

[54] **ATOMIZERS**

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[58] **Field of Search** 239/407, 412, 417, 417.5,
239/408, 410, 411, 414, 416, 417.3

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[57] **ABSTRACT**

An atomizer for liquid fuel burners and the spraying of protective liquids or lubricating liquids onto the surfaces of forging, foundry, or stamping/embossing equipment and like articles comprising a cylindrical body member providing respective generally axially directed liquid and gas conduits, the liquid conduit terminating at one end of the body in a restricted liquid discharge passage formed concentrically in a centered axially extending boss and the gas conduit opening at the one end of the body in the radially directed

body end wall outwardly of the centered boss; a closure casing slidably supported on the peripheral wall of the body member and including an end wall structure providing a radial wall opposing the radially directed body end wall to define a gas chamber and having a conical recess coaxially related to the centered boss and defining at its minor diameter end a through bore dimensioned to closely slidably receive the centered boss to control the gas flow from the gas chamber around the centered boss and also providing in axially spaced relation opposing the end of the centered boss a needle valve disposed to enter the restricted fluid passage and control the liquid flow therefrom and integrally formed on the inner ends of intersecting radial arms defining sector shaped outlet passages; and resilient means operatively arranged between the body member and closure casing to normally bias the closure casing in a direction to ensure the closure of the restricted liquid discharge passage by the needle valve and the engagement of the periphery of the centered boss with the closure casing through bore to close off the gas flow. Provision for shifting the closure casing in the opposite direction comprises convergent angularly spaced restricted passages in the centered boss radially outwardly of the restricted liquid passage to provide permanently open by-pass gas flow passages connecting the gas chamber to the atmosphere to alternately effect a gradual build up of pressure to overcome the biasing force when pressurized gas is supplied and a gradual reduction of pressure in the gas chamber when the pressurized gas supply is interrupted. The preliminary flow of gas and the terminal flow of gas through the by-pass passages as the pressure in the gas chamber rises and falls clears the liquid from the discharge end of the restricted liquid discharge passage and the needle valve to eliminate the need of a liquid return line and to minimize clogging formations on the needle valve and in the end of the restricted liquid discharge passage.

10 Claims, 3 Drawing Figures

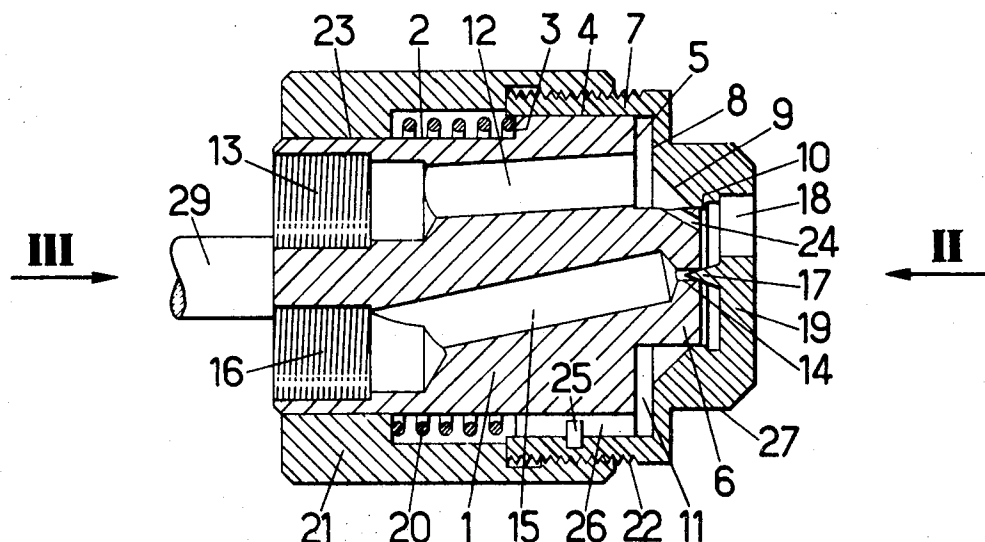


FIG. 1

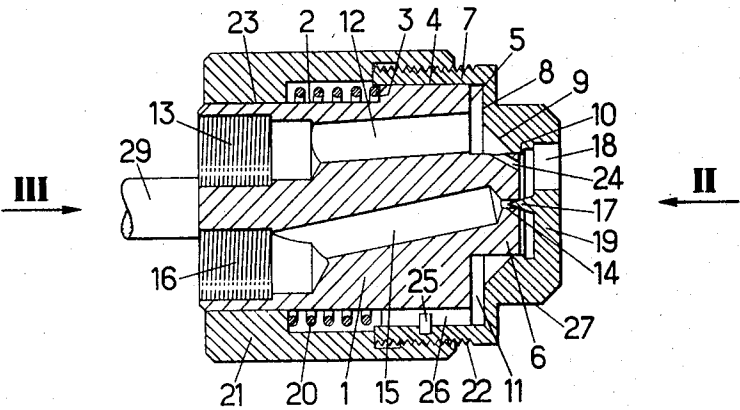


FIG. 2

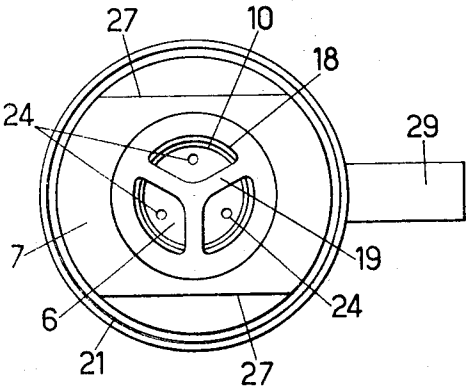
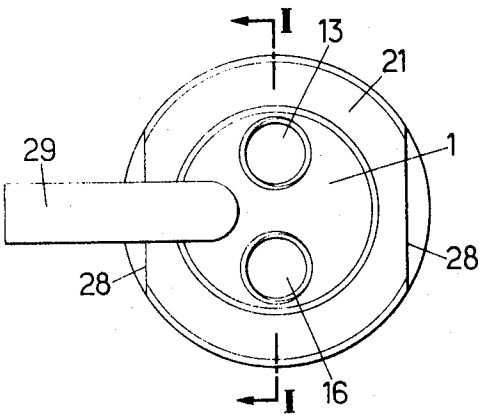


FIG. 3



BACKGROUND OF THE INVENTION

The present invention relates to atomizers intended to produce an emulsion of a liquid in a gas, notably to serve either as liquid fuel burners, the gas being generally air or possibly oxygen, or for the projection of protection liquids or lubricating liquids such as "poteyages" onto the surfaces of forging, founding or stamping/embossing equipment.

The majority of these atomizers comprise a needle inside the liquid, which necessitates joints which have low resistance to temperature and are subject to wear, which leads to leaks and necessitates a return line to the supply container. They also tend to become blocked when the liquid used comprises solids in suspension and they are relatively difficult to clean. This invention is directed primarily to overcoming these problems.

SUMMARY OF THE INVENTION

The invention accomplishes this end by providing a liquid-gas emulsion atomizer comprising two feeds under pressure, for gas and liquid to be emulsified respectively, formed in a central body member having a reduced diameter discharge tip at one end defining a centered liquid discharge passage and convergent gas discharge passages the inlet ends of which open through the peripheral tip sidewall and control means in the form of an external closure casing, having a centered needle valve opposingly related to the liquid discharge passage and enlarged, axially directed, sector shaped discharge passages opposite the gas discharge passages. The closure casing is slidably mounted on the central member and biased axially by resilient means in the direction to effect the closure of the liquid discharge passage by means of the needle valve. The closure casing is also counterbored to closely slidably receive the discharge tip and define with the end wall of the body member an annular gas chamber, operative when pressurized gas is supplied thereto, to overcome the resilient means and effect sliding movement of the closure casing in the opposite direction and, as a result, the opening of the liquid discharge passage.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects of the invention will appear from the following description and appended claims when read in conjunction with the accompanying drawings wherein:

FIG. 1 is an axial section along line I—I of FIG. 3;

FIG. 2 is an end view according to arrow II of FIG. 1; and

FIG. 3 is an end view according to arrow III of FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENT

The atomizer of the present invention comprises a central body member 1 defined externally by a cylindrical surface 2 separated by a shoulder 3 from another cylindrical surface 4 which has a slightly greater diameter. It is extended at the center of end face 5 by a cylindrical boss or discharge tip 6.

A closure casing 7, having an internal, stepped, cylindrical bore the major diameter portion of which is closely slide fitted around surface 4 of central member

1. As seen in FIG. 1, the stepped bore of closure casing 7 includes a radial wall 8 conically recessed at 9 to form a forwardly converging wall portion defining a concentric bore in the form of a narrow cylindrical surface 10 fitted in a quasi-tight manner onto the periphery of boss 6.

Chamber 11, which is defined between faces 5 and 8, is supplied with gas by a pipe or conduit 12 bored in member 1 and communicating with a threaded hole 13 in which there is fitted a gas supply conduit system which is not shown. A passage 14 is provided in the center of boss 6 for the liquid which communicates via another conduit 15 bored in member 1 with another threaded hole 16 into which is fitted a liquid supply pipe system which is also not shown. A valve needle 17, integral with the end wall of casing 7 in which three discharge apertures 18 are provided in the shape of sectors, penetrates into passage 14, which is in the axis of the device. As shown in FIG. 2, all that remains of this end wall are three radial arms 19 which connect the central needle 17 to the peripheral part of the casing enclosing bore 10.

A compression spring 20, bearing on shoulder 3 of member 1 and the base of a nut 21 screwed on the externally threaded part 22 of casing 7 and having a central bore 23 sliding on the external cylindrical surface 2 of central member 1, normally biases casing 7 and nut 21 to the left as seen in FIG. 1.

The assembly formed by casing 7 and nut 21, which are integrally joined with each other, may slide axially while being guided on the cylindrical surfaces 2 and 4 and, being biased towards the left-hand side of FIG. 1, seats needle 17 to completely block the central aperture 14 for the liquid whereas bore 10 blocks the communication between gas chamber 11 and the atmosphere. However, there are three small, convergent, communication channels 24 which provide communication between chamber 11 and discharge apertures 18. To prevent these channels emptying by chance opposite the radial arms 19, which phenomenon, while not impairing the functioning of the apparatus, would reduce the extent of the projection by blocking the flow, casing 7 is fixed against rotation relative to member 1 by means of, for example, a lug or key 25 which is integral with casing 7 and slides in a groove 26 which extends along a generatrix of the cylindrical part 4.

Flats 27 (see FIGS. 1 and 2) and 28 (see FIG. 3) are provided respectively on casing 7 and on nut 21 to facilitate the mutual tightening of these two pieces on each other. Finally, a third blind screw hole (not shown) situated on the same end face as pipe attachment holes 13 and 16 makes it possible to fixedly mount the atomizer by means of a bent stem 29.

In use, a liquid inlet pipe, for example for combustible liquid or a "poteyage" mixture, which is constantly under pressure, is fixed in threaded hole 16, while a gas inlet pipe, the gas generally being compressed air, is fixed in threaded hole 13. The air arriving via its pipe serves at the same time to control atomizing and to supply the atomizing fluid. This air pipe is connected for example to a valve or two-positions, three-aperture pneumatic distributor in such a way that in the inoperative position it is passed to the exhaust. In the operating position, the air pipe delivers the pressurized air which is necessary for atomization and for keeping the atomizer or atomizers in the opened position.

The method of operation is very simple. In the inoperative position, the pressure supplied by the spring 20 is sufficient to tightly seat needle 17 to close central aperture 14. When compressed control air is passed through aperture 13, pressure is gradually established in chamber 11 by virtue of the fact that the rate of flow through the three holes 24 is slower than that of the feed. When the pressure in this chamber reaches a value sufficient to overcome the force of spring 20, the assembly of casing 7 and nut 21 begins to be displaced to the right and progressively opens the liquid inlet, while the air is already discharging through aperture 24, thus creating a pre-atomization. As the air pressure in chamber 11 continues to increase, valve needle 17 opens aperture 14 completely while the bore 10 escapes from the extremity of the boss 6 and allows the direct distribution of compressed atomization air, this latter being canalized and orientated by the chamfer 9.

The maximum rate of flow of the liquid is controlled by the calibration of the diameter of the central passage 14, while the corresponding rate of flow of the air is limited by the course/thread of the nut 21 when spring 20 has contiguous turns, control being achieved by screwing or unscrewing the nut on the casing. When the feed is cut off, the opposite phenomenon occurs, the pressure drops gradually in chamber 11 progressively decreasing the air and liquid distribution until the moment that liquid passage 14 is completely closed when a certain quantity of air continues to pass through the three apertures 24 to ensure post-atomization.

The control of the quantity of atomized product is achieved either by means of a timing mechanism controlling the atomization time or by limiting, by means of a stop (not shown), the course/thread of the mobile external assembly.

The use of a valve needle situated entirely outside the liquid under pressure means that the device according to the invention requires no joint made of degradable material. This allows the valve needle to function perfectly even in zones where the temperature is increased, for example as a burner or a "poteyage" pipe in forging or casting operations, and also avoids all joint wear. Also, when operating or in the inoperative position, there is no danger of any escape of fuel and, therefore, there is no need for any return line to the supply container and no risk of liquid returning into the small air tube.

Moreover, the valve needle is self cleaning constantly and the central liquid output hole empties each time atomization is interrupted. This makes it possible for the operator to use products which block up conventional atomizers, for example products containing graphite. Additionally the conception of the invention apparatus makes it possible to have large outlet passages without any bifurcation, and thus avoids obstructions and makes for very good atomization. At the same time, it is extremely easy to clean the mechanism since the parts requiring cleaning are very simple and located on the outside of the apparatus. It is in fact sufficient to unscrew nut 21 in order to withdraw casing 7 and clean all the apertures without any particular need to disassemble the supply pipe network or the fixing support.

Finally, the device according to the invention avoids losses of liquid at the beginning and end of the atomization process due to the pre- and post-atomization. As

has been shown, when opening occurs the atomization air is in action before the liquid is liberated whereas when closure takes place the atomization air is still in action when the needle is closed.

Several atomizers of this type may of course be assembled in an array on joint feed pipe systems.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

1. A liquid-gas emulsion atomizer comprising a body member having respective feed conduits for conducting pressurized gas and pressurized liquid to one end of said body member to be emulsified, said liquid feed conduit terminating at said one end of said body member in an axial passage; an external closure casing slidably supported on said body member having an end wall structure including a needle valve disposed to enter said axial passage and ensure closure of said axial passage, means cooperating with said one end of said body member to define a gas chamber communicating with said gas feed conduit and a gas passage leading from said gas chamber, and also having a series of annularly spaced outlet passages; resilient means interposed between said body member and said closure casing normally biasing said closure casing axially in a direction to ensure the closure of said axial passage against the pressurized liquid and closure of said gas passage; restricted passage means interconnecting said gas chamber through said annularly spaced outlet passages to the atmosphere, said passage means being operative upon delivery of pressurized gas to said gas feed conduits to establish a progressively increasing pressure in said gas chamber effective to overcome the biasing force of said resilient means and shift said closure casing axially in the opposite direction opening said axial passage and said gas passage leading from said gas chamber thereby establishing a mixing and emulsification of the issuing liquid and gas and the discharge of the resulting emulsion from said annularly spaced outlet passages.

2. A liquid-gas emulsion atomizer as claimed in claim 1, wherein said liquid feed conduit is disposed along the axis of said body which at said one end is formed with an axially directed, centered boss of reduced diameter containing said axial passage, said gas passage leading from said gas chamber is defined by said centered boss and a radial wall of said closure casing defining a bore slidably fitted to the periphery of said centered boss.

3. A liquid-gas emulsion atomizer as claimed in claim 2, wherein the end face of said radial wall opposing said one end of said body member is conically recessed outwardly of its defined bore to direct the gas flow through said gas passage toward and to the center of the passage and the liquid issuing from said axial passage.

4. A liquid-gas emulsion atomizer as claimed in claim 1, wherein said restricted passage means in permanently communicating said gas chamber with the atmosphere effects both a pre- and post-atomization gaseous

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flow in the vicinity of said axial liquid passage thus avoiding loss of liquid and assuring emptying of the axial liquid passage whenever atomization is interrupted.

5. A liquid-gas emulsion atomizer as claimed in claim 4, wherein the pre- and post-atomization passage means comprise passages the axes of which converge towards the bottom of the needle valve.

6. A liquid-gas emulsion atomizer as claimed in claim 2, wherein the front part of the closure casing comprises radial arms located in the atomization zone and intersecting along an extension of the axis of said body member and said closure needle is connected to the intersecting portion of the radial arms in coaxial opposed relation to said axial passage.

7. A liquid-gas emulsion atomizer as claimed in claim 1 wherein said closure casing is composed of two elements screw connected to each other and slidingly supported by said body member, said body member and one of said two elements are respectively provided with

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radially directed opposing annular shoulders, and said resilient means comprises a compression spring disposed in end bearing engagement with said opposing shoulders.

8. A liquid-gas emulsion atomizer as claimed in claim 1, wherein said body member fixedly mounts on its rear face a support stem for fixedly mounting said atomizer.

9. A liquid-gas emulsion atomizer as claimed in claim 1, wherein said feed conduits extend generally axially of said body member in a common diametrical plane and terminate at the end opposite said one end in liquid and gas feed holes threaded to fixedly mount supply pipes for supplying the liquid and gas under pressure to said conduits.

10. A liquid-gas emulsion atomizer as claimed in claim 1, wherein cooperating guide means are provided on said body member and closure casing to constrain them for relative axial movement.

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