April 24, 1956 F. W. WAHLIN 2,743,138

SPRAY NOZZLE WITH SIDE VENTED DISCHARGE END

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Fig. 2.

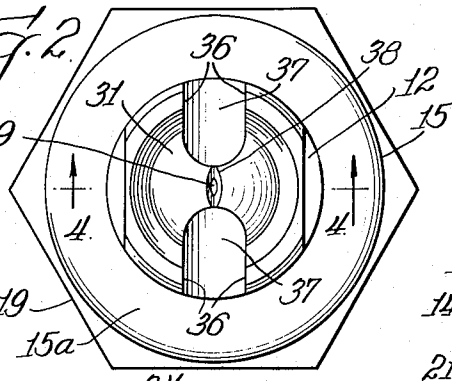


Fig. 1.

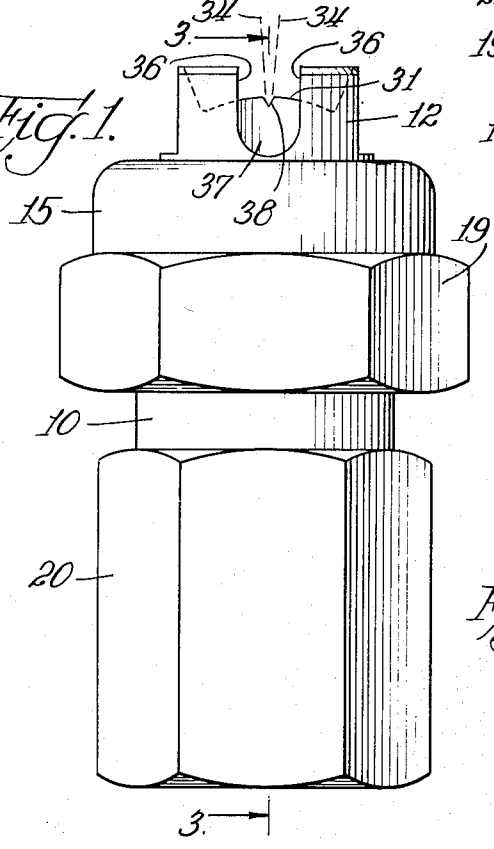


Fig. 3.

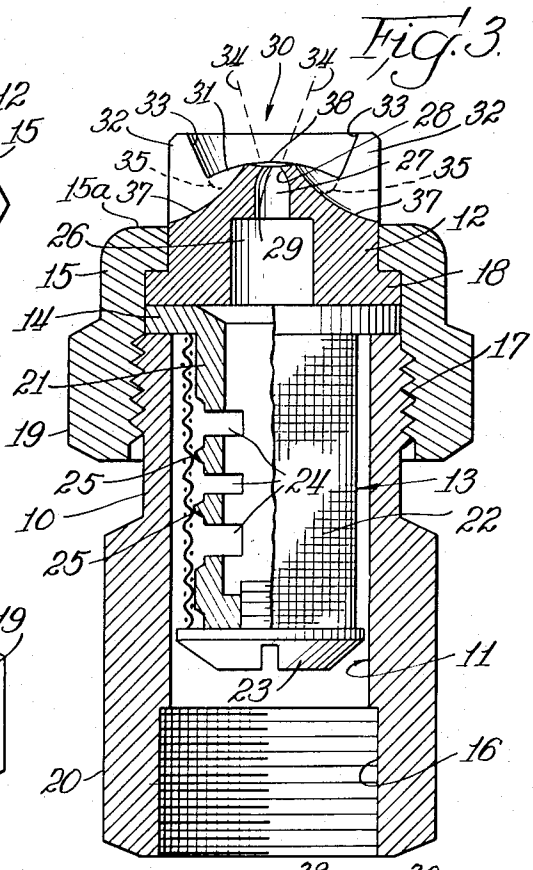


Fig. 6.

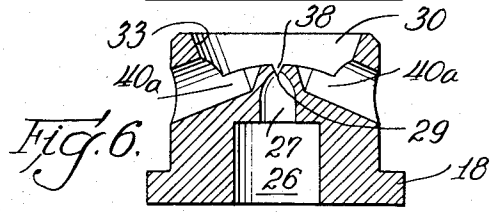


Fig. 4.

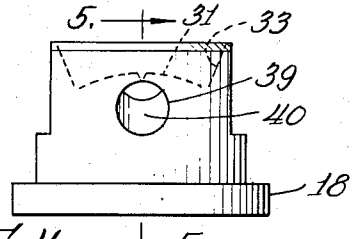
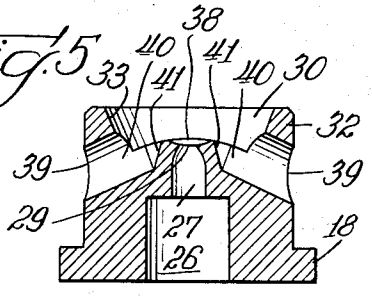


Fig. 5



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2,743,138

SPRAY NOZZLE WITH SIDE VENTED DISCHARGE END

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Application May 31, 1952, Serial No. 290,850

5 Claims. (Cl. 299—154)

This invention relates to spray nozzles which have the discharge orifice recessed in the nozzle end or tip, and has reference more particularly to the provision of such nozzles with openings or vents at the sides to provide air relief at the base of the spray stream where it issues from the orifice.

Spray nozzles are commonly made with the spray orifice recessed in the nozzle end so that portions of the nozzle end or tip extend therebeyond to protect the orifice from accidental damage which might distort or impair the precision of the spray stream.

When such extended portions completely encircle the issuing spray stream air does not reach the base of the issuing stream sufficiently freely or in the proper direction to readily relieve the low pressure created there by the aspiration effect of the issuing stream and accordingly air turbulence and eddies are created at the base of the spray stream, which tend to affect the shape of the spray stream and impart raggedness thereto.

In such cases air is drawn in through the outer open end of the encircling end portion of the nozzle in a direction opposite to the flow of the issuing stream and opposite also to the flow of the air immediately around the stream which is caused to flow along with the stream by the aspiration effect thereof, and accordingly there is a reversal of air flow within the encircling end portion of the nozzle which creates the above mentioned objectionable air turbulence and eddies at the base of the stream.

Nozzles have also been made with a deep groove extending across the end of the nozzle and having the nozzle orifice at the bottom of the groove to provide orifice protecting extensions at the opposite sides of the orifice, but in such cases air turbulence and eddies are not avoided as the flow of air entering through the ends of the groove is in a direction at right angles to the axis of the issuing stream, necessitating abrupt change of direction thereof in order to be drawn along the stream by the aspiration effect thereof, which sets up air turbulence and eddies.

Moreover the opposed side walls of the projecting extensions are not separated sufficiently to permit free entrance of air between these side walls and the issuing stream, especially at the base thereof, and as the aspirating effect of the stream causes reduced air pressure at those places, the stream tends to hug the side walls and spread out in that direction, and results in objectionable condensation of spray liquid on the side walls and dripping thereof from the nozzle.

The principal objects of the present invention are to provide an improved nozzle with recessed orifice; to insure ample area around the orifice exit and suitable supply of air thereto to avoid low pressure areas and other air conditions which may detrimentally affect the spray; to supply air at the orifice exit in a direction to facilitate flow thereof along the spray stream; and to incorporate these and other advantages in a nozzle which may be readily and economically manufactured with ordinary manufacturing facilities; these and other objects being

accomplished as explained hereinafter and as shown in the accompanying drawings, in which:

Fig. 1 is a side view of a nozzle made in accordance with the present invention;

Fig. 2 is a view looking at the top or discharge end of the nozzle of Fig. 1;

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

Fig. 4 is a side view of a nozzle tip showing a modified form of the invention;

Fig. 5 is a sectional view of the nozzle tip of Fig. 4 taken on the line 5—5 thereof; and

Fig. 6 is a view similar to Fig. 5 showing a different arrangement of the spray orifice thereof.

Referring to the drawing, the nozzle illustrated therein is similar to that shown in my copending application Serial No. 81,288 filed March 14, 1949, now Patent No. 2,621,078, of which the present application is a continuation in part, and is composed of a body **10** having a large cylindrical opening **11** therethrough, a flat sided nozzle tip **12** which is made as a separate part and secured to the outer end of the body **10**, a strainer **13** in the cylindrical opening **11** of the body and having an annular flange **14** at the outer end thereof interposed between the nozzle tip **12** and the outer end of the body **10**, and a clamping member **15** by which the nozzle tip is secured to the body **10**.

The body **10** is internally threaded at **16** at its end remote from the tip **12** for connection to a pipe or other means through which liquid is supplied to the nozzle and the other end of the body is externally threaded at **17** for threaded connection therewith of the clamping member **15** which is of collar nut type with the outer end of the collar turned in as at **15***a* to engage over an annular flange **18** at the base of the nozzle tip for clamping the latter against the outer end of the strainer **13** and the strainer flange **14** against the outer end of the nozzle body. The clamping member **15** and body **10** each have a portion of the length thereof of external hexagonal form as indicated at **19** and **20** respectively, or of other suitable form for wrench engagement for conveniently securing the parts together.

The illustrated strainer **13** has a hollow cylindrical body **21** surrounded by a cylindrical screen **22** which is secured thereon by a screw **23** which is threaded into the lower end of the strainer body **21** and has a large head against which the lower end of the screen **22** abuts. The strainer body **21** has a series of transverse slots **24** through its wall, preferably at several places therearound, for example at diametrically opposed sides thereof, so that the liquid introduced through the lower end of the nozzle passes through the screen into the interior of the strainer body **21**, and the body **21** in the vicinity of said slots preferably is turned down to a size smaller than the interior of the screen **22** but with annular screen contacting ribs **25** left at suitable intervals, so as to allow free flow of liquid through a considerable area of the screen to the slots **24**.

The nozzle tip **12** has a bored out cavity **26** communicating with the interior of the strainer body **21** and leading to a relatively small diameter bore **27** with convex or dome shaped outer end **28** through which the spray orifice **29** is formed.

While the interior of this nozzle tip **12** and the attaching facilities thereof are the same as in the nozzle tip of my above mentioned copending application, it differs therefrom in the following important respects:

At its outer end the nozzle tip **12** is provided with a relatievly large circular recess **30** having the orifice **29** located centrally in the bottom thereof so that there is ample space at all places around the exit of the orifice **29** for air to be supplied readily and uniformly around

the base of the issuing stream to relieve the aspiration effect of the spray stream.

Preferably the bottom **31** of the recess **30** is convex or dome shaped, as shown, so that it slopes downwardly or rearwardly from the exit of the orifice opening **29**, and the inner face of the projecting rim **32** may be sloped inwardly as indicated at **33** to the periphery of the sloping bottom. Thus the air supplied to the base of the spray stream, which is indicated by dotted lines at **34**, has a direction of flow imparted to it by the sloping bottom wall **31**, outwardly toward the outer open end of the recess to facilitate the further movement thereof along with the spray stream which is occasioned by the aspiration effect of the stream.

Obviously, the bottom of the recess **30** may be shaped, if desired, to increase the outward movement imparted to the air by the recess bottom. For example it may be shaped as indicated by the dotted lines at **35** in Fig. 3 to slope downwardly or rearwardly more abruptly from the orifice exit and to a greater recess depth as indicated by said dotted lines **35**.

It is an important feature of the invention that air is supplied to the recess **30** at the bottom thereof to relieve the aspiration effect of the spray stream, so as to avoid reversal of air flow which necessarily occurs when the air is supplied to the recess through the open outer end thereof and it is also an important feature of the invention that the air thus supplied at the bottom of the recess is caused to enter the recess **30** in a direction so that the flow thereof past the exit of the orifice **29** is, to a substantial extent, in the direction of stream flow from the orifice.

Accordingly the projecting rim **32** around the recess **30** is provided with large notches **36** at opposite sides of the recess **30**, as indicated particularly in Figs. 1 and 2, and these notches preferably extend down the opposite sides of the nozzle tip **12** as far as possible (approximately to the top of the clamping member **15**) and lead into grooves **37**, which are provided in the bottom of the recess at each notch **36** to match the respective notches, and lead inwardly and upwardly to the opposite sides of the orifice exit so that the air entering these notches **36** is caused by the grooves **37** to flow past the orifice exit in a direction that corresponds to the direction in which the spray stream **34** is discharged from the orifice.

Preferably these grooves **37** are round bottomed and curved from end to end, as shown, not only because they can be conveniently produced in that shape by a common curved edge rotary cutter, but because the curvature from end to end permits gradual deflection of the air outwardly toward the outer open end of the recess **30** and imparts a direction of air flow from the inner ends of the grooves **37** in a direction and manner to accord with the direction of flow thereof beyond the orifice exit.

The orifice **29** disclosed herein is of an elongated narrow shape designed to produce a flat fan shaped spray such as illustrated at **34** in Figs. 1 and 3 and is provided, in the usual manner of making such orifice openings, by cutting through the crown portion of the bottom **31** of the recess **30** and diametrically through the rounded outer end of the passage **27**, preferably in the plane of the longitudinal axes of the grooves **37**, with an acutely angled V-shape rotary cutter which produces a correspondingly acute angled V-shaped groove **38** which extends between the inner ends of the grooves **37** and intersects the rounded outer end of the passage **27**.

Preferably this rounded outer end **28** is not spherical, but of somewhat pointed arch shape, and it is to be noted that by reason of the rounded end of the passage **27**, the inner ends of the grooves **37** may be arranged quite close to the orifice **29** to facilitate flow of air therefrom along the spray stream.

It is not essential that notches **36** be provided at the outer ends of the grooves **37** as shown in Figs. 1, 2 and 3, but instead large circular openings, such as indicated at **39** in Fig. 4 may be provided at opposite sides of the nozzle tip which lead into the outer ends of the grooves **37**.

In such case, however, it is preferred that the grooves be provided, by drilling through the opposite sides of the nozzle tip, at the proper inclination, with an ordinary twist drill and continuing the drilling, up to a location near to the orifice **29** so as to form, in the same operation, the openings **39** and grooves **40** extending inwardly and upwardly as shown in Fig. 5 and terminating in an abrupt upward slope **41**, which corresponds to the end shape of the drill, and directs the air supplied through the openings almost directly upward at the nozzle orifice **29** so that its direction of flow corresponds quite closely to the direction of flow of the spray stream from the orifice.

Preferably the drilling to produce the openings **39** and grooves **40** would be performed before the recess **30** is provided in the end of the nozzle tip although the particular manner in which these openings and grooves are made is not important.

The orifice **29** in each illustrated embodiment of the invention is preferably provided after the grooves **37** of Figs. 1, 2 and 3 or the grooves **40** of Fig. 5 have been produced, so as to minimize the stock to be cut through by the cutter to make the small acutely V-shaped groove **38** which produces the orifice opening and it is preferred that the groove **38** extend between the inner ends of the air supply grooves **37** or **40** so that the orifice **29** is elongated in the plane of the axes of said air supply grooves **37** or **40**, as shown in Figs. 1 to 5 inclusive.

However, it is not essential that the orifice **29** extend lengthwise between the inner ends of the air supply grooves so that the air is supplied at the opposite ends of the orifice **29** by the air supply grooves **37** or **40**, as these air supply grooves may be otherwise arranged with respect to the orifice **29**, as for example as indicated at **40*a*** in Fig. 6, so that they lead inwardly and upwardly at the opposite sides of the elongated orifice **29** so that the air therefrom is directed along the opposite sides of the fan shaped spray **34**.

Because the recess **30** provides a relatively large uniform recess space around the base of the issuing stream **34** the air entering through the grooves **37**, **40** or **40*a*** is free to distribute around the base of the stream from grooves leading to the ends of the elongated orifice **29** as indicated at **37** and **40** or from grooves leading to the sides of the orifice as indicated in Fig. 6.

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

What I claim is:

1. A spray nozzle of the class described constructed and arranged to discharge liquid therefrom in a fan-shaped spray and having a body portion formed with two oppositely facing substantially co-axial cavities arranged in close proximity to one another in bottom-to-bottom relation and separated from one another by an intervening wall, one of said cavities being the end portion of a passage through which liquid is suppliable to said end portion for discharge therefrom into the other cavity and located in the interior of the nozzle, and the other cavity being at the exterior of the nozzle and facing outwardly therefrom and of wide expanse greatly exceeding that of the said passage end cavity and having an annular portion thereof of substantial width outlying beyond the periphery of said passage end cavity and within a cavity defining upstanding rim through which two openings extend and lead outwardly therethrough respectively in opposite directions at the opposite sides respectively of the rim defined cavity, the said intervening wall having an orifice through which liquid is discharged from said passage end cavity through the other cavity to the exterior

of the nozzle and the said orifice being elongated crosswise of the rim defined cavity toward the aforesaid openings of the cavity defining rim to convert the liquid discharge therethrough into a fan-shaped spray at the exterior of the nozzle.

2. A spray nozzle in accordance with claim 1 wherein the passage end cavity is of a rounded dome shape and the wall which separates the two cavities from one another has a groove therein at the outer side thereof extending in the direction of elongation of the orifice and having side walls which converge toward the bottom of the groove and intersect the dom shaped passage end cavity and the orifice is at the place of such intersection.

3. A spray nozzle in accordance with claim 1 wherein the passage end cavity is of rounded dome shape and the wall which separates the two cavities from one another is convex at the outer side and said convex outer side has a groove therein extending in the direction of elongation of the orifice and the said groove has side walls which converge toward the bottom of the groove and intersect the dome shaped passage end cavity and the orifice is at the place of such intersection.

4. A spray nozzle in accordance with claim 1 wherein the cavity which is defined by the upstanding rim has two grooves at the bottom thereof which extend outwardly in opposite directions at the opposite ends of the orifice to the two openings respectively of the rim.

5. A spray nozzle in accordance with claim 1 wherein

the wall which separates the two cavities is convex at the outer side and the cavity defined by the rim is of least depth at the center and progressively increases in depth outwardly from said center to the cavity defining rim and has two grooves at the bottom thereof which extend outwardly in opposite directions from said center to the two openings respectively of the rim.

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