May 22, 1956 N. FEIS 2,746,802

ATOMIZER FOR LIQUIDS

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Fig. 1.

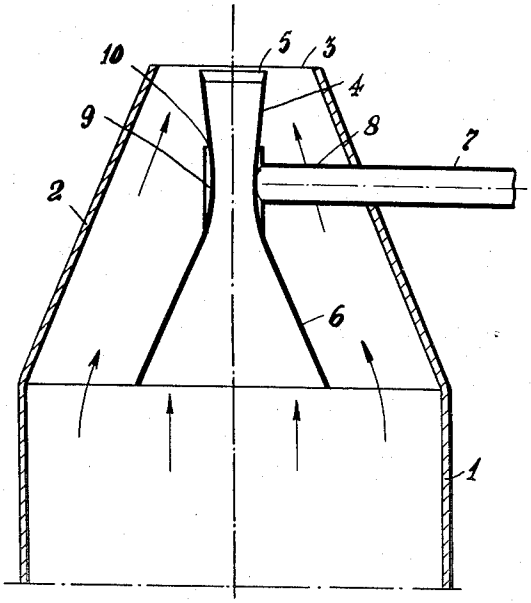

Fig. 2.

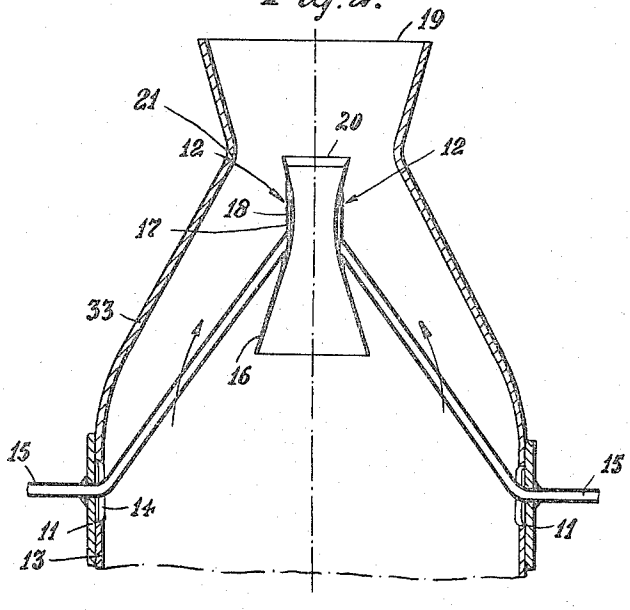

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Fig. 3.

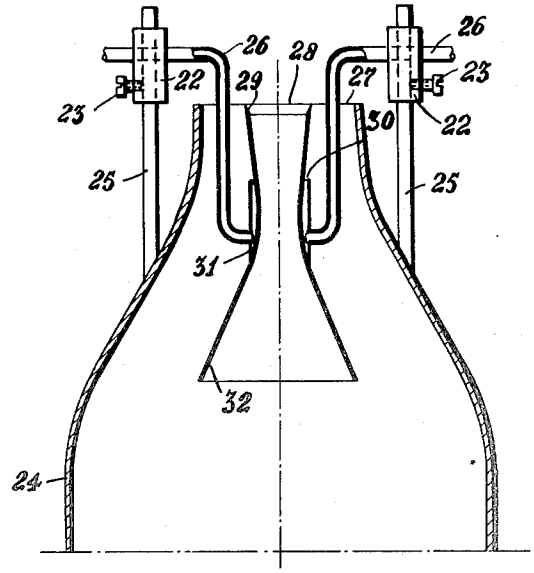
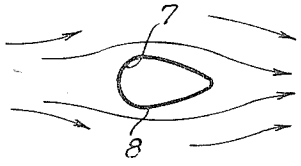


Fig. 4.



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ATOMIZER FOR LIQUIDS

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13 Claims. (Cl. 299—140)

The invention relates to an atomizer for liquids of the type wherein the liquid is introduced into a high velocity air current flowing through an air duct by means of a conical body diverging in the direction of the air current. The liquid to be atomized is led to the surface of the cone; the air stream flowing along this surface spreads the liquid over it in the form of a film and tears it away from the edge of the cone in the form of extremely fine droplets. Such an atomizer, however, has the disadvantage that a vortex is created in the air stream immediately behind the cone so that a fraction of the atomized liquid flows together into coarser droplets.

Wherever in this specification and in the claims the word "liquid" is used it is intended to refer not only to homogeneous liquids but also to emulsions and suspensions.

It is the object of the invention to provide an atomizer which is free from the disadvantage set out above, by giving the conical body the shape of an open cone frustum so as to allow the air stream to flow not only along the outer surface of the cone but through it as well, preventing thereby the formation of a vortex behind the cone or at least strongly reducing its importance.

Another object of the invention is to provide an open cone frustum having a knife-edge rear end so as to avoid the formation of coarser droplets at said end of the cone.

Another object of the invention is to form the upstream part of the cone frustum as an inverted cone so as to increase the quantity of air flowing through the cone.

Yet another object of the invention is to shape the double cone as a Venturi.

A further object of the invention is to provide an atomizer of the type set out above wherein the position of the cone in the air duct can be varied in axial direction.

Other objects of the present invention will be more clearly apparent from the following detailed description of several embodiments of the invention illustrated in the accompanying drawings, wherein

Fig. 1 shows in longitudinal section a first embodiment of the atomizer according to the invention,

Fig. 2 shows in longitudinal section another embodiment of the atomizer,

Fig. 3 represents in longitudinal section a third embodiment of the atomizer, and

Fig. 4 is a cross-section of the liquid duct of the atomizer of Fig. 1.

In Fig. 1 the reference numeral 1 shows an air duct provided with a conical mouth piece 2. A Venturi-shaped double cone frustum 4, 6 is located within said mouth piece. The liquid to be atomized is fed through the duct 7 to an annular chamber provided around the constriction of the Venturi and constituted by a tubular member 9 whose upstream end is fastened to the conical part 6 of the Venturi. The liquid fed to this chamber emerges therefrom through the annular aperture 10 at its downstream end, flows under the impulsion of the air stream over the external surface of cone 4 towards its downstream end provided with a sharp edge 5 and is

torn away from said edge by the air stream as extremely fine droplets. The downstream end of the cone 4 can be located with advantage substantially in the plane of the aperture 3 of the air duct. Air flowing through cones 6,4 prevents the formation of vortexes behind the edge 5 so that the atomized liquid will be carried away without formation of coarser droplets.

In the embodiment shown in Fig. 2 the air duct 13 is provided with a Venturi-shaped end piece 33. A Venturi-shaped body 16 is located within the air duct with its downstream end 20 preferably in the constriction 21 of the Venturi-shaped end piece. The liquid to be atomized is fed through the ducts 15 to an annular chamber provided around the body 16 and constituted by the tubular member 18 fastened at both ends to the external surface of the body 16. The liquid emerges from the orifices 12 provided circumferentially in member 18, flows under the impulse of the air stream as a film over the external surface of the member 18 and of the Venturi 16 towards the sharp-edged downstream end of the latter and is subsequently carried away by the air stream in the state of extremely fine division.

In order not to disturb the air stream in the neighbourhood of the edge 20 the liquid duct or ducts are given a sloping position with respect to the axis as shown in the drawing. In order to allow variations in the longitudinal position of the body 16 with respect to the constriction 21 of the Venturi-shaped end piece of the air duct, the liquid ducts 15 are not fastened to the air duct 13 but are carried by an annular member 11 slidable on the air duct. Longitudinal slots 14, provided in the air duct 13, allow an axial displacement of the member 16, the ducts 15 and the annular part 11. Air leakage through slots 14 is prevented by the annular part 11 covering the slots even in the extreme positions of said part. The degree of atomization depends on the velocity of the air stream adjacent the edge 20 of the cone and can therefore be varied by changing the position of member 16. Maximum fineness is achieved when the edge 20 is positioned in the plane of constriction 21 of the Venturi. Air, flowing through member 16, prevents the formation of vortexes behind the edge 20 so that the atomized liquid will be carried away without formation of coarser droplets.

In the embodiment according to Fig. 3 the air duct 24 is provided at its end with a constriction 27 and carries a Venturi-shaped body 32. Reference numerals 31 and 30 show parts corresponding with those shown by the reference numerals 9 and 10 in Fig. 1.

The liquid duct 26 carrying the Venturi-shaped body 32 is provided with a guiding piece 22 slidably associated with a support 25 fastened to the air duct 24. A set screw 23 allows to fix the body 32 in the desired position. In order to achieve the highest degree of atomization the sharp downstream edge 28 has to be positioned in the plane of the orifice 27. The formation of vortexes behind the body 32 is prevented by air flow through said body.

Experiments have shown that it is of advantage to dimension the conical body so as to have substantially equal air velocities in a cross-section of the air stream behind said body.

It is also of advantage to give the liquid ducts a streamlined cross-section so as to reduce as much as possible the creation of vortexes downstream thereof. Fig. 4 shows a cross-section of a streamlined duct, more specifically at line 8 of duct 7 of Fig. 1. The portions of the liquid ducts situated within the air ducts of the other figures may be visualized as being similarly streamlined. In order to achieve good atomization of watery or oily liquids the air velocity adjacent the downstream end of the conical body from which the liquid is carried away

by the air stream must be of substantially 250–400 feet per second.

I claim:

1. An atomizer for liquids comprising a duct for guiding therethrough a stream of a gaseous fluid in unidirectional flow, a hollow liquid dispersing member disposed within said fluid duct in axial alignment therewith and open at both ends for causing a fluid flow along the inner and outer wall of said hollow member, the said member having inner and outer wall surfaces both outwardly tapered in the direction of the fluid flow, and liquid conduit means for feeding liquid to be dispersed to the outer wall of said hollow member.

2. An atomizer according to claim 1, wherein the said hollow open ended member comprises a portion in form of a frusto-conical body inverted in the direction of the fluid flow.

3. An atomizer according to claim 1, wherein the said hollow open ended member comprises a double cone forming a Venturi, the said liquid conduit means leading approximately to the throat of said Venturi.

4. An atomizer according to claim 1, wherein the said hollow open ended member ends on its downstream side in a sharply edged rim.

5. An atomizer for liquids comprising a duct including a constricted portion for guiding therethrough a stream of a gaseous fluid in uni-directional flow, a hollow liquid dispersing member disposed within said fluid duct in axial alignment therewith and open at both ends for causing a fluid flow along the inner and outer wall of said hollow member, the said member having inner and outer wall surfaces both outwardly tapered in the direction of the fluid flow, a sleeve member encompassing the outer wall of said hollow member so as to form an annular chamber with said wall, the said sleeve member having at least one discharge orifice, and liquid conduit means for liquid to be dispersed communicating with said chamber.

6. An atomizer according to claim 5, wherein the said sleeve member has a plurality of circumferentially spaced discharge orifices.

7. An atomizer for liquids comprising a duct including a constricted portion for guiding therethrough a stream of a gaseous fluid in uni-directional flow, a hollow liquid dispersing member disposed within said fluid duct in axial alignment therewith and open at both ends for causing a fluid flow along the inner and outer wall of said hollow member, the said member having inner and outer wall surfaces both outwardly tapered in the direction of the fluid flow, a sleeve member encompassing the outer wall of said hollow member so as to form an annular chamber with said wall, the downstream end of said sleeve member being circumferentially spaced from the juxtaposed outer wall portion of the hollow member for forming an annular discharge orifice from said annular chamber, and liquid conduit means for liquid to be dispersed communicating with said chamber.

8. An atomizer for liquids comprising a duct for guiding therethrough a stream of a gaseous fluid in unidirectional flow, a hollow liquid dispersing member disposed within said fluid duct in axial alignment therewith and open at both ends for causing a fluid flow along the inner and outer wall of said hollow member, the said member having inner and outer wall surfaces both outwardly tapered in the direction of the fluid flow, adjustable support means supporting said hollow member for axial adjustment thereof relative to said duct, and liquid conduit means for feeding liquid to be dispersed to the outer wall of said hollow member.

9. An atomizer according to claim 1, wherein the said liquid conduit means include at least one liquid duct disposed at an angle relative to the axial direction of said liquid duct.

10. An atomizer according to claim 7, wherein the said liquid conduit means include within the fluid duct a duct portion streamlined in the direction of the fluid flow.

11. An atomizer according to claim 7, wherein the said fluid duct comprises a constricted portion, and wherein the downstream end of said hollow member is disposed approximately level with the narrowest cross-section of said constricted duct portion.

12. An atomizer according to claim 11, wherein the said narrowest cross-section of the constricted fluid duct portion is at the downstream end of said duct.

13. An atomizer according to claim 11, wherein the said fluid duct constitutes a Venturi, and wherein the downstream end of said hollow member is situated substantially level with the throat of said Venturi.

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