Nov. 21, 1950 F. W. WAHLIN 2,530,671

FLAT SPRAY NOZZLE

Filed March 8, 1945

Fig. 1.

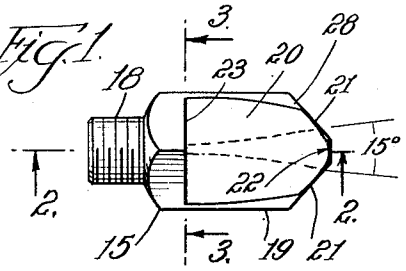


Fig. 2.

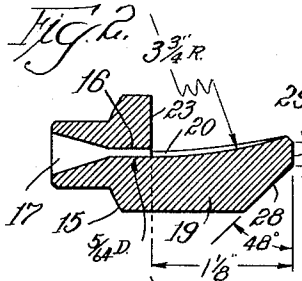


Fig. 3.

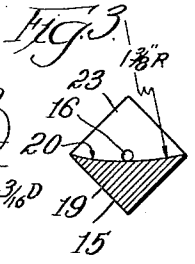


Fig. 4.

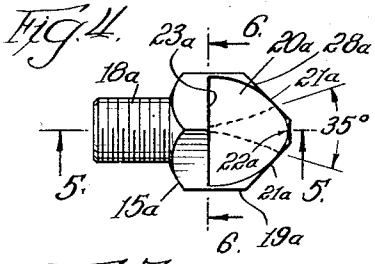


Fig. 5.

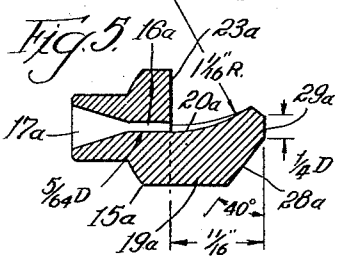


Fig. 6

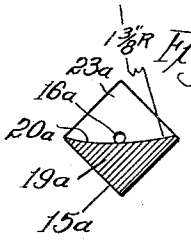


Fig. 7.

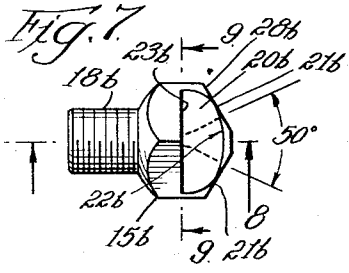


Fig. 8.

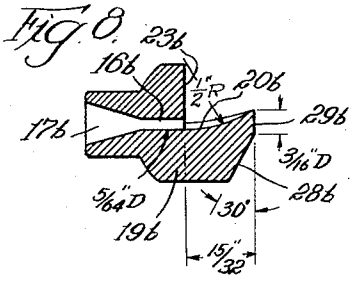


Fig. 9.

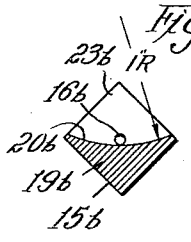


Fig. 10.

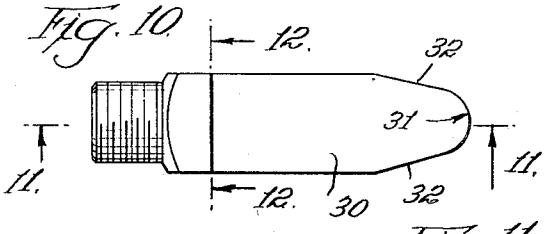


Fig. 11.

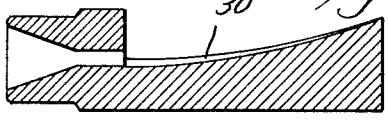


Fig. 12.

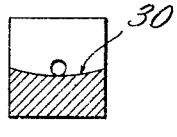
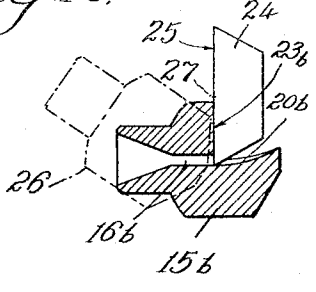


Fig. 13.



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FLAT SPRAY NOZZLE

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3 Claims. (Cl. 299—121)

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My invention relates to spray nozzles for discharging liquid in a thin flat V-shaped stream and has reference more particularly to a nozzle having an extension beyond the orifice formed with a deflector face along which the liquid is discharged and by which the stream issuing from the nozzle orifice is caused to assume the thin flat V-shape in which it is to be sprayed. My invention also includes a method of making such nozzles.

The principal objects of my invention are to provide an improved flat spray nozzle which insures greater uniformity and accuracy of spray pattern than heretofore; to effect the flat V-shape distribution with minimum deflection and minimum loss of velocity; to incorporate these advantages in a simple form of nozzle which may be made without special equipment; and to provide an improved method of making such nozzles, these and other objects being accomplished as pointed out hereinafter and as shown in the accompanying drawing in which:

Fig. 1 is a side view of my improved nozzle looking at the deflector face thereof;

Fig. 2 is a longitudinal sectional view of the nozzle taken on the line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1;

Figs. 4, 5, and 6 are views similar to Figs. 1, 2 and 3 respectively but showing a nozzle of wider spray angle than that of Figs. 1, 2 and 3;

Figs. 7, 8 and 9 are views similar to Figs. 1, 2 and 3 respectively but showing a nozzle of still wider spray angle than the nozzle of Figs. 4, 5 and 6;

Figs. 10, 11 and 12 are also views similar to Figs. 1, 2 and 3 respectively but showing another form of nozzle; and

Fig. 13 is a view illustrating a method of making the nozzles of Figs. 1 to 12 inclusive.

Referring to the drawing, and more particularly to Figs. 1, 2 and 3 thereof, the reference numberal 15 indicates the nozzle body which has an orifice 16 therethrough, preferably flared at the intake end as indicated at 17, suitable connection facilities being provided, such for example, as the external threading 18 for securing the nozzle body to a liquid supply system from which liquid is discharged under pressure through the orifice 16.

At the outer end of the orifice 16 the nozzle body 15 is provided with an extension 19, preferably integral therewith, which has a deflector face 20 along which the liquid is discharged from the orifice 16 and by which it is shaped into

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a thin flat V-shaped stream, as shown by dotted lines in Fig. 1, in which form it is discharged from the outer end of said deflector face 20.

This deflector face 20, which at its inner end is flush with one side of the orifice 16 as shown in Figs. 2 and 3, is of the same curved trough shape or transversely concave form throughout its length, the transverse curvature thereof being shown in Fig. 3, and in the direction of its length or in the direction of the stream issuing from the orifice 16 it is gradually curved laterally or across the axis of the issuing stream as shown in Fig. 2 so as to gradually deflect the liquid laterally and thereby impose a spreading and flattening effect upon the stream that issues from the orifice 16, the deflector face being terminated at its outer end in a form to cause the liquid to leave the outer end of the deflector face in a flat thin V-shaped stream of uniform thickness.

To this end the extension 19 is beveled at opposite sides of the outer end portion of the deflector face 20 as indicated at 21, 21 so that the outer portion of the deflector face 20 is tapered toward the extremity which is rounded as at 22, the taper 21, 21 and the rounding at 22 providing a take off edge contour bearing such relation to the trough shape or transverse curvature of the particular deflector face and to the angle of deflection at the outer end thereof that the lines of discharge of the liquid from the end of the deflector face 20 are in substantially the same plane throughout the width of the spray. Thus, the liquid which flows outwardly on the deflector face 20 in a progressively widening thin stream which is transversely curved in conformity with the transverse curvature of the face 20, is transformed into a flat planar form as it leaves the outer end of the deflector face 20.

For convenience of manufacture and also because of the efficiency and perfection of spray accomplished thereby, the longitudinal curvature of the deflector face 20 and also the transverse curvature thereof are preferably along arcs of circles of suitable selected diameters to effect the desired spread of liquid for which the nozzle is intended. Thus in the nozzle of Figs. 1, 2 and 3 wherein a flat spray with 15 degree spread is desired to be produced with a spray orifice 16 of 5/64 inch diameter, it has been found advantageous to produce the deflector surface 20 with a longitudinal curvature of 3¾ inch radius on a center in a plane perpendicular to the outlet end of the orifice 16 and with a trans-

verse curvature of 1⅜ inch radius, the orifice **16** being arranged to lead onto the deflector face **20** midway of the width thereof as shown in Figs. 1 and 3 and longitudinally onto the deflector face in a substantially tangential manner as shown in Fig. 2. Preferably the nozzle body is faced perpendicularly to the axis of the nozzle opening **16** at the outer end thereof as indicated at **23** in Figs. 1 and 2, this perpendicular facing being particularly convenient in the method of making the nozzle as will be apparent from the detailed description hereinafter of the method.

With a nozzle having such arcuate curvatures or similar arcuate curvatures the deflector surface may be readily produced, as indicated in Fig. 13 and explained more particularly hereinafter, by merely employing a rotary cutter of the proper radius or diameter to produce the desired transverse curvature of deflector face and either swinging the cutter sidewise along the length of the nozzle stock on the proper radius to produce the longitudinal curvature or swinging the nozzle stock lengthwise on such radius against the cutter which may, at the same time, face off the nozzle body at **23**.

Variations in the spread of the spray are obtained by appropriate change in the longitudinal curvature of the deflector face or in the transverse curvature thereof or both.

For example, to produce a spray angle of 35 degrees with the same orifice as that of Figs. 1, 2 and 3, namely a 5/64 inch orifice, the nozzle may be formed as shown in Figs. 4, 5 and 6, and to produce a spray angle of 50 degrees with the same orifice, the nozzle may be formed as shown in Figs. 7, 8 and 9, the same numerals that are used to designate parts of the nozzle in Figs. 1, 2 and 3 being used to designate the corresponding parts in Figs. 4, 5 and 6 but with the letter *a* and likewise in Figs. 7, 8 and 9 but with the letter *b*.

In the 35 degree angle nozzle of Figs. 4, 5 and 6 the transverse curvature of the deflector face is, as shown in Fig. 6, the same as that of the deflector face of Figs. 1, 2 and 3, namely of 1⅜ inch radius whereas the radius of longitudinal curvature of the deflector face is $1\frac{1}{16}$ inches as shown in Fig. 5, and a much shorter deflector face is required. The outer end of the deflector face is also less abruptly curved as indicated at **22***a*, than is the end of the deflector face in Figs. 1, 2 and 3, and there is a less abrupt taper at the sides as shown at **21***a*.

In the 50 degree angle nozzle of Figs. 7, 8 and 9 the transverse curvature of the deflector face **20***b* is, as shown in Fig. 9, on a 1 inch radius and the longitudinal curvature on a ½ inch radius, as shown in Fig. 8 and a much shorter deflector face is required than in the nozzle of Figs. 4, 5 and 6. The outer end of the deflector face is also less abruptly curved, as indicated at **22***b* in Fig. 7, than is the end of the deflector face of Figs. 4, 5 and 6, and there is also less abrupt taper at the sides, as shown at **21***b*.

In making these nozzles of Figs. 1 to 9 inclusive, a rotary cutter **24** is employed as shown in Fig. 13 of a radius or diameter corresponding to the transverse curvature to be given to the deflector face, a cutter **24** of 1⅜ inch radius or 2¾ inch diameter being employed for the nozzles of Figs. 1, 2 and 3 and Figs. 4, 5 and 6, whereas a cutter of 1 inch radius or 2 inch diameter is employed for the nozzle of Figs. 7, 8 and 9.

A piece of stock of suitable size for the particular nozzle is selected and either the cutter **24** is swung laterally on the appropriate radius lengthwise along the stock or the stock is swung on such appropriate radius to produce the deflector face. I prefer the latter procedure, and in making the nozzle the rotary cutter **24** is stationarily mounted, and the nozzle stock is carried by a support which is suitably located and swung on a suitable radius, preferably having its center in the plane of the cutting face **25** of the cutter, and guides the nozzle stock endwise on an arc so that the cutter **24** cuts away the stock along one side on a transverse curvature corresponding to the radius of the cutter and on a longitudinal curvature corresponding to the radius of the swinging support on which the stock is carried, the cutting being continued until the cutter face **25** reaches the location where the nozzle opening is to discharge onto the deflector face.

In Fig. 13 I have, for the purpose of illustrating the above method of making the deflector face, shown the making of a nozzle **15***b* like that of Figs. 7, 8 and 9. The deflector face may be produced at substantially any stage in the production of the nozzle, that is as the first operation on the stock or otherwise but preferably the stock is previously formed with all operations complete thereon except the cutting of the deflector face.

In making this **15***b* nozzle a stationarily mounted rotary cutter **24** of 1 inch diameter is employed and a piece of stock, indicated by broken lines at **26** and otherwise completed except for the cutting of the deflector face, is mounted on a swinging carrier which is pivoted at an appropriate center to cut longitudinally of the stock on a curve of ½ inch radius. Thus, the pivotal axis of the swinging carrier would be on a line perpendicular to the point **27** which is at the center of the 1 inch rotary cutter **24**. This stock **26** is secured on the swinging carrier to advance endwise against the cutter **24** as shown in Fig. 13 with the end thereof foremost that is to constitute the outer end of the deflector surface, said stock **26** being so located that when the nozzle opening **16***b* of the stock swings to a point at right angles to the plane of the cutter face as shown in full lines in Fig. 13 the nozzle opening will be tangential to the inner surface of the deflector face in the direction of the length of the latter, or in other words will be at the level of the inner end of the longitudinal center line of the deflector face so as to discharge directly along that face, all as shown in Fig. 13.

With the stock thus located on the swinging carrier the latter with the stock thereon is swung to advance the stock from the position indicated by broken lines at **26** to the full line position of Fig. 13 thereby cutting away the material at one side of the stock to produce the deflector face **20***b* and at the same time facing off the stock to produce the face **23***b*.

I have found it advantageous to make the nozzles from square bar stock and cut the deflector face longitudinally of this stock so that it extends transversely across the place of greatest width of the stock or substantially diagonally across the stock as shown particularly in Figs. 3, 6 and 9, the square cross-sectional form not only affording a desirable shape for wrench connection but also affording a wider deflector face with square stock of relative small cross-section.

Moreover, I have found that the stock of square cross-section with the deflector face extending approximately diagonally across the stock in

the manner shown in Figs. 1 to 9 inclusive, simplifies and facilitates the shaping of the deflector face at the outer end to discharge the liquid in the proper form of a uniform thin flat spray; such shapes of the deflector face being accomplished by merely machining the outer end of the spray nozzle in a suitably tapered conical form.

For example, for the 15 degree angle spray nozzle of Figs. 1, 2 and 3, the stock is cut to a length to leave 1⅛ inch length beyond the face **23** and the outer end is turned in conical form as indicated at **28**, at a 48 degree angle as shown in Fig. 2 leaving a circular flat **29** of $\frac{3}{16}$ inch diameter at the outer end.

The conical formation may be provided at any time in the making of the nozzle but preferably before the cutting of the deflector face and by a turning operation in which a cutting tool, operating at the proper angle shapes the rotating stock in the conical form, and it has been found that by shaping the end of the stock in this conical form the cutting of the deflector face **20** in the manner hereinbefore described produces the proper curvature **22** and angularity **21** at the outer end of the deflector face to cause the liquid to discharge therefrom in a perfectly uniform thin flat spray of 15 degree spread.

In the 35 degree nozzle of Figs. 4, 5 and 6 the stock is cut to leave a length of $\frac{1}{16}$ inch beyond the face **23***a*, and the outer end is turned in conical form as indicated at **28***a* at a 40 degree angle as shown in Fig. 5, leaving a circular flat **29***a* of ¼ inch diameter at the outer end whereas in the 50 degree nozzle of Figs. 7, 8 and 9, the stock is cut to leave a length of $\frac{1}{32}$ inch beyond the face **23***b* and the outer end is turned in conical form as indicated at **28***b* at a 30 degree angle as shown in Fig. 8 leaving a circular flat **29***b* of $\frac{3}{16}$ inch diameter at the outer end.

The nozzles may, if desired, be made of square bar stock with the deflector face extending across the width of the stock as shown in Figs. 10, 11 and 12 in which the deflector face is indicated at **30**, and this deflector face may be produced with a rotary cutter in the same manner as illustrated in Fig. 13. When thus constructed the outer end of the deflector face is shaped by milling, grinding, or in other convenient manner with a rounded end **31** and tapered sides **32** which will cause the liquid to discharge from the end of the deflector face in the desired form of thin flat spray.

It will be understood that the size of stock employed for the nozzle depends upon the volume and spread of liquid for which the nozzle is designed and that the transverse curvatures of the deflector face and the longitudinal curvature thereof are governed not only by the angle or spread of spray desired but also the volume of liquid.

While I have shown and described my invention in a preferred form, I am aware that various changes and modifications may be made therein without departing from the principles of my invention, the scope of which is to be determined by the appended claims.

I claim as my invention:

1. A flat spray nozzle of the class described comprising a nozzle body having a jet orifice extending therethrough and a jet deflector projecting from the body at one side of the exit end of the orifice, said deflector having a transversely and longitudinally curved trough shaped deflector face extending outwardly along and across the orifice discharge path, said deflector face being transversely curved concavely crosswise of said path and longitudinally curved concavely lengthwise of said path whereby the discharge from the orifice is spread in a thin transversely curved progressively widening stream, said concavely curved face being centrally extended lengthwise at the outer end in convex end form whereby the stream is transformed into flat planar form as it leaves the outer end of the deflector face.

2. A flat spray nozzle of the class described comprising a nozzle body having a jet orifice extending therethrough and a jet deflector projecting from the body at one side of the exit end of the orifice, said deflector having a transversely and longitudinally curved trough shaped deflector face extending outwardly along and across the orifice discharge path, said deflector face being transversely curved concavely crosswise of said path and longitudinally curved concavely lengthwise of said path whereby the discharge from the orifice is spread in a thin transversely curved progressively widening stream, said concavely curved face being centrally extended lengthwise at the outer end in convex end form whereby the stream is transformed into flat planar form as it leaves the outer end of the deflector face, said face being, throughout its length, of the same transverse curvature and of progressively increasing inclination to the axis of the jet orifice.

3. A flat spray nozzle of the class described comprising a nozzle body having a jet orifice, and a jet deflector extending outwardly from the body, said deflector having a deflector face which extends outwardly from the body along one side of the path of discharge from said orifice in a curved direction toward the other side of said path so as to deflect the discharge from the orifice in said curved direction, said face being concavely curved crosswise of said path and said deflector having a convex surface at the outer end extending arcuately along the outer end of said concavely curved face at an angle thereto.

FRED W. WAHLIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
868,715	Skinner	Oct. 22, 1907
1,349,874	Coles	Aug. 17, 1920
1,364,141	Reams	Jan. 4, 1921
1,439,177	Loepsinger	Dec. 19, 1922
1,506,721	Javorsky	Aug. 26, 1924
1,506,722	Yunker	Aug. 26, 1924
1,509,448	Skinner	Sept. 23, 1924
2,187,324	Many	Jan. 16, 1940

FOREIGN PATENTS

Number	Country	Date
3,788	Great Britain	Feb. 16, 1909