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J. E. NYROP
LIQUID ATOMIZER

2,645,525

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3 Sheets-Sheet 1

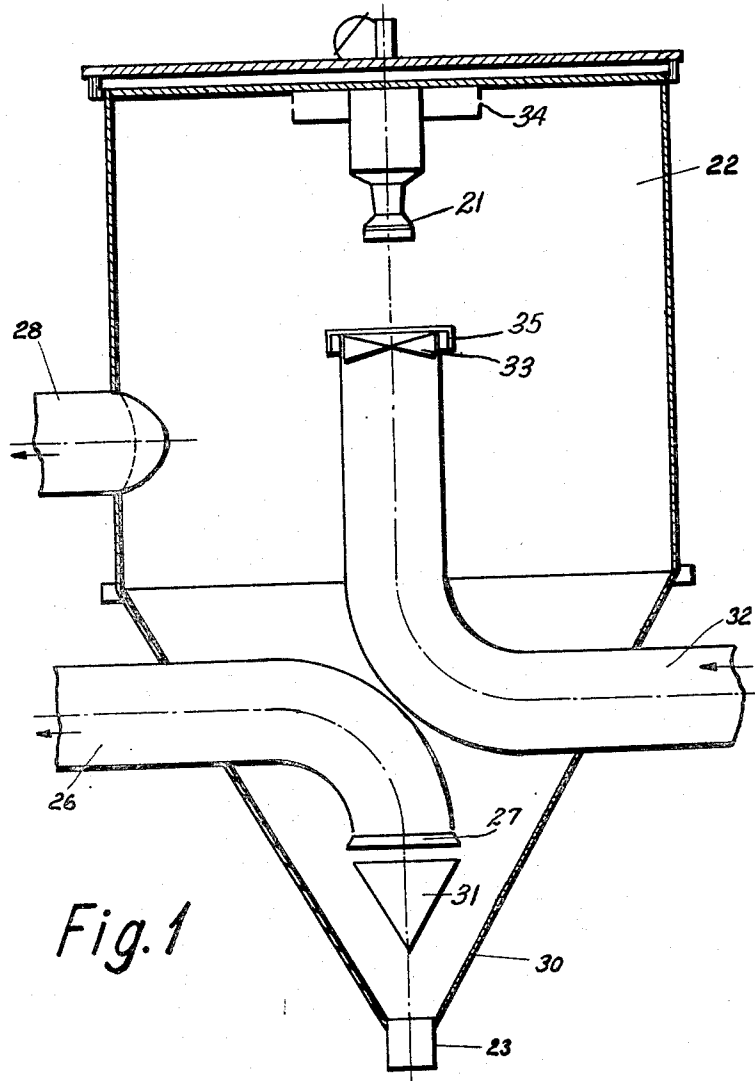


Fig. 1

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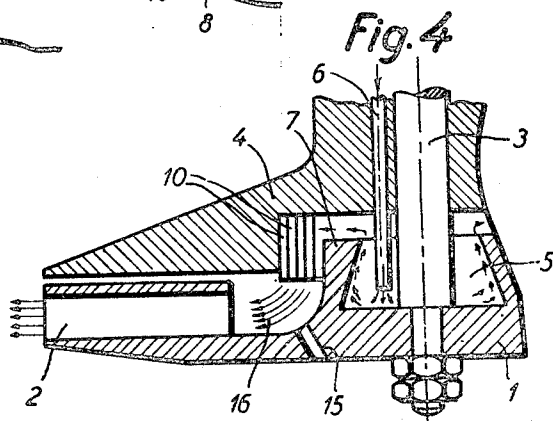
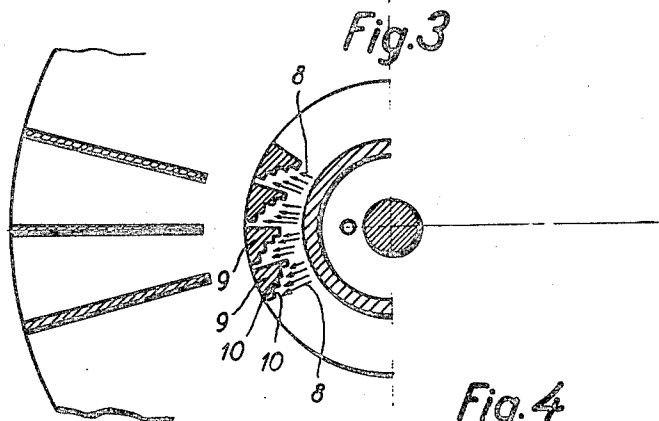
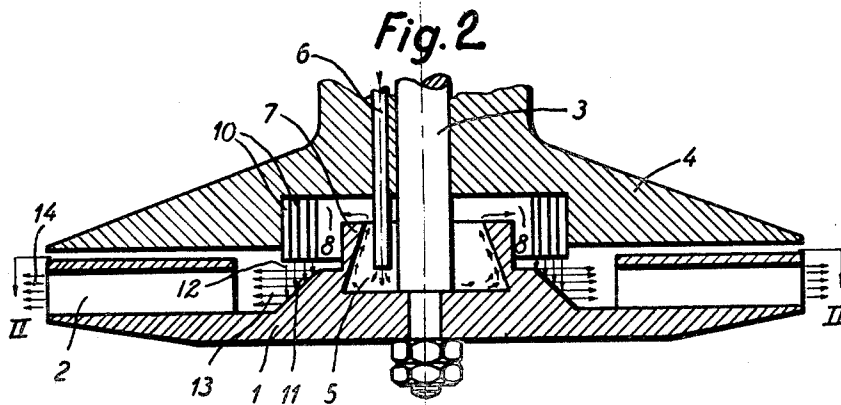
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Fig. 5

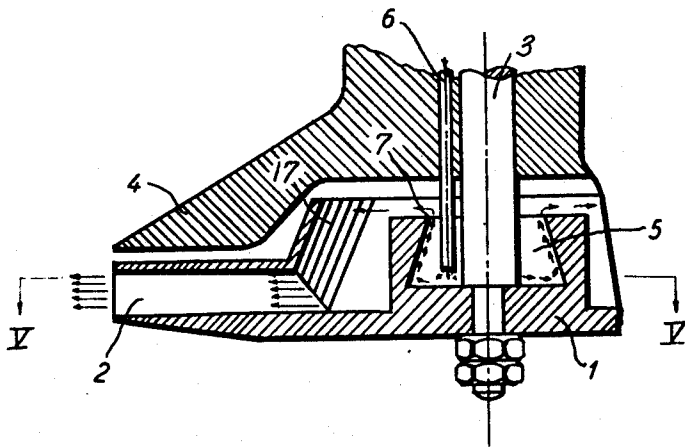
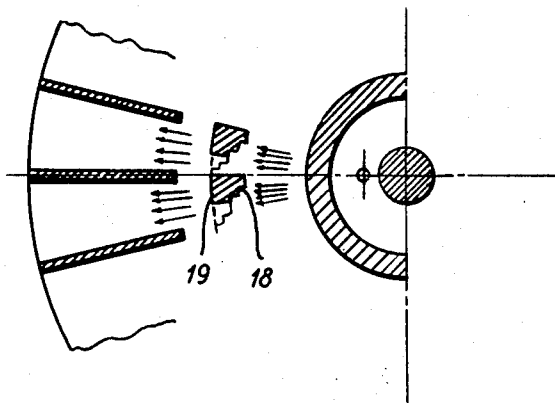


Fig. 6



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LIQUID ATOMIZER

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8 Claims. (Cl. 299—63)

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The invention relates to a liquid atomizer which consists of a fast-rotating vane wheel, the vanes of which at the periphery fling out the liquid, which is supplied at the middle, in an atomized form.

In processes, by which gases are to react with liquids, dispersions, or finely comminutable material, e. g. by drying processes, it is known to use atomizers, by means of which the liquid, dispersion, or finely comminutable material, which materials will in the following for the sake of brevity all be called liquids, are flung out in a very finely comminuted, so-called atomized, form, the liquid being led into a fast-rotating vane wheel, the vanes of which fling it out liquid from its outer edge. The liquid to be atomized is supplied to the horizontally rotating vane wheel through suitable supply lines, e. g., vertical supply pipes which are mounted in the stationary part of the atomizer situated above the vane wheel. The supply of the liquid is effected in the vicinity of the center of the vane wheel, where suitable distribution means may be provided, e. g. horizontal or conical surfaces which are hit by the liquid supplied which is from there distributed to the vanes of the vane wheel.

One object of the invention is to obtain a highly uniform atomization, and more specifically to provide a highly uniform distribution of the liquid to the vanes, which will result in a highly uniform atomization.

It is known to improve the distribution of the liquid by providing a large number of fine pipes or slots placed close to each other in a circle for supplying the liquid to a liquid distribution member.

Such fine pipes or slots will, however, frequently be more or less obstructed by deposition of solid particles with the result that the liquid distribution is no longer uniform.

A further object of the invention is to provide means for obtaining a highly uniform distribution of the liquid without the use of fine supply pipes or slots or other means subject to a risk of obstruction.

Still a further object of the invention is to provide means for uniform distribution of the liquid based on the principle of repeated deflection in steps, or more specifically based on the principle that when causing a liquid stream to strike a distribution member constituted, for example, by a plane surface at a certain angle to the direction of movement, the stream will be deflected with a cross sectional area that is different from that of the original stream dependent on the angle be-

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tween the original direction of the stream and the deflecting surface.

An important object of the invention is to set forth certain combinations of deflection means by which this principle can be used in a very effective manner for attaining a highly uniform distribution of the liquid without the risk of obstruction.

The invention will appear more clearly from the following detailed description with reference to the accompanying drawings showing by way of example preferred embodiments of the invention.

In the drawings:

Fig. 1 is a sectional view of a drying apparatus in which an atomizer according to the invention may be used;

Fig. 2 is an embodiment of a distributor of an atomizer in accordance with the invention;

Fig. 3 is a partial section on line II—II in Fig. 2;

Fig. 4 is a modified embodiment of the atomizer shown in Fig. 2;

Fig. 5 is a further embodiment of the atomizer in accordance with the invention, and

Fig. 6 is a partial section on line V—V in Fig. 5. Fig. 1 shows a known embodiment of a drying apparatus for drying or crystallization of solutions or liquid dispersions of any kind, contingently simultaneously with chemical reactions, by atomizing of the liquid.

It consists of a drying chamber 22 with an atomizer 21. A drying medium such as hot air, steam, combustion products or another gas is led into the chamber 22 through a lead-in pipe 32. At the mouth 35 of the pipe 32 are disposed vanes 33.

The drying medium is taken off through a pipe 26 and the dried product, which settles to the bottom of the lower part 30 of the chamber 22, can be taken off through a closure 23.

To retain the dried product against sucking out by the medium taken off through the pipe 26 a conical screen 31 is disposed beneath the mouth of this pipe.

A secondary part of the drying medium may be taken out through the pipe 23 to avoid the formation of vortices in the chamber.

It should be understood that the invention is by no way limited to the application of a drying apparatus of the embodiment shown in Fig. 1, as any other appropriate form for such apparatus may be applied. This apparatus is only shown for the better comprehension of the application

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of the inventional features, nor is the invention limited to drying apparatus.

The atomizer shown in Fig. 2 consists of a vane wheel 1 with vanes 2. The vane wheel is secured on a very rapidly rotatable axle 3, and concentrically with the vane wheel above the vanes a cover piece 4 is mounted for the contingent prevention of air being sucked in by the rotation of the vanes.

In the boss of the vane wheel 1 there is a cup-shaped depression 5, to which the liquid is led through a single supply pipe 6. There may contingently be several such pipes, but the number of pipes is in all circumstances rather limited, the placing and number of the pipes making no contribution to the distribution desired of the liquid over the vanes.

The liquid supplied through the pipe 6 is flung away over the edge 7 of the depression by means of the centrifugal force substantially in a thin, plane or somewhat conical film, as indicated by arrows 8. The liquid thus flung out impinges in the embodiment shown on a stationary distribution member which consists of a suitable shaped inner surface of the cover piece 4. As appears from Fig. 3 this distribution member has in a cross section at right angles to the axis of rotation the form of a number of mutually adjacently mounted stepped sections 9, each of which has a number of guide surface elements 10 provided at varying distances from the axis. The liquid flung out along the arrows 8 is stopped by these guide surface elements and led downwards towards a conical distribution member 11 shaped on the boss of the vane wheel, and on account of the different axial distances of the elements 10 the liquid is distributed uniformly over this member 11. The course of the liquid from the elements 10 towards the member 11 is designated by vertical arrows 12 in Fig. 2.

When the liquid passing in the direction indicated by the arrows 12 impinges on points of the conical member 11 situated at different axial distances the liquid deflected by this member will be distributed over a corresponding level range, and the dimensioning of the different elements has been done in such a way that a uniform distribution over the whole of the space within the vanes 2 is just attained in the full height of the latter as indicated with horizontal arrows 13 in Fig. 2. The liquid is therefore flung out so as to be distributed completely uniformly as indicated by arrows 14, a very large uniformity in the size of the particles flung out being attained on account of the uniform distribution over the vanes.

As no narrow pipes or slots are provided, in which there is the possibility of deposition of particles, there is no possibility of the conditions being altered during the operation, and due to this there is a very large guarantee that particles of substantially uniform size will constantly be obtained.

The embodiment shown in Fig. 4 differs from that shown in Fig. 2 only in that instead of the conical member 11, a flow of air is used which is sucked in through bores in the vane wheel, only a single bore 15 of which being shown on the drawing. The air sucked in through these bores causes a deflection of the liquid flowing down from the guide surface elements 10 so that the liquid will be made to pass along the arrows 16.

In the embodiment shown in Fig. 5 a rotary liquid distribution member 17 has been used

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for the distribution of the liquid flung out over the edge 7. This liquid distribution member is in rigid connection with the vane 1 and therefore rotates at the same velocity. It may, however, be constructed for rotating at some other velocity. As appears from Fig. 6, this distribution member 17 has similar to the distribution members in the embodiment shown in Fig. 2 a number of guide surface elements 18 at varying distances from the axis shaped in such a way that in horizontal cross section as shown in Fig. 6 there will be a number of stepped sections 19 placed side by side in a circle. In the embodiment shown the individual guide surface elements 18 are not, however, plane like the guide surface elements 10, but have substantially the form of flutes.

As appears from Fig. 6 the guide surface elements 18 decline outwards from the axis, and the liquid flung out from the edge 7 will therefore both by its gravity and by the centrifugal force be led downwards along the guide surface elements 18.

The sections 19 are below cut off obliquely, so that the guide surface elements 18 provided at the greatest distance from the axis are terminated at a higher level than those provided at a smaller distance from the axis. When the liquid flowing down the guide surface elements 18 reaches the lowest edge of the elements, it is flung out radially by the centrifugal force, and on account of the different levels of the terminations of the different elements a completely uniform distribution of the liquid flung out will be obtained in the whole space within the vanes, so that also by this construction there is a guarantee that the size of the particles of liquid flung out by the vanes is very uniform.

The cover plate shown in Fig. 5 is not necessary and the atomizer may hang freely in a long spindle, only a feed pipe being led down to it. This feed pipe may, by the way, be formed by a hollow spindle or a pipe led through a hollow spindle.

The invention is not limited to the embodiments shown on the drawing, it being possible to make many constructional modifications of the different details without getting outside the scope of the invention. The essential feature of the invention is that such a double deflection of the liquid occurs that it is distributed perfectly uniformly over the space within the vanes.

Furthermore it is possible to combine the measures indicated with other measures for the attainment of a uniform flinging-out of the liquid, e. g. suitable constructions of the vanes.

Instead of the rotary distribution member shown in Fig. 5 a conical or cylindrical distributor may be used, towards the inner surface of which the liquid is flung and from which it is flung out towards the vanes through cuts in line with these. The distribution means are shown above the atomizer wheel, but they may also be placed below or in the wheel.

The invention may also advantageously be applied in such atomizers where several vane wheels are mounted on the same axle for the purpose of distributing a large quantity of liquid over several wheels and thereby over more vanes than can be mounted on a single wheel. In this case a simultaneous atomization of several liquids may also be achieved without the liquids being mixed together before the atomization.

I claim:

1. A liquid atomizer comprising a shaft, means

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for rapidly rotating the shaft, a cup-shaped first liquid distribution member secured to the shaft, the edge of said cup-shaped first distribution member lying in a plane substantially at right angles to the shaft and concentrically with said shaft, a stationary liquid supply pipe leading into said first distribution member, a second liquid distribution member co-axially surrounding said first distribution member and spaced from the latter, said second distribution member having guide surface elements thereon facing said first distribution member, said guide surface elements being disposed at different distances from the axis of rotation of the first distribution member, said second distribution means defining deflection paths for the liquid, said paths being at an angle with respect to the plane of the edge of said first liquid distribution means, third liquid distribution members disposed within the range of said deflection paths and defining further deflection paths for the liquid at an angle with respect to the first deflection paths, a vane wheel secured to said shaft, outer edges on said vanes for flinging out liquid in atomized condition and inner edges on said vanes disposed within the range of said further deflection paths.

2. In a liquid atomizer as claimed in claim 1, said second liquid distribution member being stationary.

3. In a liquid atomizer as claimed in claim 1, said second liquid distribution member being connected to said shaft.

4. In a liquid atomizer as claimed in claim 1, said guide surface elements of said second liquid distribution member being of an elongated shape and extending parallel to said shaft.

5. In a liquid atomizer as claimed in claim 1, each of said guide surface elements of said second liquid distribution member being of an elongated shape, and intersecting the plane through said edge of the first liquid distribution member near one end of the respective surface elements and disposed obliquely relative to said shaft.

6. In a liquid atomizer as claimed in claim 1, said guide surface elements of said second liquid distribution member being connected together in step formation in groups of said surfaces, each group comprising a plurality of surfaces having mutually different distances from said shaft.

7. In a liquid atomizer as claimed in claim 1, said third liquid distribution members consisting of openings through the vane wheel in the vicinity of the boss of said vane wheel for sucking in air upon rotation of said vane wheel for defining said further deflection paths of the liquid.

8. In a liquid atomizer as claimed in claim 1, said guide surface elements of said second liquid distribution elements being of elongated shape intersecting near one end the plane through the edge of said cup-shaped liquid distribution element, the edge of each of said guide surface elements at the opposite end thereof being disposed at a distance from said plane dependent on the distance from said shaft to the respective surface elements whereby surface elements having mutually different distances to the shaft have also mutually different distances from said plane to said edge, said edges thereby constituting said third liquid distribution member.

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