July 11, 1950 H. J. J. JANSSEN 2,514,581

METHOD AND ATOMIZER FOR ATOMIZING FUEL OIL

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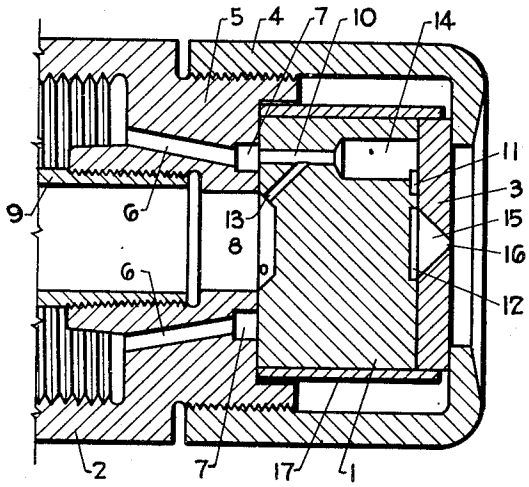


Fig. 1

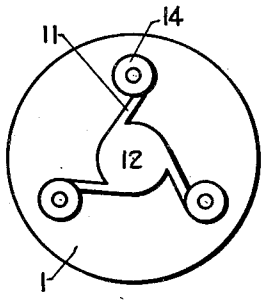


Fig. 2

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METHOD AND ATOMIZER FOR ATOMIZING FUEL OIL

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This invention relates to an improved method of atomizing fuel oil in contact with a gaseous medium, such as steam, air, or a gaseous fuel, and to an improved atomizer capable of carrying out the method, but capable also of atomizing other fluids. The invention is, more particularly, concerned with atomization of the fuel by causing it to rotate very rapidly in a whirl chamber by flow through inwardly directed tangential ducts, and to be discharged axially from the whirl chamber.

Fuel burners having atomizing whirl chambers with inwardly directed tangential feed ducts are known. It is also known to improve atomization by leading a gas into the whirl chamber; in the known atomizers of this type the liquid and the gaseous medium are led into the whirl chamber separately, for example, by means of separate channels for the two fluids, directed tangentially into the whirl chamber. In such a construction the time during which the liquid and gas are in contact is only very short. Often, however, it is desirable that the liquid and gas be maintained in contact with one another for a longer time, for instance in cases where it is intended to effect an interchange of substances and/or heat between the fluids. The stream of liquid and gas have, in some prior devices, been united prior to being discharged into a turbulent zone, but such constructions did not result in a sufficiently uniform mixing to work efficiently with whirl chambers having inwardly directed tangential ducts.

In accordance with the present invention it was found that satisfactory results can be obtained by mixing the liquid and gas in a plurality of separate mixing zones, flowing the resulting mixtures through individual, enlarged contact zones, and then flowing the mixtures through inwardly directed tangential ducts into a confined whirling zone, wherein the separately formed mixtures are united. The resulting combined whirling mass is then discharged from the whirling zone, preferably through an orifice or slit, to cause the mixture to be atomized, i. e., broken up into a fine spray or mist. With such a method of operation it becomes possible to attain effective contacting while providing comparatively small contact zones. It thereby is possible to use an atomizer of comparatively

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small size to handle a large quantity of fluids. The method is conveniently effected in the atomizing device forming a part of this invention and described more particularly herein, although the method is not restricted thereto.

An example of the practical application of the improved method will be described with reference to the atomizer shown in the drawings forming a part of this specification, wherein:

Fig. 1 is a longitudinal cross-sectional view of an atomizer according to the invention; and

Fig. 2 is an end view of the atomizer with the nozzle tip removed.

The mixing and distributing body or insert 1 is mounted on the end of a supply pipe 2 by means of a nozzle tip 3, in the form of a centrally perforated cover disc, and a nozzle cap 4 threaded to the supply pipe and having an annular flange engaging the disc. The end wall 5 of the pipe 2 has a plurality of ducts 6 communicating with an annular recess 7 for the flow of liquid fuel which is fed through the supply pipe by the usual supply means, not shown, under pressure. The end wall has a central passage 8, threaded at its rearward end to engage a concentric tube 9 through which a gas is supplied under pressure.

The insert 1 is provided with a plurality, e. g., three, ducts 10 leading to an equal number of inwardly directed ducts 11 formed as indentations on the outer face, and feeding tangentially into a central, circular recess 12. The ducts are radially disposed so as to be opposite to the annular recess 7, permitting communication for the flow of liquid regardless of the orientation of the insert 1. Each duct 10 has a branch duct 13 associated with it, and disposed to feed gas from the central passage 8 into the duct 10. It is preferable to incline the branch ducts 13 forwardly and radially outwardly to cause one fluid to entrain the other, although I may practice the invention without such a juncture. In the device shown the liquid will entrain the gas. Between the juncture of the ducts 10 and 13 and the face of the insert enlarged contact chambers 14 are provided; these serve as contact or pre-mixing zones, permitting a more intimate contact between the two fluids before being discharged at higher velocity through the tangential ducts 11.

The whirl chamber consists of the space formed by the circular recess 12 and the conical recess 15 on the inner face of the nozzle tip 3. The contacted mixture of gas and liquid swirls within this chamber and issues through the orifice 16 as a fine spray or mist. The nozzle tip 3 is maintained in proper alignment with the insert 1 by means of a collar 17 which is in close engagement with both of these parts.

By using increment mixing, i. e., by mixing the fluids at a plurality of separate points and by providing a separate contact chamber 14 for each mixture, effective contacting is attained with a minimum of size of the contact chambers and residence time. Moreover, the compositions of the mixtures flowing through the several tangential ducts is more uniform than when the entire streams of gas and liquid are brought together and then fed through separate tangential ducts into a whirl chamber. In the chambers 14 the gas and the liquid have an opportunity to react on one another. If, for example, the gas is composed of hydrocarbons, such as propane or butane, and the liquid is a heavy oil, then the mixing of the two fluids results in the light hydrocarbons dissolving in the heavy oil, making the latter more thinly liquid and also raising its temperature due to the heat of solution. The consequent lowering of the viscosity of the oil results in a better atomization and combustion. If the gas consists of heated air or steam an efficient heating of the oil may be obtained in the premixing chambers 14. These chambers also contribute to the formation of an intimate dispersion of the gas and liquid.

The capacity of the chambers 14 may be varied to meet particular requirements. If, for instance, the liquid is a heavy hydrocarbon oil and the gas is propane, a certain time is required to dissolve the gas in the oil; the size of the chamber 14 is then determined taking into account the required mixing time and the desired rate of flow of the fluids through the atomizer.

I claim as my invention:

1. A method of mixing and atomizing a liquid and a gas comprising the steps of simultaneously mixing separate streams of liquid with separate streams of gas, flowing each resulting mixture through a separate contact zone to permit said liquid and gas to react one upon the other, thereafter flowing each reacted mixture as a separate stream tangentially inwardly into a confined whirling zone, thereby combining the separate reacted mixtures and causing the whirling thereof, and discharging the combined whirling mixtures from the common whirling zone to cause the atomization thereof.

2. A method of mixing and atomizing a liquid fuel oil and a gas comprising the steps of simultaneously mixing separate increments of oil and gas at a plurality of points to produce a corresponding plurality of mixtures, flowing each resulting mixture through an enlarged contact zone to permit the oil and gas to react one upon the other, thereafter flowing each reacted mixture as a separate stream tangentially inwardly into a common confined whirling zone, thereby combining the separate reacted mixtures and causing the whirling thereof, and discharging the combined whirling mixtures from the common whirling zone through a common orifice to cause the atomization thereof.

3. The method according to claim 2 in which the gas is a light hydrocarbon.

4. The method according to claim 2 in which the gas is steam.

5. The method according to claim 2 in which the gas is heated air.

6. The method of mixing and atomizing a liquid and a gas comprising the steps of commingling a plurality of increments of liquid and gas at a plurality of points and flowing each resulting mixture as a separate stream tangentially inwardly into a common confined whirling zone to combine the several mixtures and cause the whirling thereof in the whirling zone, and discharging the whirling mixture from the whirling zone to cause the atomization thereof.

7. A method of mixing and atomizing a liquid and a gas comprising the steps of commingling a plurality of increments of liquid and gas at a plurality of points, flowing each resulting mixture through a separate enlarged contact zone to permit said liquid and gas to react one upon the other thereafter flowing each reacted mixture as a separate stream in a tangential direction into a common, confined whirling zone to combine the several mixtures and cause the whirling thereof in the whirling zone, and discharging the whirling mixture from the whirling zone to cause the atomization thereof.

8. A method of mixing and atomizing a liquid and a gas comprising the steps of commingling a plurality of increments of liquid and gas at a plurality of points, thereafter flowing each mixture as a separate stream in a tangential direction into a common, confined whirling zone to combine the several mixtures and cause the whirling thereof in the whirling zone, and discharging the whirling mixture from the whirling zone to cause the atomization thereof.

9. An atomizer for mixing and atomizing two fluids, comprising a distributing body having a plurality of separate feed ducts therethrough for feeding a first fluid, a nozzle tip, a whirl chamber formed between the body and nozzle tip, a central orifice in the nozzle tip, a separate tangential duct connecting each feed duct to the whirl chamber and discharging tangentially into the chamber, and a branch duct connected to each feed duct for admitting a second fluid into the feed duct.

10. The atomizer according to claim 9 wherein the feed ducts are enlarged between the branch duct and the tangential duct, to provide a contact zone for the fluids.

11. An atomizer for mixing and atomizing two fluids, comprising a first supply pipe for feeding a first fluid provided with an end wall, passages through said wall joining said pipe in flow communication with an annular recess on the outer face of the wall, a distributing body in engagement with the wall, a plurality of separate feed ducts through the distributing body in communication with said annular recess, a second supply pipe within the first supply pipe for feeding a second fluid, a passage through said end wall permitting the passage of second fluid from said second supply pipe, a plurality of branch ducts in said distributing body, each branch duct connecting said passage with one of said feed ducts, a nozzle tip in engagement with the distributing body, a whirl chamber formed between said distributing body and the nozzle tip, a separate tangential duct connecting each feed duct to the whirl chamber and discharging tangentially into the whirl chamber, and an outlet orifice for the whirl chamber formed in the nozzle tip.

12. The atomizer according to claim 11 in which

each feed duct is enlarged between the points of juncture therewith of the branch duct and the tangential duct to provide a contact zone for the fluids.

HENDRIK J. J. JANSSEN.

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