United States Patent

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[31] **68/6227**

[54] **SPRAY NOZZLES**
10 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **239/504,** 239/524, 239/558, 239/561
[51] **Int. Cl.** **B05b 1/26**
[50] **Field of Search** 239/461, 483, 491, 504, 510, 556, 558, 560, 561, 521, 590.3

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ABSTRACT: The invention is directed to a method of forming a spray, to a spray nozzle and to a method of making a spray nozzle. The method of forming a spray includes the step of directing a jet of liquid onto an apertured diffuser element of coniform which diverges in the flow direction of the jet of liquid. The spray nozzle includes a nozzle and an apertured diffuser element of coniform opposite the nozzle outlet and diverging away from the nozzle. The invention also shows that an annular deflector element is provided around the diffuser element.

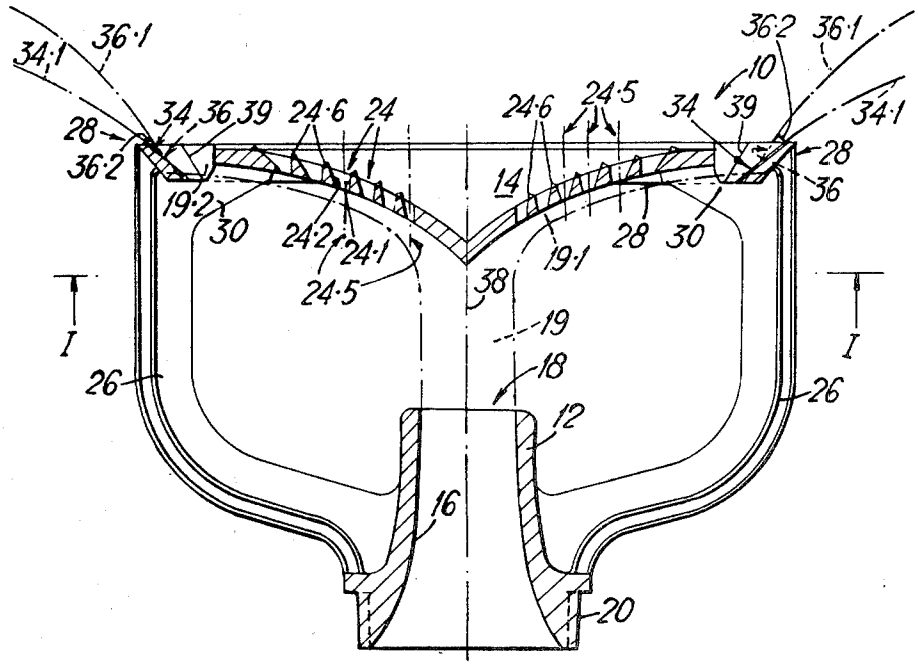

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Fig. 1.

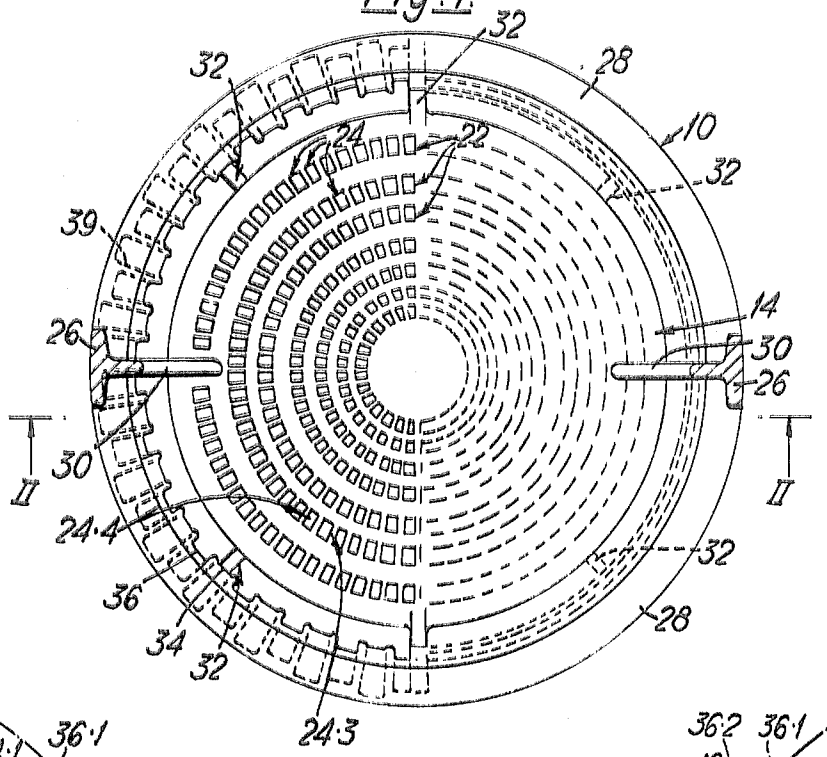
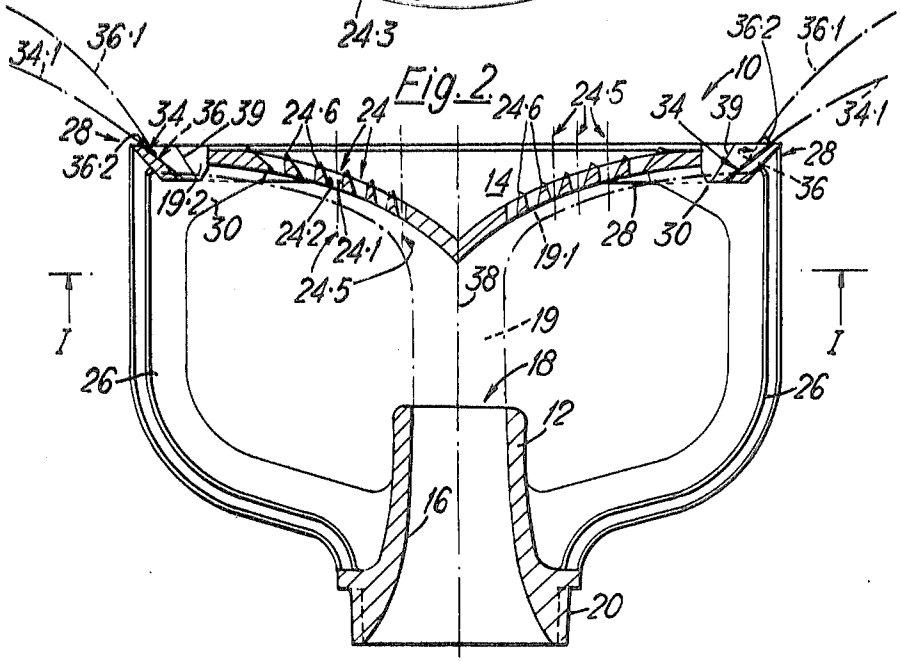


Fig. 2.



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SPRAY NOZZLES

FIELD OF THE INVENTION

This invention relates to improvements in or relating to spray nozzles. More particularly, the invention relates to an improved spray nozzle and to a method of forming a spray.

SUMMARY OF THE INVENTION

According to the invention, a spray nozzle includes a nozzle, an apertured diffuser element of coniform, and support means to support the diffuser element opposite and spaced from the nozzle outlet and diverging away from the nozzle.

Further according to the invention a method of forming a spray includes directing a jet of liquid onto an apertured diffuser element of coniform which diverges in the flow direction of the jet or liquid.

The method may further include the step of deflecting washoff liquid from the diffuser element into the direction of flow of the jet of liquid. Furthermore, the washoff liquid may be deflected in adjacent zones of different degrees of divergence circumferentially spaced about the diffuser element.

The diffuser element may be of hollow concave form, and may be a curved cross-sectional profile.

The apertures of the diffuser element may be spaced about its polar axis. These apertures may be round, elliptical, triangular, rectangular, segmental, or of any other convenient shape. The side or sides of each of these apertures may conveniently diverge in a direction away from the nozzle relative to an axis parallel to the polar axis.

The inclination of the radially remote side of an aperture from the polar axis may be proportional to its distance from the said polar axis. Consequently, the apertures diverge in the direction of divergence of the diffuser element.

In one form, the support means may include at least two ribs fast with the nozzle and with the diffuser element.

A spray nozzle according to the invention may include an annular deflector element around the diffuser element and mounted with a radial clearance defined between the elements.

Conveniently, the annular deflector element may have a plurality surfaces, having different degrees of divergence from the nozzle.

If desired, a spray nozzle according to the invention may be molded as a single integral unit in a synthetic plastic material.

According to a further feature of the invention, a spray nozzle includes a nozzle, an apertured diffuser element, support means to support the diffuser element opposite and spaced from the nozzle outlet, and deflecting means around the diffuser element to deflect washoff liquid from the rear side of the diffuser element relative to the nozzle in a direction away from the nozzle.

The deflecting means may comprise an annular element radially spaced from the diffuser element and having a plurality of circumferentially spaced deflecting surfaces at different degrees of divergence from the nozzle.

The invention is described by way of example with reference to the accompanying drawings in which:

FIG. 1 shows a section on line I—I of the spray nozzle shown in FIG. 2; and

FIG. 2 shows a section line II—II of the spray nozzle shown in FIG. 1.

Reference numeral **10** indicates generally a spray nozzle consisting of a nozzle **12** and an apertured diffuser element **14**. The nozzle has a tapering bore **16** and an outlet **18**, and has a screw-threaded section **20**. The element **14** diverges away from the nozzle **12**.

The diffuser element **14** is of coniform and is more particularly of a hollow concave form. The axial profile of the diffuser element **14** is curved smoothly as shown in FIG. **2**. The curve of the profile of the rear side of the diffuser element relative to the nozzle may for instance be circular or parabolic. If desired, the profile may be wholly or partially linear, or wholly or partially curved.

Radially spaced concentric rows **22** of apertures **24** are provided through the diffuser element **14**. In each row **22**, the apertures **24** are circumferentially spaced. The apertures **24** shown in the drawings are of angular cross section but they may also be of round or curved cross section.

Two ribs **26** are provided for supporting the diffuser element **14** on the nozzle **12** in line with and spaced from the nozzle outlet **18**. An annular element **28** is provided fast with the ends **30** of the ribs **26**. The annular element **28** extends around the diffuser element **14** and is radially spaced from its periphery. In addition to the rib ends **30**, lugs **32** are provided for securing the diffuser element **14** to the annular element **28**.

The annular element **28** has circumferentially spaced deflecting surfaces **34** and **36**. The surfaces **34** and **36** alternate and are inclined at different angles to the axis **38** of the nozzle **12** and of the diffuser element **14**. Raised ribs **39** separate surfaces **34** and **36**.

The apertures **24** in the diffuser element **14** are of tapering form and diverge in the direction of divergence of the diffuser element. Furthermore, the sides **24.1**, **24.2**, **24.3**, **24.4** of the apertures **24** diverge away from the nozzle relative to axes **24.5** parallel to the polar axis. The inclination of each side **24.2** may be proportional to its distance from the axis **38**. The sides **24.2** are extended slightly by providing projections **24.6** which assist in guiding the spray in the direction of the sides **24.2**.

In use, the screw-threaded section **20** of the nozzle **12** is screwed into a liquid supply line. Liquid under pressure is ejected through the nozzle onto the diffuser element **14**. The diffuser element deflects the jet **19** of liquid so that a sheet of liquid **19.1** flows across its divergent exterior surface. The liquid enters the apertures **24** which cause the liquid to be diffused into droplets. The droplets emerging from the apertures **24** form a spray at the rearward side of the diffuser element, i.e. on the remote side from the nozzle. Washoff liquid **19.2** from the diffuser element **14** strikes the incline surfaces **34** and **36** of the annular element **28**. The surfaces **34** and **36** deflect the washoff liquid in the direction of spray. By being differently inclined, the surfaces **34** and **36** cause the washoff liquid to be deflected into two spaced concentric zones, **34.1** and **36.1**. The surfaces **36** are extended slightly by providing projections **36.2** which assist in guiding the spray in the direction of the surfaces **36**.

The spray nozzle **10** may be of a suitable synthetic plastic material, In one material particular method of manufacture it is molded as a single unit in a synthetic plastic material. The divergent shapes of the apertures **24** allows a mold part used in the manufacture for forming the apertures **24** to be axially withdrawn from the apertures in the molding of the spray nozzle. This feature of the invention is advantageous to keeping the number of mold components to a minimum when a composite mold is used.

The spray nozzle **10** may be employed to form a spray in the cooling of liquids. It may for instance be used in cooling towers or ponds to cool hot water.

An advantage of a spray nozzle according to the invention is that the liquid jet issuing from the nozzles strikes the diffuser element at an angle to the exterior surface of the diffuser element. This is advantageous in preventing blocking of the apertures in the diffuser element. A further advantage is that little or no liquid is deflected back in a direction away from the spray. The invention is further advantageous in obtaining substantially uniform liquid distribution by forming a spray zone and one or more zones of deflected washoff liquid around the spray zone.

I claim:

1. A spray nozzle including a nozzle, an apertured diffuser element of coniform, and support means to support the diffuser element opposite and spaced from the nozzle outlet and diverging away from the nozzle, the diffuser element having a plurality of apertures spaced about its polar axis and the sides of each aperture diverging in a direction away from the nozzle relative to an axis parallel to the said polar axis.

2. A spray nozzle according to claim 1, in which the radially outward side of each aperture of the diffuser element is inclined to the said polar axis at an inclination which is proportional to its distance from the said polar axis.

3. A spray nozzle according to claim 1, which is an integral molding of a synthetic plastic material.

4. A spray nozzle including a nozzle, an apertured diffuser element of coniform, support means to support the diffuser element opposite and spaced from the nozzle outlet and diverging away from the nozzle, and an annular deflector element around the diffuser element and mounted with a radial clearance space between the elements.

5. A spray nozzle according to claim 4, in which the annular deflector element has a plurality of circumferentially spaced deflecting surfaces at different degrees of divergence from the nozzle.

6. A spray nozzle including a nozzle, an apertured diffuser element, support means to support the diffuser element opposite and spaced from the nozzle outlet, and deflecting means around the diffuser element to deflect washoff liquid from the rear side of the diffuser element relative to the nozzle in a direction away from the nozzle.

7. A spray nozzle according to claim 6 in which the deflecting means comprises an annular element radially spaced from the diffuser element and having a plurality of circumferentially spaced deflecting surfaces at different degrees of divergence from the nozzle.

8. A method of making a spray nozzle as claimed in claim 1, which includes molding the nozzle in a synthetic plastic material and forming the apertures during the molding operation.

9. A method for forming a spray which includes directing a jet of liquid onto an apertured diffuser element of coniform which diverges in the flow direction of the jet of liquid so that liquid passing through the apertures is diffused and emerges in the form of a spray while the liquid not passing through the apertures is washed off the diffuser element in a direction transverse to the flow direction of the jet of liquid, and which further includes deflecting the washoff liquid towards the spray.

10. A method according to claim 9, in which the washoff liquid is deflected in adjacent zones of different degrees of divergence circumferentially spaced about the diffuser element.