Sept. 1, 1959 J. E. NYROP 2,902,223

LIQUID ATOMIZERS

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Fig.1

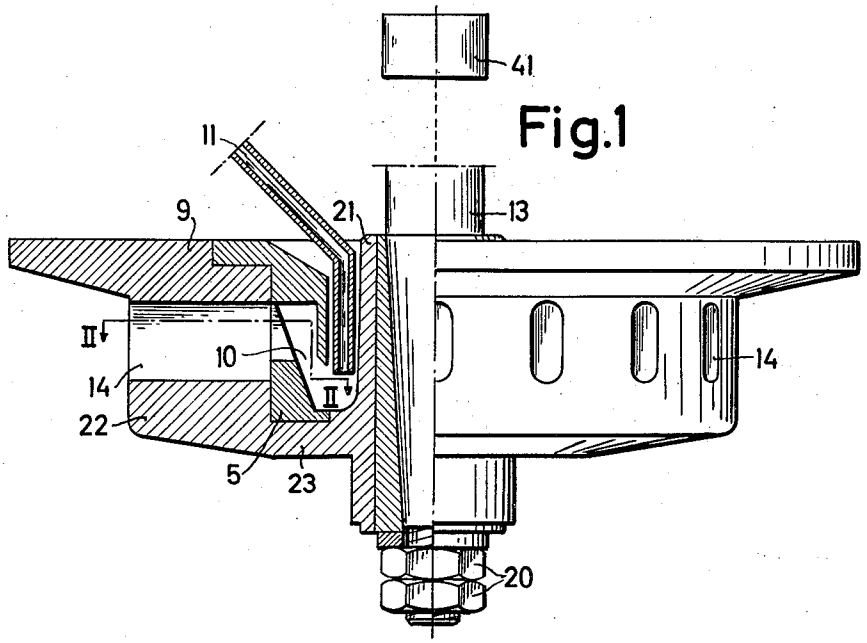


Fig.2

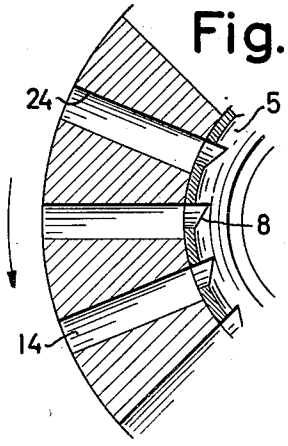
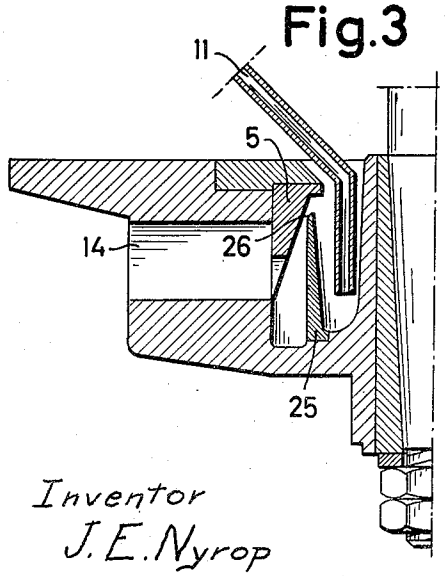


Fig.3



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Fig.4

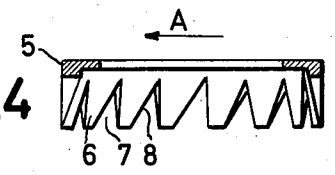


Fig.5

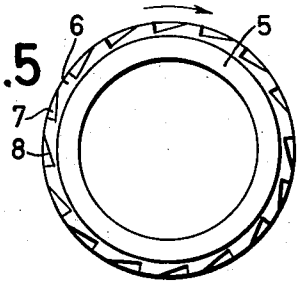


Fig.9

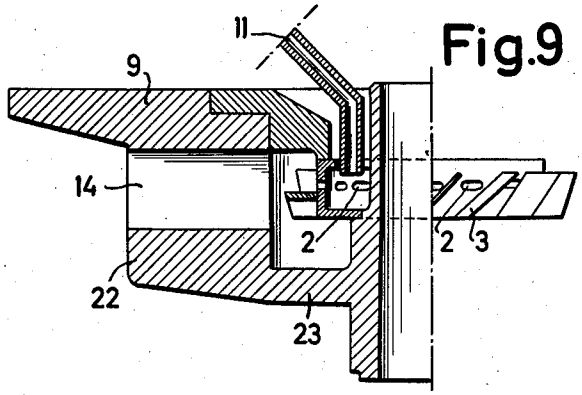
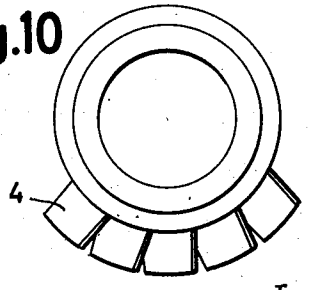


Fig.11



Fig.10



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Fig.6

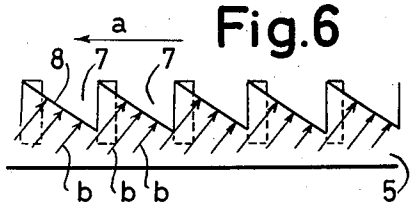


Fig.7

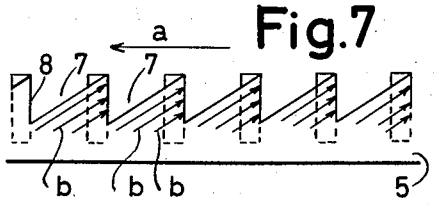
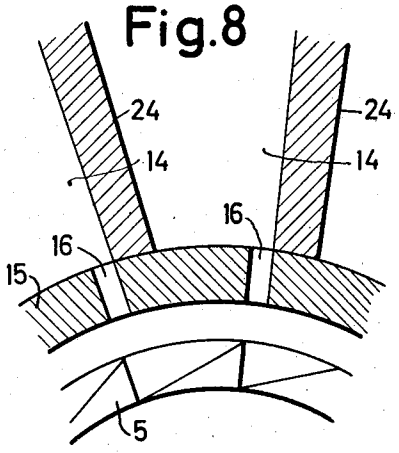


Fig.8



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LIQUID ATOMIZERS

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Application June 25, 1951, Serial No. 233,298

Claims priority, application Denmark June 26, 1950

1 Claim. (Cl. 239—223)

The invention relates to a liquid atomizer which consists of a rapidly rotating vane wheel, the vanes of which at their periphery fling out liquid in an atomized form, which liquid is supplied to the vane wheel by means of a single or a limited number of supply pipes for the supply of the liquid to a liquid distributing member rotating coaxially with the vane wheel.

In order to achieve an atomization that is as effective as possible, it is of importance that the liquid supplied to the vane wheels is supplied so as to be distributed as uniformly as possible over the inner edge of each individual vane, and the purpose of the invention is to indicate a simple and expedient design of such a liquid distributing member in such a way that an effective distribution of the liquid is achieved.

It has proved that the effectivity of the atomization increases with the product n^2r, where n is the rate of revolution and r the radius of the atomizer wheel. In the case of atomization of certain substances inclined to coagulate, such as e.g. polyvinyl chloride latex, it is, however, necessary to pay regard to the fact that coagulation occurs when the product nxr exceeds a certain limit dependent on the substance used. From said two quantities it appears that in cases where regard should be paid to the coagulation one should aim at reducing the radius and increasing the rate of revolution.

A reduction of the radius of the vane wheel will, however, also lead to a reduction of the space at disposal for the distributing member, and it is therefore of the greatest importance to be able to design such a member, which gives an effective liquid distribution, with the smallest possible radius.

Fig. 1 shows an embodiment of the atomizer according to the invention viewed in side elevation and partly in section.

Fig. 2 shows a part of the atomizer shown in Fig. 1 in a cross-section at right angles to the axis.

Fig. 3 shows a modification of a detail of the atomizer shown in Fig. 1 in a sectional view.

Fig. 4 shows a sectional view of the liquid distribution member of the atomizer shown in Fig. 1 or the modification shown in Fig. 3.

Fig. 5 shows the same distribution member as viewed in axial direction.

Figs. 6 and 7 are diagrammatical illustrations of part of said distribution member for the purpose of further explanation of the distribution action.

Fig. 8 shows a sectional view of part of the atomizer shown in Fig. 1 for illustration of a further modification.

Fig. 9 shows a further modification of the distribution member of the atomizer in Fig. 1 viewed in side elevation and partly in section.

Fig. 10 shows the same modification in plan view.

Fig. 11 shows a detail of the same modification.

The atomizer is in Fig. 1 shown as secured on a shaft **13** by means of nuts **20**. The shaft **13** is in a well known manner connected with a driving means **41** only schematically shown for rotating the atomizer rapidly.

The atomizer comprises a vane wheel generally designed by **9**. Said vane wheel consists of a hub **21** secured to the shaft **13** and an annular vane member **22** secured to the hub **21** by means of a plate or bottom part **23**. As may be seen in Fig. 2, the vane member **22** surrounds co-axially the hub **21**, an annular space being provided between them. In the vane member **22** a number of channels **14** extend from the inner circumference to the outer circumference of the annular vane member. Said channel may have any appropriate shape and need not necessarily be rectilinear as shown in Fig. 2. As it is well known a wall **24** of each channel constitutes a vane in such a manner that when the vane wheel is rapidly rotated in the direction of the arrow indicated in Fig. 2, a liquid supplied at the inner circumference of the vane member **22** will be moved along the wall or vane **24** due to the centrifugal force and be flung out in an atomized state from said wall or vane **24** at its terminating edge on the outer circumference of the vane member **22**. If the vane is rotated in opposite direction, the opposite wall of each channel will act as a vane, unless the shape of the channel **14** is such that the necessary centrifugal action only appears when the wheel rotates in the first-mentioned direction.

In the space between the hub **21** and the vane member **22** an annular liquid distribution member **5** is provided co-axially surrounding the hub **21**. In said space is further provided a supply tube **11** for the supply of liquid inside said distribution member. Said distribution member **5** is provided with a number of liquid distributon elements **6** each having a flinging-off edge **8** as shown in Fig. 2 and more clearly illustrated in Figs. 4 and 5 showing the distribution member separately. The distribution member should be further described later.

In the modification shown in Fig. 3 the liquid distribution member **5** is disposed up-side down relative to the corresponding member **5** in Fig. 1. Further a bowl-shaped member **25** is disposed concentrically surrounding the hub **21** with its flinging-off edge **26** inside the range of the distribution member **5**. Such bowl-shaped members are well known for the purpose of distributing the liquid supplied by a stationary supply tube. When the bowl-shaped member rotates, e.g. owing to a positive connection to a vane wheel the liquid is flung out from the edge of the bowl as a thin film in a practically plane surface. In the known devices this film directly impinges the vanes, but in the device described the film impinges the distribution member **5**.

Said distribution member **5** is of the same shape in Fig. 1 and in Fig. 3, but is oppositely disposed. In Fig. 4 it is shown in the position corresponding to that in Fig. 3. As seen in Figs. 4 and 5 it has the shape of an annular body with a conical internal surface interrupted by evenly distributed saw-tooth-like or angular recesses **7** dividing said conical surface in the above-mentioned elements **6**.

In the following explanation it is supposed that the distribution member **5** is intended for rotating in the direction of the arrow A. The liquid to be atomized is flung against the upper part of the conical surface from the flinging-off edge **26** of the bowl-shaped member **25** in Fig. 3. When the liquid impinge on the distribution member **5** it will owing to the centrifugal force move down along the elements **6** as the radius of the conical surface increase downwards. Due to the slip the liquid does not completely follow the motion of the distribution member, but flows in a direction obliquely backwards towards the oblique edges **8** produced by the cut **7**. From the edges **8** the liquid is due to the centrifugal force flung out against the vanes **24**.

In Fig. 1 the conical internal surface of the member

5 has upwards increasing radius. The liquid supplied through the tube 11 will consequently be forced upwards from the plate or bottom part 23 by the centrifugal force. Otherwise the effect is the same as described above.

As will be seen, the outermost edges of the teeth do not come in contact with the liquid on account of the backwards-directed motion of the latter and are therefore superfluous, and therefore the forwards-directed edges may very well be cut off obliquely.

For increasing the conveyance force it is in both cases, but especially in the case of the design shown in Fig. 1, expedient that the part of the conical inner surface, which is not interrupted by the recesses 7, is provided with projections or keys or other irregularties for increasing the conveyance force. The part of the hub 9 forming the bottom of the chamber 10 may be designed correspondingly for the same purpose.

The recesses 7 in the distributing member 5 may in relation to the direction of rotation be designed either as shown in Fig. 7 or as shown in Fig. 8. In Fig. 7, the flinging-off edges 8 intersect the radial planes of the distributing member, while in Fig. 8 they coincide with the corresponding radial planes. The sawtoothing of the conical part of the distributing member produced by the recesses 7 will in other words in the two cases extend with the teeth oppositely directed in relation to the direction of rotation.

In both cases the slip between the liquid and the distributing member will entail that the motion of the liquid, which is indicated by arrows *b*, will get a backwards-directed component in relation to the direction of rotation. It appears from the figures, however, that this component in the case shown in Fig. 8 should be larger than that shown in Fig. 7 or in other words that there should be a larger slip in the case shown in Fig. 8 in order that the liquid should not be flung too far up along the conical surface and be flung off at the wrong edge. This can be attained by the conical surface being made less steep.

In order to reduce the relative velocity between the liquid flung off by the distribution member and the vane at the point where it is hit by the liquid, there are between distribution member and vane inserted guiding members for the liquid, e.g. as indicated in Fig. 8 a cylindrical ring 15 with slots 16, placed at the front of the vanes 14 reckoned in the direction of motion. The distributing member 5 flings the liquid against the ring 15, which it follows to one of the slots 16. Ring and distribution member may also be built together without any spacing. Hereby said relative velocity and the possibility of whipping in air are reduced.

Figs. 10 to 11 illustrate a modification of the distribution member 5 in Figs. 1 and 3. In Fig. 10 is schematically shown part of the vane wheel for illustration of the position of the distribution member in the atomizer.

In this modification said member comprises an annular bowl-shaped distributor 1 co-axially surrounding the hub 5. In the wall of said distributor a number of slots or elongated holes 2 is provided. The liquid is supplied to the interior of the distributor 1 by means of the supply pipe 11 in Fig. 1.

In each interval between two holes 2 a wing 3 is secured on the outside of the bowl-shaped distributor 1. The wings 3 have in the shown embodiment the shape of a rectangular plate piece as shown in Fig. 11 and may e.g. be secured by brazing in milled grooves in the outside of the distributor.

As appears from the figures, the holes 2 are all located at the same level and in the vicinity of the upper edge of the wings 3.

The liquid jets flung out from the holes 2 hit the obliquely mounted wings 3 on which the liquid will flow in part in the downward direction and in part on account of the effect of the centrifugal force outwards towards the obliquely placed edges 4 of the wings. As the parts of said liquid jets deriving from the part of a hole 2 located nearest the particular wing is hit by the wing at an earlier time than the parts deriving from the remotest part of the particular hole 2, the former parts of the liquid will have a longer time for running down the wings than the latter parts, and hereby the liquid will be distributed along the edge of the wings.

From said oblique edges 4 the liquid is flung outwards against the vanes. Thus the effect is the same as described above in connection with Figs. 1 to 5.

The invention is not limited to the embodiments shown on the drawing, the essential feature of the invention being the application of distribution elements of such shape that due to the centrifugal force the liquid will flow in such a way that it is led evenly distributed out towards an obliquely placed flinging-off edge.

The stationary supply member for the liquid may consist of one or more supply pipes, or the supply may be effected through the clearance between two pipes mounted co-axially.

Said supply pipes may be bent in the direction of motion, so that the liquid is not accelerated very much at the transition to the atomizer. For the same purpose, guide vanes may be mounted between the two co-axial pipes.

I claim:

In a liquid atomizer comprising a rapidly rotating vane wheel, said vane wheel comprising a hub and an annular vane member secured to said hub and coaxially surrounding the same, said hub and said vane member defining an annular space between them, said vane member having an inner circumference and an outer circumference and vanes constituted by a number of surfaces evenly distributed around the axis of said hub and extending from said inner to said outer circumference, an annular liquid distribution member being disposed in said space for rotation with said vane member about the axis of said hub and coaxially surrounding said hub, said distribution member being provided with a plurality of liquid distribution elements, said distribution elements constituting together a conical internal surface of said annular distribution member, said conical surface having angular recesses therein, one edge of each of said recesses constituting a flinging-off edge arranged in such a manner that it intersects an intersection line between said surface and a radial plane of said distribution member including the axis of rotation and said distribution member and said hub defining an annular space between them for receiving the liquid to be atomized said angular recesses have their apices located upwardly, a cup-shaped liquid impelling member being disposed coaxially with said annular distribution member inside said conical internal surface and having a flinging-off edge within the range of said conical surface.

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