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Habers

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[54] **ATOMIZER FOR LIQUID FUEL**

[75] Inventor: **Wilhelmus Habers**, Amsterdam, Netherlands

[73] Assignee: **Shell Oil Company**, New York, N.Y.

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[30] **Foreign Application Priority Data**

Oct. 26, 1970 Netherlands 7015687

[52] **U.S. Cl.** **239/431**, 239/433

[51] **Int. Cl.** **B05b 7/06**

[58] **Field of Search** 239/429, 430, 431, 239/432, 433

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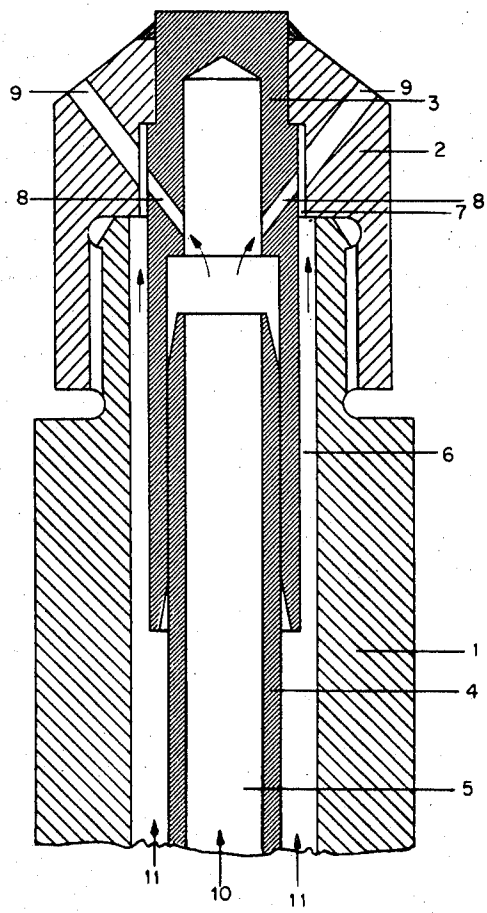
Primary Examiner—Lloyd L. King

Attorney—Harold L. Denkler et al.

[57] **ABSTRACT**

An atomizer for liquids of the type utilizing atomization by a gas is provided with at least two channels which terminate at the head of the atomizer and which communicate with a common supply for the gas. The channels pass through a common, bounded space and at the location of the intersections around their entire circumference communicate with that space. The bounded space communicates with a supply for the liquid.

10 Claims, 5 Drawing Figures



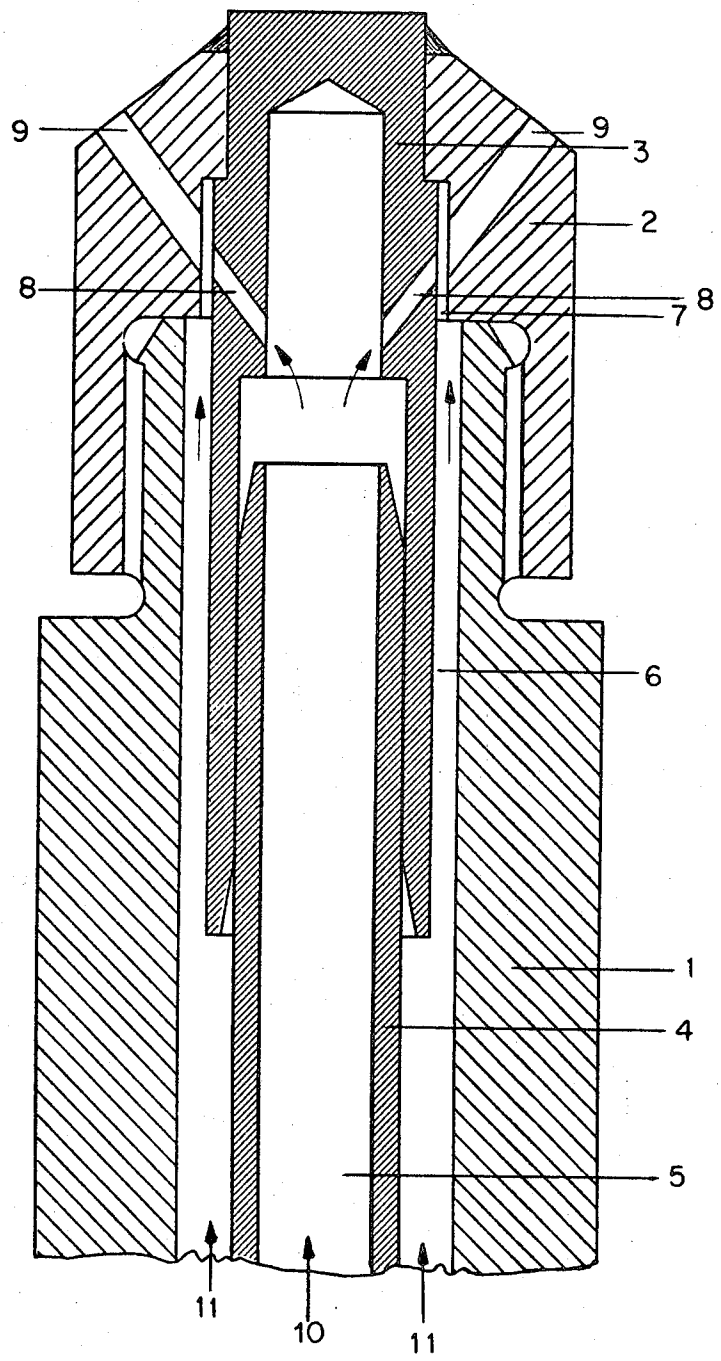


FIG. 1

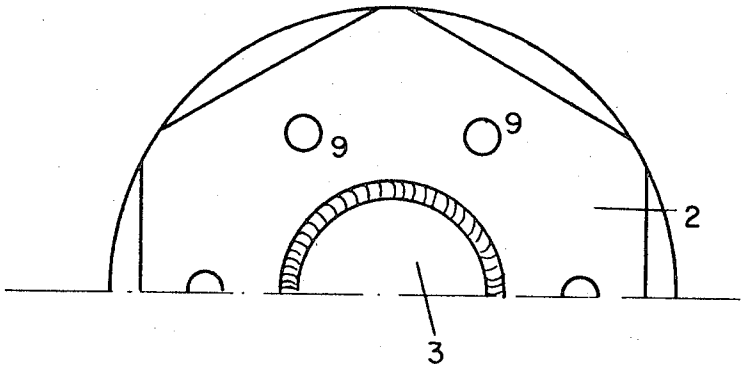


FIG. 3

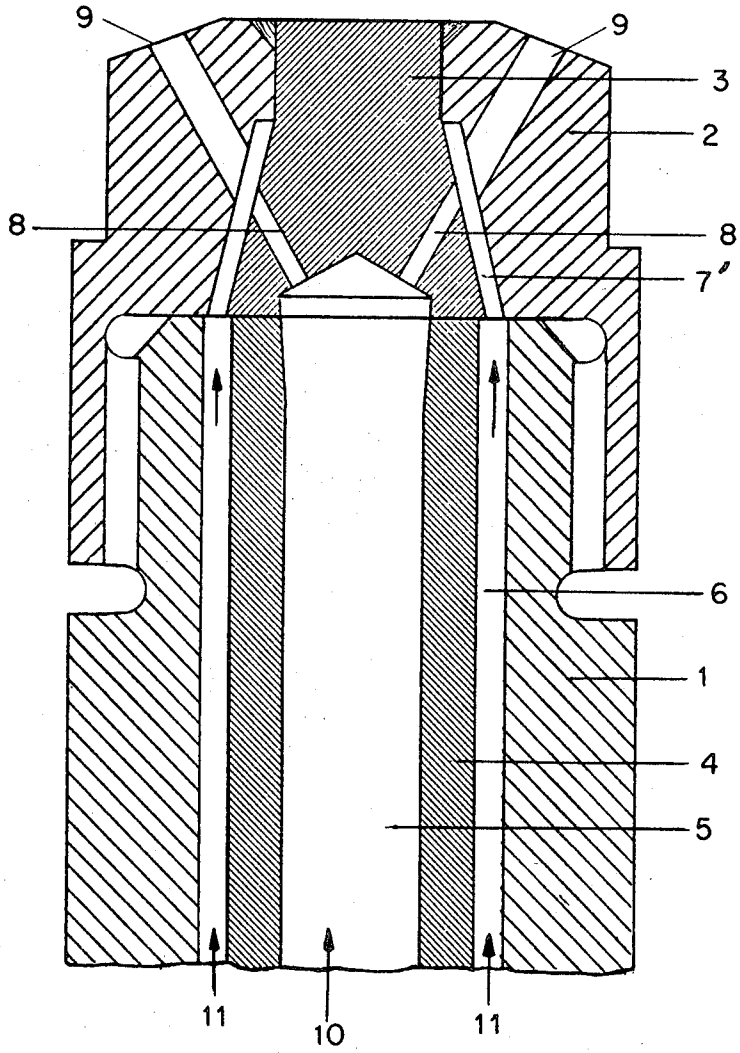


FIG. 2

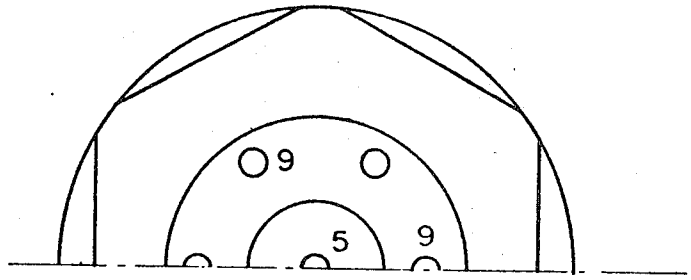


FIG. 5

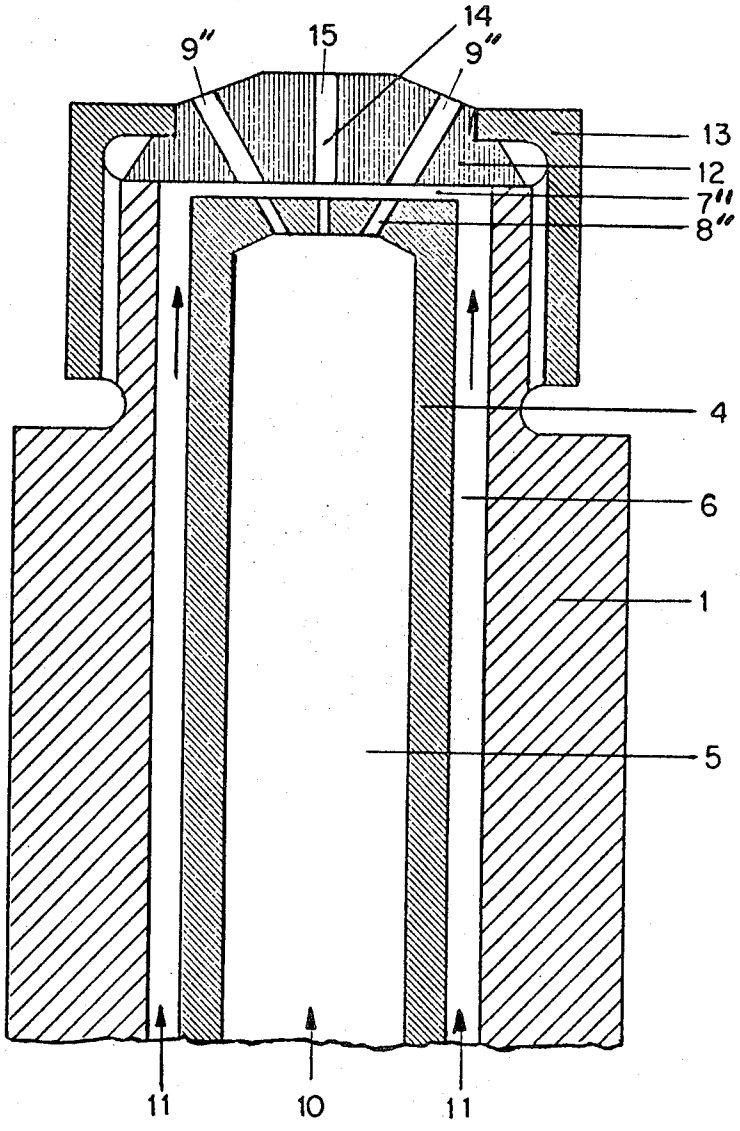


FIG. 4

ATOMIZER FOR LIQUID FUEL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an atomizer for liquids, including dispersions of solid particles in a liquid and emulsions.

2. Description of the Prior Art

Atomizers are applied on a large scale in combustion engineering. Liquid fuel is often divided into very small droplets in an atomizer prior to being mixed with air in a combustion chamber. Atomization is generally effected by providing for the liquid to spurt under pressure from one or more openings of special shape and dimensions. The addition of a gas, for instance steam, improves the atomization. It is of importance to have available atomizers which are capable of accommodating to large variations in fuel supply while maintaining desired combustion properties and with minimum steam consumption. Although the elucidation to be given hereinafter will deal mainly with steam atomization of oil, the atomizer is not restricted thereto. Steam may be replaced by, for instance, air, natural gas, refinery gas, etc. The steam may also be somewhat wet. The atomizer can also be applied in spraying installations, for instance, for the purpose of the vaporization of a volatile component.

SUMMARY OF THE INVENTION

According to the invention, an atomizer for liquids of the type utilizing atomization by a gas is provided with at least two channels which terminate at the head of the atomizer and which communicate with a common supply for the gas. The channels pass through a common, bounded space and at the location of the intersections around their entire circumference communicate with that space, which space communicates with a supply for the liquid.

Thus, passing as from inside the atomizer to the outlets of the channels, at first only steam is passed through the channels. At the locations of the intersections of the channels with the common bounded space, oil enters into the channels. This entry at those locations takes place around the entire circumference of the channels, which for this purpose have been interrupted there. By adjustment of the pressures on the oil supply and on the steam supply the ratio between oil and steam can be determined. By providing for all channels to pass through one common oil space stable operation is ensured and a simple construction becomes possible.

Experiments to be mentioned hereinafter have revealed that with this atomizer a surprisingly small quantity of steam is required for obtaining a very good atomization. A good atomization is promoted if the liquid space is bounded mainly by two surfaces which are parallel to each other and at a short distance from each other. The liquid space may very suitably be annular and in a coaxial position relative to the atomizer. The annular liquid space may form a hollow cylinder or may form a hollow cone, both being in a coaxial position relative to the atomizer. The aperture of the hollow cone may be directed away from the head of the atomizer. The liquid space may also have the shape of a flat box whose bounding flat faces are perpendicular to the centre line of the atomizer.

The flow pattern of the oil in the narrow annular or box-shaped common space guarantees a good atomization. The width of the gap may amount to 0.5–2.0 mm. At the location where a channel around its entire circumference communicates with the oil space, the steam jet meets an oil film which enters around the entire circumference of the channel. Due to this omnidirectional flow and due to the small thickness of the oil film, the oil film as soon as it joins the steam, is easily and evenly divided into droplets which split into even finer droplets leaving the outlets of the channels. Apart from the very low steam consumption already mentioned the additional advantage of a simple construction of the atomizer and of easy maintenance is achieved. This will be further elucidated when discussing the figures.

The outlets of the channels may be evenly arranged around the central axis of the atomizer, for instance in one or more circles. The channels may be situated in the plane of the lateral face of a body of revolution with the center line of the atomizer as the axis of rotation. That body of revolution may be a hollow cone with the base directed towards the head of the atomizer, i.e., upwardly when the atomizer is in a vertical position with the head to the top. Suitable atomizers, for large to very large capacities, may be provided, for example, with 6–12 channels. Owing to the above-mentioned configurations flames of a regular shape can be obtained. Of course, the way in which the combustion air is supplied and the shape of the burner throat as a matter of fact play an important roll.

It is of importance that the section of each channel between the liquid space and the outlet has a larger diameter than the remaining section of that channel, for instance, about 1.5 times as large. In this section of channel sufficient volume will then be available for the mixture of steam and oil droplets which is formed at the intersection.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of an embodiment of the atomizer of this invention having a cylindrical common bounded liquid space.

FIG. 2 is a sectional view of an embodiment of the atomizer of this invention having a conical bounded common liquid space.

FIG. 3 is a top view of the apparatus of FIG. 2.

FIG. 4 is a sectional view of an embodiment of the atomizer of this invention having a box-shaped common bounded liquid space.

FIG. 5 is a top view of the apparatus of FIG. 4.

DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. 1 is a cross-sectional view of an atomizer with an annular liquid space that forms a hollow cylinder. On an outer tube 1 there is positioned an unscrewable head 2. A tube section 3 affixed to the head 2 matingly engages an inner tube 4. The inner tube 4 contains a steam channel 5 which terminates in the tube section 3. An annular space 6 between the outer tube 1 and the tube 3 serves as the oil supply. This space 6 ends in an annular space 7. This space 7 forms a hollow cylinder which, together with at least two channels 8 passing through the wall of the tube section 3 and the head 2 constitutes the essence of the invention. The cylindrical bounding walls of the space 7 are close to each other. The channels 8 pass through that space and communi-

cate with it around their entire circumference. This is possible because the space 7 extends beyond the intersection with the channels 8. The channels 8 are wider beyond the space 7 where they pass through the head 2 than before it. They terminate at 9. The outlets 9 are preferably disposed in a circular pattern around the center line of the atomizer. The arrow 10 denotes the supply of the steam, the arrows 11 that of the oil.

The apex of the cone formed by the atomized oil amounts to about 75°. This angle can also be larger or smaller.

Because of its simplicity of construction the atomizer described can easily be mounted and made free from leaks. This is important because in burners high pressures are of ten applied, in particular when burning heavy oils. Moreover, the liquid space and the channels can easily be inspected and cleaned. By removing the unscrewable head 2 the liquid space 7 is exposed completely and the channels 8 are readily accessible.

FIG. 2 shows a cross-sectional view of an atomizer with an annular liquid space 7 that forms a hollow cone. Numbers in this and in the next figure that have been used earlier represent the same parts as denoted by them before. In this embodiment, the advantages as discussed with FIG. 1 remain. In FIG. 3 half of the top view of the atomizer of FIG. 2 is represented.

FIG. 4 gives a cross-section of an atomizer with a box-shaped liquid space. The box-shaped space 7'' is formed by the top face of the inner tube 4, and the bottom of a head piece 12. The head piece 12 is forced tight by means of a coupling nut 13. Besides the channels 8'' passing through inner tube 4 and head piece 12 in a manner similar to the channel 8 of FIG. 1, another central channel 14 with outlet 15 is present here. This atomizer also can be dismounted and cleaned easily.

EXAMPLES

A burner provided with an atomizer according to the invention, in particular approximately according to FIG. 2, was constructed for a maximum fuel consumption of 1500 kg/h of fuel oil. The burner was provided with six channels. The burner was found to operate well over a very wide fuel consumption range, namely from 120 up to 1200 kg/h of oil. The quantity of steam was dependent both on the fuel consumption and on the steam pressure which was kept constant here at 13.5 atm. With 120 kg/h of oil, 65 kg/h of steam was found to be required and with 1500 kg/h of oil only 19 kg/h (1.25 percent). This is exceptionally low and, as a result, a substantial reduction in costs is obtained.

Flame stability was always good. No carbon deposits were found on the head. Nor was fouling of the channels and spaces in the atomizer observed, not even after burning heavy fuel oil.

Reduction of the steam consumption at low loads can be achieved by providing for the steam supply to be throttled down together with the fuel supply. This provision makes the installation more expensive, however, and in view of the steam consumption being low already is superfluous with this burner. If the combustion air is controlled so as to follow the fuel consumption, then the fuel supply can be throttle down by a factor of 10 without objections.

A burner provided with an atomizer approximately according to FIG. 1, with 10 channels, was constructed for a maximum consumption on 2000 kg/h of fuel oil. With this burner, too, the same favorable results were achieved as with the burner described hereinbefore. It was found that the fuel consumption could be varied by a factor of 10 and a minimum steam consumption of only 1.25 percent w at an oil consumption of 2000kg/h could be attained.

I claim as my invention

1. An atomizer for liquids comprising:
an atomizer head having a plurality of fluid outlets for atomized liquid therein;
at least two channels within the atomizer, each channel terminating at an outlet in the atomizer head and being in fluid communication with a common gas supply channel;
the atomizer head having a bounded space therein in fluid communication with a supply of liquid to be atomized;
the channels intersecting and passing through said bounded space, the section of each channel between the bounded space and the outlet of the atomizer being of a larger diameter than the section of each channel between the bounded space and the common gas supply channel; and
each of the channels communicating with the bounded space around the entire perimeter of the channel at the location of the intersection of the channel with the bounded space;
whereby gas flowing from the common gas supply passes into the channels, contacts and atomizes liquid at the intersection of the channels with the bounded space, and carries atomized liquid further down the channels to the fluid outlets.

2. An atomizer according to claim 1, wherein the bounded space is bounded by two surfaces which are parallel to each other and at a short distance from each other.

3. An atomizer according to claim 2, wherein the bounded space is annular and in a coaxial position relative to the central axis of the atomizer.

4. An atomizer according to claim 3, wherein the annular bounded space forms a hollow cylinder.

5. An atomizer according to claim 3, wherein the annular bounded space forms a hollow cone, the apex of the hollow cone being axially directed in the direction of flow of atomized liquid.

6. An atomizer according to claim 3, wherein the bounded space has the shape of a flat box, having bounding flat faces perpendicular to the central axis of the atomizer.

7. An atomizer according to claim 3, in which atomizer the fluid outlets are evenly arranged around the central axis of the atomizer.

8. An atomizer according to claim 1, in which atomizer the channels are situated in the plane of the lateral face of a body of revolution with the central axis of the atomizer as the axis of rotation.

9. An atomizer according to claim 8, in which atomizer the body of revolution is a hollow cone with the base directed in the direction of flow of atomized liquid.

10. An atomizer according to claim 1, in which atomizer the diameter of the section between the bounded space and the outlet is about 1.5 times as large as that of the section between the gas supply and the bounded space.

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