphragm 24 is mounted directly in the tip between the recess 22' and the chamber 22 and provided with the central sharp-edged flow control orifice 25 for regulating the rate of flow of oil to the discharge orifice 23 of the nozzle when the valve 13 is raised to uncover the oil inlet port formed in the valve seat 12. Due to the thinness of diaphragm 24, the orifice 25 therein serves as a sharp edged control orifice even though there is no outward tapering or chamfering of the lower edges of the opening through diaphragm 24 shown in Fig. 1 of the drawing. In case a thick diaphragm were used, it would be obvious that some such tapering or chamfering of the edge of the opening would be necessary to provide the sharp edged flow control orifice 25.

Air under pressure is supplied from the outer conduit 11 to the chamber 22 through the air inlet port or orifice 26 which is formed tangentially in the side of the nozzle tip 20 so as to produce a whirling mixture of air and oil in chamber 22. An expansible gasket ring 27 of babbitt or other suitable material serves to seal the end of the outer conduit 11 with the nozzle tip 20 when the gasket 27 is compressed by means of the compression gland or outer nozzle tip 28 which is shown in screw-threaded engagement with the outer conduit 11.

In the nozzle construction illustrated in Fig. 1 the enlarged recess 22' at the bottom of the cutoff valve seat 12 is of the same diameter and in alignment with the chamber 22 formed in the removable nozzle tip 20 thus constituting in effect a single chamber with the diaphragm 24 having the flow control orifice 25 therein located in this chamber to segregate the oil inlet port in the valve seat 12 from the air inlet port 26 and the discharge orifice 23.

The rate of flow of oil into chamber 22 through the oil inlet port formed in the valve seat 12 is regulated by the size and character of the orifice 25 formed in the diaphragm 24. At the same

time the rate of flow of air into chamber 22 is regulated by the size of the air inlet orifice 26. Thus by properly proportioning the orifices 25 and 26 the proper proportions of oil and air are mixed in the chamber 22 before discharge thereof through the discharge orifice 23. The pressure maintained in the mixing chamber 22 as well as the atomizing discharge characteristics of the mixed oil and air are dependent upon the size and character of the discharge orifice 23. Hence with the size and character of the three orifices 23, 25 and 26 once properly proportioned to obtain the desired rates of flow and atomization characteristic, this relationship is permanently maintained.

For example, if it is desired to atomize the oil at the rate of a predetermined number of gallons per hour, the oil regulating orifice 25, the air regulating orifice 26 and the discharge orifice 23 are proportioned to provide the proper atomization characteristic at this rate. In case a different rate of oil atomization is desired, a substitute nozzle tip having a different size discharge orifice 23, air rate regulating orifice 26 and oil rate regulating orifice 25 may be provided for the desired rate. Since the compression gland 28 and the nozzle tip 20 are readily removable, it is a simple matter to substitute a different nozzle tip with the orifices therein proportioned for the desired rate of atomization.

Fig. 2 shows the improved nozzle construction of the present invention applied to an oil burner head of the type described and claimed in the copending application of John Eaton and Walter O. Lum, Serial No. 691,320, filed September 28, 1933, and assigned to the assignee of my present invention. As illustrated, the burner head 30 is located in a well 31 of an oil furnace with certain parts broken away to show the operating position of the atomizing nozzle, particularly the tip 20 and the compression gland 28. Suitable electrodes 32 are provided for igniting the atomized oil stream discharged from the nozzle tip 20. The burner head is provided with a combustion air inlet 33 which communicates with suitable conduits 34 and 35 for supplying the combustion air around the atomized oil stream. Oil is supplied to the combustion head through the oil pipe 36 which communicates with the interior of the oil supply conduit 10 of the nozzle. Atomizing air under pressure is supplied to the burner head through the pipe 37 which is suitably connected to communicate with the space between the inner conduit 10 and the outer conduit 11 of the nozzle. While not shown in detail, it will be understood that suitable means such as the electromagnet shown diagrammatically in Fig. 1 as of the type disclosed in the above Eaton and Lum application may be provided in the burner head for controlling the operation of the cutoff valve 13.

Fig. 3 illustrates the manner in which oil and air under pressure are supplied to the burner head 30. As shown diagrammatically, the oil and air are maintained under pressure in the sump 40 of an electric motor driven oil and air pumping mechanism 41 which preferably is of the improved type disclosed and claimed in the copending application of Walter O. Lum, Serial No. 737,063, filed July 26, 1934, and assigned to the assignee of the present invention. The pumping mechanism is arranged to maintain the oil and air in the sump 40 under substantially constant equalized pressure. Thus when the improved nozzle construction of the present invention is used in a viscosity compensated oil flow control for oil burners of the type described and claimed in the Lum application, Serial No. 19,268 previously mentioned, the oil supply pipe 36 is proportioned to cooperate with the thin walled sharp edged oil flow orifice 25 in the nozzle tip so as to maintain the oil rate substantially constant irrespective of variations in the viscosity of the oil. The manner in which the oil supply conduit 36 and the orifice 25 are proportioned for this purpose is fully explained in the Lum application and need not be further explained herein. In such viscosity compensated oil rate control the improved nozzle construction of the present invention insures that the oil is maintained under substantially uniform pressure until it passes through the control orifice 25 into the mixing chamber 22 in the atomizing nozzle tip. Thus any air dissolved in the oil can not be released due to pressure reduction until the oil is in the mixing chamber. This effectively prevents any air accumulating in the oil supply conduits 36 which might result in interrupting the steady flow of oil.

When different size control orifices 25 are used in a viscosity compensated oil rate control of the above type to obtain different oil rates, the maximum compensation for variation in viscosity will not be obtained unless the oil supply conduit 36 is proportioned for each size of control orifice. However, where the oil rates do not vary substantially, the same oil conduit 36 may be employed successfully with different size control orifices where the maximum viscosity compensation is not required. Also, if desired, a suitable adjustable valve may be connected in the air supply pipe 37 as diagrammatically shown in Fig. 3 to regulate the flow of air to the air inlet orifice 26 in the nozzle tip 20. In this case the size of the air inlet orifice 26 will not determine the rate of air flow.

With the improved nozzle construction of the present invention, the nozzle tip 20 may be readily removed for cleaning. This is accomplished by inserting a suitable spanner wrench into the wrench sockets 38 provided in the exposed end of the nozzle tip after removing the packing gland 28 and the gasket 27.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A nozzle for atomizing liquid and expansible fluid having a liquid supply conduit, a cutoff valve at the end of said conduit with an enlarged recess formed at the discharge end thereof, a nozzle tip removably connected to said valve with a liquid and expansible fluid mixing chamber formed therein in registering alinement with said recess, a thin wall sharp edge calibrated orifice mounted in the nozzle tip at one end of said mixing chamber for determining the rate of liquid flow from said recess into said mixing chamber when the valve is opened, an expansible fluid supply conduit surrounding said valve and removably sealed to said nozzle tip, a complementary calibrated inlet orifice formed in the nozzle tip adjacent said thin wall orifice for admitting expansible fluid from said expansible fluid supply conduit into the mixing chamber at a predetermined rate, and a complementary calibrated discharge orifice formed in the nozzle tip at the other end of said mixing chamber for determining the atomization characteristics of the liquid and expansible mixture discharged from said mixing chamber.

2. An atomizing nozzle having a removable tip with a cylindrical chamber formed therein for

mixing liquid and expansible fluid under pressure, means for supplying liquid to said chamber including a cutoff valve removably connected with one end of said nozzle tip and having a recess formed therein in alinement with said chamber, a thin wall sharp edge calibrated orifice mounted in said tip at one end of said chamber for regulating the rate of liquid flow between said recess and said chamber when the cutoff valve is open, means for supplying expansible fluid to said tip including a calibrated inlet opening formed in the tip at one side of said chamber adjacent said thin wall orifice, said tip having a calibrated discharge orifice at the other end of said chamber for atomizing the mixture discharged under pressure therefrom.

3. A device for discharging an atomized mixture of liquid and expansible fluid under pressure including a pair of concentric tubes, means for separately supplying under pressure liquid to the inner tube and expansible fluid to the outer tube, a cutoff valve mounted inside the inner tube at the end thereof and having an enlarged recess formed at the discharge end thereof, a calibrated flow regulating nozzle tip having a threaded screw connection with the inner tube and a removable compression seal connection with said outer tube and having a mixing chamber formed therein in registering alinement with said recess and provided with a calibrated atomizing discharge orifice at one end of said chamber and a complementary calibrated inlet port for expansible fluid extending through the wall of the nozzle tip adjacent the other end of said mixing chamber for regulating the rate of expansible fluid flow from said outer tube to the mixing chamber and a complementary calibrated thin wall sharp edge orifice mounted in the nozzle tip at said other end of said mixing chamber for regulating the rate of liquid flow from said recess to said mixing chamber upon the opening of said valve.

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