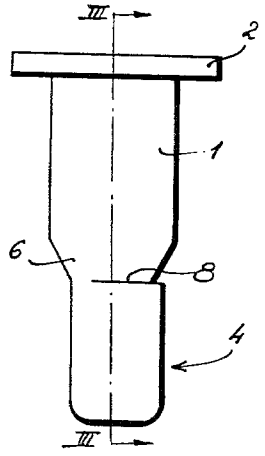
March 1, 1966 P. G. VICARD ETAL 3,237,871

STATIC LIQUID ATOMIZER

Filed March 9, 1964

Fig. 2



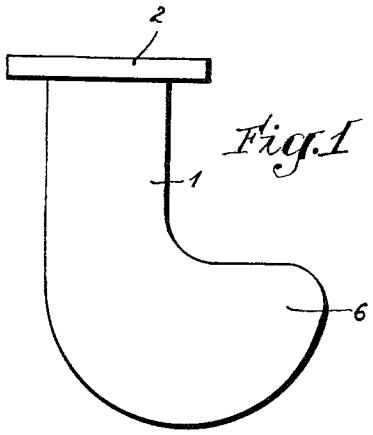


Fig. 1

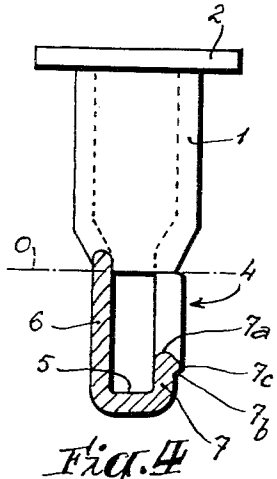


Fig. 4

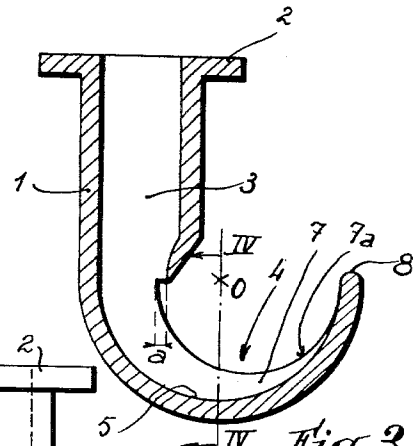


Fig. 3

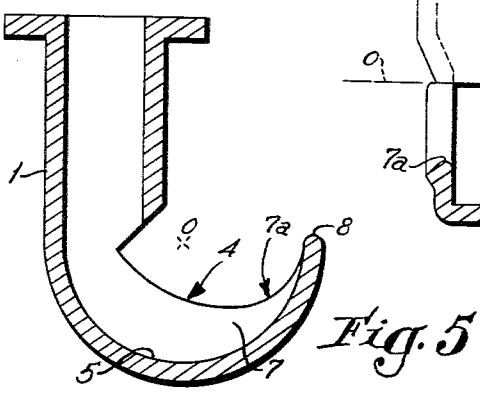


Fig. 5

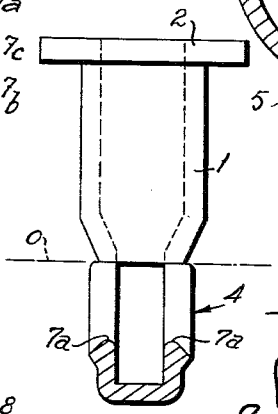


Fig. 6

INVENTORS

Pierre Georges Vicard

Jean-François Vicard

BY Alexander Mowell

ATTORNEYS

United States Patent Office 3,237,871 Patented Mar. 1, 1966

3,237,871

STATIC LIQUID ATOMIZER

Pierre Georges Vicard and Jean Francois Vicard, Lyon, France, assignors to L.A.B., Le Montellier, France, a French limited-liability company

Filed Mar. 9, 1964, Ser. No. 350,316
Claims priority, application France, Mar. 14, 1963, 43,433, Patent 1,359,281
5 Claims. (Cl. 239—468)

This invention relates to static i.e. non rotary liquid atomizers of the kind comprising a substantially circular whirl chamber into which the liquid is admitted tangentially, the said chamber having one or two coaxial outlet orifice or orifices through which the liquid which rotates at a high speed within the whirl chamber according to the so-called irrotational régime, issues in the form of a thin rotating sheet, the said sheet breaking up almost immediately into a more or less conical layer of fine droplets.

When the liquid to be sprayed contains solid particles in suspension, these particles separate from the liquid within the whirl chamber under the action of centrifugal force and they are applied against the inner periphery of the chamber where they are entrapped in the form of a ring which rotates at a high speed and thus causes a considerable attrition of the chamber wall.

Another disadvantage of the known static liquid atomizers is that the layer of fine droplets which they form extends through 360° about the axis of the whirl chamber and cannot be limited to a smaller angle as this would often be desirable.

It is an object of the present invention to provide a liquid atomizer which will be free from these inconveniences.

In accordance with this invention a liquid atomizer comprises an arcuate gutter-shaped member opening towards the axis of curvature and extending thereabout through less than 360°, and an inlet nozzle opening tangentially into one end of the said gutter-shaped member, one at least of the lateral walls of the said member, adapted to form a spraying edge, being of decreasing height with respect to the bottom of the said member from a maximum at the end thereof into which the nozzle opens to zero at the other end, while the height of the other lateral wall of the said member is at least equal to the height of the first one in each transverse plane.

The jet which issues from the tangential nozzle is deviated by the gutter-shaped member and is thus imparted a rotary motion with a high angular velocity. It therefore overflows the spraying edge formed by one of the lateral walls of the said member in the form of a thin sheet which breaks up into a layer or spray of fine droplets. The angular extension of this layer cannot of course exceed the angular extension of the spraying edge and may therefore be much lower than 360°. The solid particles in suspension in the liquid are immediately expelled at the free end of the gutter-shaped member (i.e. at the end thereof remote from the nozzle) and their abrasive action on the bottom of the said member is therefore quite limited.

In order that the formation of the spray may begin immediately at the outlet of the tangential nozzle it is of advantage so to arrange the said outlet that it extends radially towards the axis of curvature of the gutter-shaped member slightly beyond the profile of the spraying edge. Further, in order to take into account the fact that owing to frictional losses the linear velocity of the liquid stream tends to decrease from the nozzle to the opposed end of the gutter-shaped member, the curvature of the latter is progressively increased from the said nozzle end, the profile of the said member thus becoming an arc of a spiral.

In the annexed drawings:

FIG. 1 is a plan view of an atomizer according to the invention.

FIG. 2 is the corresponding side view.

FIG. 3 is a section taken along line III—III of FIG. 2.

FIG. 4 is a section taken along line IV—IV of FIG. 4.

FIG. 5 shows a modification of the atomizer of FIGS. 1–4.

FIG. 6 is a section similar to FIG. 4 but corresponding to a modification.

The static atomizer illustrated comprises an inlet conduit **1** provided with a coupling flange **2**. This conduit **1** terminates in a nozzle **3** which opens tangentially into one end of an arcuate gutter-shaped member **4**. As clearly shown in FIGS. 3 and 4 this gutter-shaped member **4** opens inwardly, i.e. its more or less U-shaped cross-section opens towards the axis of curvature **0** of its bottom **5** (see FIG. 4). In the example illustrated its angular extent is 180°. Its upper lateral wall **6** (FIG. 1) (i.e. the left-hand wall in FIGS. 2 and 4) is relatively wide and covers substantially the whole of the said member **4**, while its lower lateral wall **7** is of decreasing height with respect to the bottom **5** from the outlet of the tangential nozzle **3** to the free end **8** of the member **4** where this height is reduced to zero.

It is to be noted that the outlet of the tangential nozzle **3** which opens into gutter-shaped member **4** extends radially towards the axis of curvature **0** slightly beyond the profile of the edge **7***a* of the lower lateral wall **7** of the gutter-shaped member **4**, as clearly shown in FIG. 3 in which the radial distance between the edge **7***a* and the innermost point of the outlet of the tangential nozzle has been referenced *a*.

This edge **7***a*, which forms the spraying edge of the atomizer, is of increased thickness so as to determine a projecting rib on the outer side of the lower lateral wall **7**. The cross-sectional profile of this rib is rounded with an outer flat portion **7***b* which determines a sharp point or ridge **7***c*, as this is conventional in static atomizers.

When liquid under pressure is supplied to the atomizer described, the tangential nozzle **3** produces a high velocity jet which enters the gutter-shaped member **4**. Owing to the arcuate profile of the bottom **5** thereof the liquid is compelled to rotate about the axis **0** with a high angular velocity. At the same time, due to the decreasing height of the lower lateral wall **7**, the liquid overflows the spraying edge **7***a* in the form of a thin sheet which also rotates at a high angular velocity about the axis of curvature **0** and this sheet which extends more or less conically from the ridge **7***a*, breaks up almost immediately into a layer or spray of quite fine droplets, as in the known static atomizers, but with this difference that while in the latter the spray always extends through 360°, with the atomizer according to the present invention it is limited to the angular extent of the gutter-shaped member **4**, namely to 180° in the embodiment illustrated. Further while in the conventional atomizers the particles in suspension in the liquid are applied by the intense centrifugal force against the peripheral wall of the whirl chamber where they are retained in the form of a continuously acting abrasive ring, with the construction described these particles are immediately expelled at the free end **8** of the gutter-shaped member **4** and their action on the bottom **5** thereof is therefore negligible.

Owing to the inwardly protruding portion *a* of the outlet of the tangential nozzle **3** with respect to the gutter-shaped member **4**, the jet which issues from the said nozzle may begin overflowing the spraying edge **7***a* close to the outlet of the nozzle without any noticeable dead angle. The angular extent of the spray is therefore substantially equal to the angular extent of the gutter-shaped member

itself. It is obvious that in the absence of this arrangement, the liquid would only begin overflowing when the cross-sectional area of the jet would become greater than the cross-section area of the gutter-shaped member **4** considered as radially limited to the spraying edge *7a* (i.e. assuming that the upper lateral wall **6** is formed as the lower wall **7**).

In order to obtain a uniform atomization of the liquid along the spraying edge *7a* it is important that the angular velocity of the liquid along the said edge should remain substantially constant. If the velocity of the liquid flow through the gutter-shaped member **4** were constant, this condition would be fulfilled with a spraying edge exactly in the form of an arc of a circle. But owing to frictional losses the velocity of the liquid decreases from the tangential nozzle to the free end **8**. This may be compensated by slightly increasing the curvature of the spraying edge *7a* which becomes an arc of a spiral. This slight departure from the circular shape has been illustrated in FIG. 5 wherein the departure from the true circular shape has been exaggerated for the sake of clarity.

It is of course necessary that the cross-sectional area of the gutter-shaped member **4** (again considered as radially limited to the spraying edge *7a*) should decrease regularly from the nozzle end where it is slightly less than the cross-sectional area of the outlet of the tangential nozzle **3**, to the free end **8** where it becomes zero. This is obtained by providing the lateral wall **7** with a regularly decreasing height, as above explained, the width of the gutter-shaped member being constant. The height of the lateral wall **7** should theoretically be proportional to the angle about the axis of curvature **0** starting from the free end **8**. But in order to take into account the decrease of the flowing velocity of the liquid owing to frictional losses, it is convenient that the decrease of the height of the lateral wall **7** be slightly less than would result from a strictly proportional relation.

The angular extension of the gutter-shaped member may vary. Both lateral walls **6** and **7** thereof may be formed with a spraying edge such as *7a*, as indicated in FIG. 6, in order that the liquid may be atomized on both sides of the device, symmetrically with respect to the plane III—III of FIG. 2, in which case the height of both walls with respect to the bottom of the gutter-shaped member **4** should be the same in any plane transverse to the said member (as for instance in any plane containing the axis of curvature **0**).

We claim:

1. A static liquid atomizer comprising an arcuate gutter-shaped member of uniform width, extending through less than 360° about an axis of curvature and having a first end and a second end, and opening towards said axis, said member embodying a bottom, a first lateral wall and a second lateral wall with said first and second lateral walls being substantially parallel to each other to maintain a substantially uniform width for said member between said walls from said first end to said second end, said first lateral wall having an arcuate edge and being of decreasing height with respect to said bottom between said first end where its height is at a maximum and said second end when it becomes equal to zero, and the height of said second lateral wall with respect to said bottom being at least equal to the height of said first lateral wall in any plane transverse to said gutter-shaped member, in order that the arcuate edge of said first lateral wall may form at least one of the spraying edges of said atomizer; and a nozzle having an outlet opening into said first end of said gutter-shaped member; tangentially to the bottom thereof, said nozzle having a width parallel to said axis of curvature equal to said uniform width of said gutter-shaped member and having a height radially with respect to said axis of curvature substantially equal to the height of said first wall of said gutter-shaped member at said first end of said member.

2. In a static liquid atomizer as claimed in claim **1**, the outlet of said nozzle which opens into said first end of said gutter-shaped member having a cross-sectional area substantially equal to the cross-sectional area of said first end of said gutter-shaped member considered as limited in depth to the height of said first lateral wall.

3. In a static liquid atomizer as claimed in claim **1**, the outlet of said nozzle which opens into said first end of said gutter-shaped member extending towards said axis of curvature slightly beyond said arcuate edge of said first lateral wall at said first end of said gutter-shaped member.

4. In a static liquid atomizer as claimed in claim **1**, the profile of said arcuate edge of said first lateral wall being an arc of a spiral.

5. A static liquid atomizer comprising an arcuate gutter-shaped member extending through less than 360° about an axis of curvature and having a first end and a second end, and opening towards said axis, said member embodying a bottom, a first lateral wall and a second lateral wall forming a substantially U-shaped profile, with said first and second lateral walls being substantially parallel to each other to maintain a substantially constant width for said member between said walls from said first end to said second end, said first lateral wall having an arcuate edge and being of decreasing height with respect to said bottom between said first end where this height is at a maximum and said second end where it becomes equal to zero, and the height of said second lateral wall being at least equal to the height of said first lateral wall in any plane transverse to said gutter-shaped member, in order that the arcuate edge of said first lateral wall may form at least one of the spraying edges of said atomizer; and a nozzle having an outlet opening into said first end of said gutter-shaped member, tangentially to the bottom thereof, the outlet of said nozzle having a profile which closely joins the profile of said gutter-shaped member at said first end thereof, with the cross-sectional area of said outlet being substantially equal to the cross-sectional area of said first end of said member considered as limited in depth to the height of said first lateral wall at said first end.

References Cited by the Examiner

UNITED STATES PATENTS

816,897	4/1906	Bray	239—510
971,516	10/1910	Beaver	239—523
1,947,752	2/1934	Benesh	239—523
2,245,553	6/1941	Biedermann et al.	239—523
2,484,577	10/1949	Murphy	239—468
2,530,671	11/1950	Wahlin	239—523
2,535,766	11/1950	Wahlin	239—523
2,775,458	12/1956	Miller	239—504
2,864,652	12/1958	O'Brien et al.	239—523
2,986,343	5/1961	Trentini et al.	239—468
3,081,041	3/1963	Showalter	239—523

FOREIGN PATENTS

632,278	10/1927	France.
525,500	8/1940	Great Britain.

ROBERT B. REEVES, *Primary Examiner.*

EDWARD W. KIRBY, M. HENSON WOOD, JR., *Examiners.*

R. S. STROBEL, *Assistant Examiner.*