

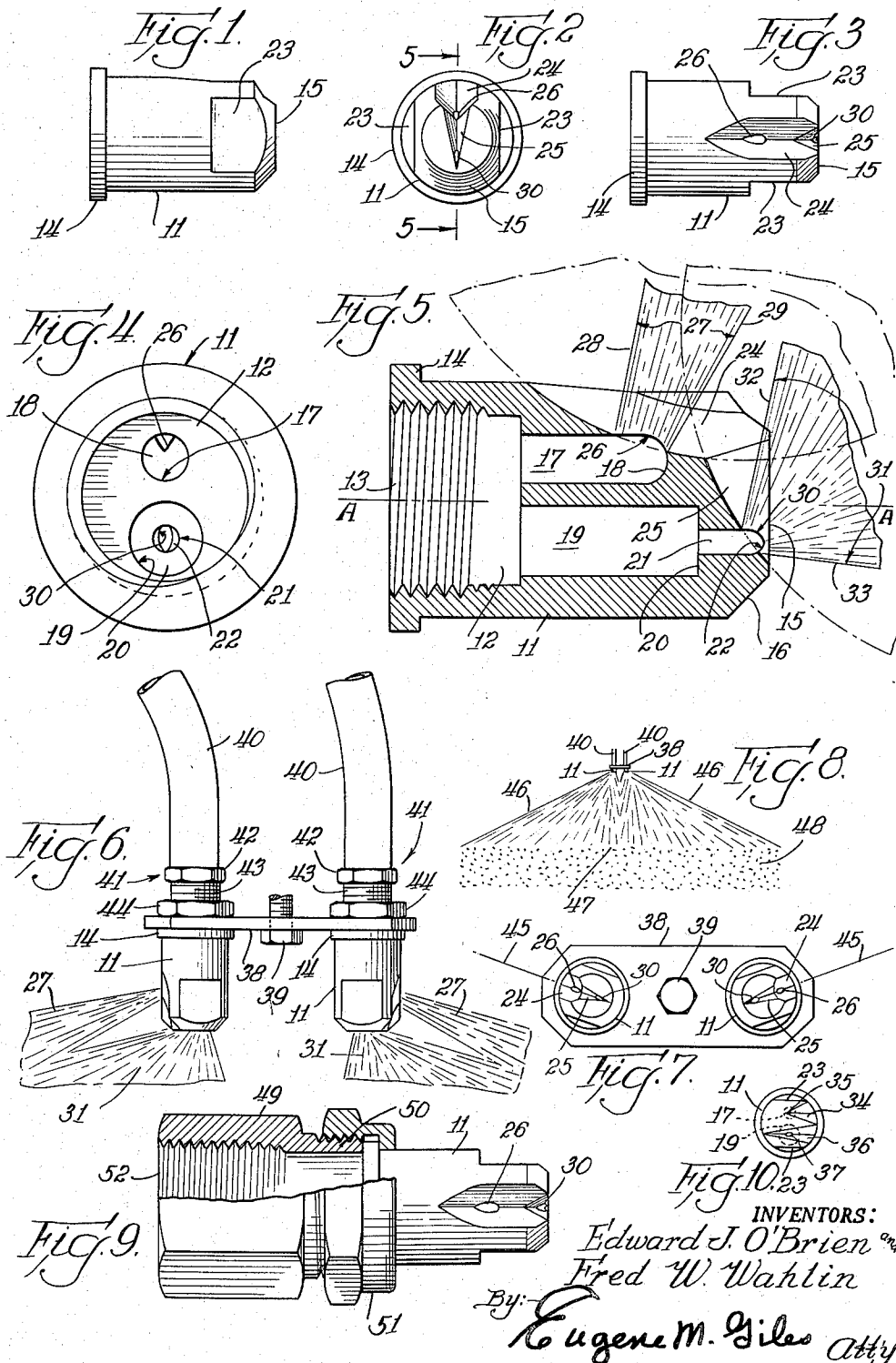
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PLURAL ORIFICE FAN SHAPED SPRAY NOZZLE

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PLURAL ORIFICE FAN SHAPED SPRAY NOZZLE

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3 Claims. (Cl. 239—544)

This invention relates to nozzles for producing a fan shaped spray and has reference more particularly to the provision of such nozzles with several separate orifices arranged to conjointly produce the fan shaped spray.

In many spraying operations in which fan shaped spray nozzles are employed it is important to provide a wide fanwise spread with certain fanwise portions thereof projected at a far flung distance considerably greater than the distance of other portions of the spray, and it is important not only to provide a spray discharge which will insure such desired far flung distance of spray but also to proportion the volume throughout the fanwise expanse of the spray so that the spray deposit is uniform throughout the range of coverage thereof.

In field and roadside spraying, for example, in which it is oftentimes inconvenient or impractical to distribute nozzles throughout the wide range of coverage which is required, it is customary to employ nozzles which have an elongated arcuate relatively narrow orifice which extends crosswise of the nozzle and is off center with at least most of the length thereof at one side of the nozzle so that one end is well down that side of the nozzle and discharges sidewise therefrom, and the other end is at or sufficiently near the nozzle end to discharge forwardly therefrom or to some extent toward the other side of the nozzle, and the arcuate orifice is formed to provide large volume of discharge sidewise from the nozzle for projection thereof to the desired far flung distance and to diminish the volume toward the other or forward end of the orifice where the spray therefrom is deposited at a shorter distance from or near to the nozzle.

Such nozzles are generally mounted in pairs for field spraying and the like so that each discharges sidewise to the far flung distance in a direction opposite to that of the other nozzle, and with the spray from the outer or forward ends of their orifices meeting or overlapping midway between their far flung places of spraying so as to provide a continuous swath of spray deposited from the far flung place of spray deposit from the one nozzle to the far flung place of spray deposit from the other nozzle; whereas in roadside spraying, or the like, a single nozzle is usually employed for the roadside and is arranged to discharge sidewise from the road to the remote side limits of the roadside, and with the other or forward end of the orifice discharging at the inner limits of the roadside and so that the spray is distributed across the entire width of roadside area.

Considerable difficulty has been experienced heretofore, however, in obtaining with such nozzles the desired far flung distance of spray deposit and uniformity of spray deposit throughout the fanwise range of distribution of the spray.

The principal objects of the invention are to provide an improved fan shaped spray nozzle; to avoid the difficulty mentioned above which has been experienced heretofore with nozzles of the above indicated field and roadside spraying type; to insure better control of the distance and distribution of the spray; to provide regulation of

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individual portions of the spray; to insure greater uniformity of spray deposit; to permit distant portions of the spray deposit to be produced independently of portions of the spray deposited nearer to the nozzle and the respective volumes thereof to be proportioned as required; to provide a simple form of fan shaped spray nozzle which may be readily manufactured with the improvements of the present invention incorporated therein; and to provide an improved nozzle mounting for such nozzles; these and other objects being accomplished as pointed out more particularly hereinafter and as shown in the drawing, 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 right hand end of the nozzle of Fig. 1 and showing the spray discharge end thereof;

Fig. 3 is a side view of the nozzle taken from the top of Fig. 1 and showing that side of the nozzle from which spray is discharged therefrom;

Fig. 4 is an enlarged view looking at the left hand end of the nozzle of Fig. 1;

Fig. 5 is an enlarged longitudinal sectional view of the nozzle taken on the line 5—5 of Fig. 2; and showing spray discharging from the two orifices thereof;

Fig. 6 is a side view of an assembly of two of the nozzles on a mounting for conjoint spraying;

Fig. 7 is a view of the assembly of Fig. 6 taken from the bottom of Fig. 6;

Fig. 8 is a top view, somewhat diagrammatic of the spray produced by the assembly of Figs. 6 and 7;

Fig. 9 is a view of a nozzle similar to that of Fig. 2, incorporated in a nozzle assembly; and

Fig. 10 is a view of a modified form of the nozzle looking at the outer discharge end thereof.

The nozzle which is shown in the drawing as illustrative of the present invention, is in the form of a nozzle tip, such as commonly employed in nozzles, for example in the nozzle of Wahlin Patent No. 2,621,078, and comprises a generally cylindrical body 11 which has in one end thereof, hereafter referred to as the rear end or the mounting end, a cavity 12 which is internally threaded so that it may be screwed directly on a pipe or on a threaded fitting of a liquid supply line as shown, for example in Figs. 6 and 7, so as to serve alone as the nozzle, the said body also being provided at the same end thereof at which the cavity is located with an external annular flange 14 by which the body may be clamped onto a supporting member or part, as indicated for example in Fig. 9, to form a nozzle assembly in which the body 11 serves as the nozzle tip thereof.

Thus, although the body 11 with its passages and orifices is referred to herein as a nozzle, it is to be understood that the term nozzle as used herein contemplates forms of the invention which serve alone as a nozzle or which serve as a nozzle tip of a nozzle assembly.

At its other end, which is referred to hereinafter as the discharge end or the outer end, or the forward end, the body 11 has a flat end face 15 around which the end of the body is preferably beveled as indicated at 16, and two laterally spaced passages are provided within the body, at opposite sides respectively of the longitudinal center line A—A of the nozzle body, and both of which said passages extend from the cavity 12 toward the outer end of the body but terminate at a distance therefrom.

One of these passages, which is indicated at 17, terminates in an outer end 18 of rounded dome shape which is relatively remote from the outer end of the body and the other of said passages is of stepped form comprising a large diameter portion 19 which is stepped down at 20 to a small passage portion 21 the latter of which terminates in an outer end 22 also of rounded dome shape

which is relatively close to the outer end of the body, all of which is clearly shown in Fig. 5, the enlargement 19 of the passage 19, 21 being provided particularly as a manufacturing expedient for precision in drilling the smaller portion 21.

The rounded end 18 of the passage 17 is preferably of hemispherical dome shape and the rounded end 22 of somewhat pointed dome shape as shown.

The passages 17 and 19, 21 are located in a diametrical plane of the body 11 at the center line A—A thereof and the outer end portion of the body is preferably cut away at opposite sides of that diametrical plane, as at 23, to provide opposite flat faces for wrench engagement.

Two grooves 24 and 25, preferably of V-shape, are cut respectively in the side and in the outer end of the body 11, both in the aforesaid diametrical plane of the passages 17 and 19, 21, and the side groove 24 is quite deep at one end where it opens through the outer end of the body 11 and it extends a substantial distance down the side of the body 11 at a progressively diminishing depth so that it cuts through or intersects the outer end of the passage 17 at one side thereof, as shown in Fig. 5, and thereby forms partly at the end but mostly at the side of the passage 17 an elongated orifice 26 through which liquid supplied to the passage 17 discharges in a relatively narrow angle fan shaped spray stream 27, the general direction of which is sidewise from the body 11 with one fanwise margin 28 of the spray stream directly or almost directly sidewise from the body and the other fanwise margin 29 thereof sloping forwardly to an appreciable extent.

The other groove 25 leads at one end into the outer end of the side groove 24 and is quite deep at that end and slopes forwardly, from the deep end thereof, across the outer end of the body 11 at a progressively decreasing depth as shown, so that it cuts through or intersects the outer end of the small passage portion 21 of the stepped passage 19, 21 almost completely thereacross but lower down the rounded end 22 at the passage 17 side thereof than at the opposite side, as shown in Fig. 5 so as to form an elongated orifice 30 through which liquid is discharged from the passage portion 21 in a relatively wide angle fan shaped spray stream 31, the mean direction of which is almost equally forwardly from the outer end of the body 11 and sidewise from the body with one fanwise margin 32 thereof extending almost directly sidewise from the body 11 at the orifice 26 side thereof, and leading obliquely toward the other spray stream 27, and the other fanwise margin 33 thereof extending almost directly forwardly from the outer end of the body and preferably slightly toward the opposite side of the body 11 as shown in Fig. 5.

As the grooves 24 and 25 are in the diametrical plane of the passages 17 and 19, 21 the elongated orifices 26 and 30 and the spray streams 27 and 31 therefrom, are likewise in that plane, and the said orifices 26 and 30 are arranged so that the spray streams 27 and 31 overlap at the adjoining fanwise margin thereof sufficiently to produce a continuous composite fan shaped spray from the fanwise margin 28 to the fanwise margin 33.

The orifice 26 is relatively larger than and generally about twice the size of the orifice 30 to provide the required volume for its distant range of coverage, the orifice 30 being smaller for its closer range of coverage, and the orifices 26 and 30 are arranged so that the streams therefrom overlap sufficiently at their adjoining fanwise margins to provide the necessary volume at that place for appropriate coverage.

The employment of separate orifices for the respective outermost and innermost portions of the spray deposit range and the overlapping thereof at the place where they combine with one another permits such regional regulation of the spray volume throughout the range of spray deposit from the outermost limit thereof distantly from the spray nozzle to the innermost limit thereof where it is

nearest to the spray nozzle that a high degree of uniformity of spray deposit is obtained throughout the range thereof.

As a specific example of the invention, a nozzle of the Fig. 5 construction, having a total capacity of 3.2 gallons per minute at 40 pounds per square inch, may be made as follows:

The passages 17 and 19, 21 are each centered at a distance of 177 thousandths of an inch from the center line A—A of the body 11 and parallel therewith and the diameter of the passage 17 is 201 thousandths of an inch, and the outer end 18 of said passage is hemispherical and curved on a radius of one half the passage diameter and located seven sixteenths of an inch from the outer end face 15 of the body.

The small outer end portion 21 of the passage 19, 21 is 116 thousandths of an inch in diameter with the rounded outer end 22 somewhat pointed and curved to the pointed end thereof on a radius of two thirds the diameter of the portion 21, and this outer end 22 of the passage portion 21 terminates at a distance of 25 thousandths of an inch from the outer end face 15 of the body 11.

Both orifices 26 and 30 of this specific example are made by cutting the respective grooves 24 and 25 thereof with three inch diameter rotary cutters with V-shaped cutter edge at the periphery thereof, the V-edge of the cutter for the orifice 17 having a 90 degree included angle and the V-edge of that cutter, while rotating and maintained with its center of rotation in a line which is perpendicular to the center line A—A of the nozzle body at a place 336 thousandths of an inch beyond the forward extremity of the rounded end 18 of the passage 17, is projected inward along that perpendicular line into the side of the body 11 to a depth 176 thousandths of an inch from the center line A—A at said perpendicular line, this depth being one thousandths of an inch from the center line of the passage 17.

The cutter for the orifice 30 has a V-shaped cutter edge of 42 degrees included angle and while this cutter is rotating and maintained with the center of rotation thereof in a line paralleling and 758 thousandths of an inch from the center line A—A of the nozzle body at the opposite side of that center line A—A from the passage 19, 21, it is projected toward the nozzle body end along that said paralleling line until the center of the cutter reaches a line perpendicular to the center line A—A of the nozzle body at a distance of 1113 thousandths of an inch from the forward extremity of the rounded end 22 of the passage portion 21.

As the last mentioned cutter wears down and is sharpened, the distance of its center from the center line A—A of the nozzle and the extent of its movement toward the nozzle body is varied to compensate for its decreased diameter.

In the operation of the cutter which is projected into the side of the nozzle body as aforesaid, the groove 24 is cut at place and to a depth to intersect the outer end of the passage 17 and thereby produce an orifice 26 having a capacity of 2.2 gallons per minute at 40 pounds per square inch and in the operation of the cutter which is projected into the end of the nozzle body as aforesaid, the groove 25 is cut at a place and to a depth to intersect the outer end of the passage portion 21 and thereby produce an orifice 30 having a capacity of 1 gallon per minute at 40 pounds per square inch.

The orifice 26 of the above described specific example produces a fan shaped spray of 20 to 25 degree angle and the orifice 22 a fan shaped spray of 80 to 85 degree angle, and with a pressure of 40 pounds per square inch, and at a nozzle elevation of 36 inches the spray is projected sidewise from the nozzle to a distance of twenty feet.

The particular size of the nozzle body 11 is not critical so long as it provides sufficient stock for the two passages

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17 and 19, 21 therein, but in the example is preferably made of one and one eighth diameter stock turned down to 995 thousandths of an inch diameter beyond the flange 14 and has an overall length of one and five eighths inch.

Nozzles of other capacities can be made with the nozzle body of the above example by employing passages 17 and 19, 21 of appropriate sizes and, preferably at the same distance from the center line A—A as in the example, with orifices 26 and 30 also of appropriate sizes, and moreover the size and relative sizes of the passages 17 and 19, 21 and the shape of their rounded ends, and the location and size of the orifices 26 and 30 and the length and width thereof may be varied as desired or necessary to modify or change the spray characteristics of the orifices 26 and 30 to proportion the volume and distribution of the spray throughout its fanwise range.

While it is preferred to arrange the passages 17 and 19, 21 and their orifices 26 and 30, and the grooves 24 and 25 in the same diametrical plane of the body 11 as explained above, it is not essential, as separate laterally spaced grooves 24 and 25 may be employed which are in separate parallel planes at right angles to the diametrical plane of the passages 17 and 19, 21 so that the orifices 26 and 30 and spray streams therefrom are likewise in the said separate parallel planes and spaced sidewise from one another.

Such side by side arrangement of the grooves and orifices is shown in Fig. 10 wherein the nozzle body 11 has passages 17 and 19 like those of the nozzle of Figs. 1 through 5, the passage 19 of which is to be understood to have a stepped down outer end portion like the small passage portion 21 shown in Fig. 5.

A groove 34, like the groove 24 of the previously described structure (but differently located), extends down the side of the nozzle body of Fig. 10 and intersects the outer end of the passage 23 to provide an orifice 35 therefrom which is the same as the orifice 26 of the previously described structure, but this groove 34 and the orifice 35, instead of being located in the diametrical plane of the passages 17 and 19 are in an off center plane at the longitudinal axis of the passage 17 and extending lengthwise of the body 11 at right angles to the diametrical plane of the passages 17 and 19.

Also in said Fig. 10, a groove 36, which is like the groove 25 of the previously described structure, extends across the outer end of the body and intersects the outer end of the small passage portion 21 at the end of the passage 19 to provide an orifice 37 from the passage portion 21 which is the same as the orifice 30 of the previously described structure, but the groove 36 and the orifice 37, instead of being located in the diametrical plane of the passages 17 and 19, are in an off center plane which is at the longitudinal axis of the passage 19, 21 and extends lengthwise of the body 11 at right angles to the said diametrical plane of the body 11 and is parallel with and laterally spaced from the plane of the other groove 34 and orifice 35.

The orifices 35 and 37 discharge sidewise from the nozzle body toward the same side thereof in the same manner as the corresponding orifices 26 and 30 of the nozzle body of Fig. 5 except that the spray streams from the orifices 35 and 37 are in parallel planes spaced slightly apart, whereas the spray streams from the orifices 26 and 30 are in a common plane, and the spray streams from the orifices 35 and 37 overlap and together form a composite fan shaped spray like that produced by the orifices 26 and 30 of the spray nozzle of Fig. 5.

For field spraying or the like, two of the above described nozzles are preferably paired together in side by side relation, as shown in Figs. 6 and 7, on a plate 38 which may be provided with a mounting screw 39 at the center and has openings therethrough at the opposite

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ends for attachment of the nozzles, the said nozzles being indicated in said figures by the reference numeral 11.

A separate hose 40 is provided for each nozzle to supply liquid thereto and each hose has on the end thereof a fitting 41 of bushing type with a wrench flange 42 and externally threaded sleeve portion 43 therebeyond which extends through one of the opposite end openings of the plate 38 and is screwed into the threaded cavity 12 of the respective nozzle, the threaded sleeve portion 43 of each fitting 41 having a lock nut 44 thereon at the opposite side of the plate 38 from the nozzle for clamping the latter in a fixed position on the plate.

Because of the flexibility of the hoses 40 each nozzle 11, when secured on the end of the respective fitting 41 may be turned in the opening of the plate 38 when the lock nut 44 is released and thereby adjusted as desired for inclination of the spray from the nozzle and held in the selected position of adjustment thereof by setting the clamp nut 44 against the plate 38.

Each nozzle 11 is adjusted on the plate 38 and set so that each discharges sidewise in a direction opposite to the sidewise discharge from the other and preferably so that the direction of sidewise discharge from each is directed slightly upward in the direction indicated by the lines 45 in Fig. 7 which are preferably at an angle of about 20 degrees to the horizontal.

A top view of the combined spray of two nozzles paired together on a plate 38 as in Figs. 6 and 7 is shown in Fig. 8 in which the opposite lateral edges of the combined fan shaped spray stream of the two nozzles are indicated by the reference numerals 46 and the line of spray deposit from the opposite fanwise extremities of spray spread of the composite spray is indicated at 47, and the reference numeral 48 indicates a crosswise strip of the sprayed surface produced by the spray stream of Fig. 8 as it advances across a field in field spraying.

The nozzle of Figs. 1 through 5 is shown in Fig. 9 and indicated by the reference numeral 11, as a nozzle tip of a nozzle assembly which comprises a mounting part 49 through which liquid is supplied to the nozzle tip and which has an externally threaded end portion 50 which is engaged by an internally threaded clamping ring 51 which engages the flange 14 of the nozzle tip 11 and clamps the latter onto the end of the part 49.

The part 51 is shown as a coupling which is internally threaded at 52 for attachment to a supply pipe or the like, but it may be any other desired part, as for example, a nozzle barrel having a strainer therein as in the nozzle of the above mentioned Wahlin Patent No. 2,621,078.

While we have shown and described our invention in a preferred form, various changes and modifications may be made therein without departing from the spirit of our invention, the scope of which is to be determined by the appended claims.

What is claimed is:

1. A spray nozzle of the class described comprising a body which has a forward end and is provided with first and second passageways therein which lead toward said forward end of the body and terminate respectively in first and second dome shaped ends which bulge toward said forward end of the body and are provided with respective first and second elongated spray discharge orifices extending down the dome shaped ends at the same side thereof and each of which forms the spray discharge therefrom in a flat fan shaped spray which combines at one fanwise margin with the fan shaped spray from the other orifice and extends in the opposite fanwise direction therefrom, the first dome shaped end being at a distance beyond the second dome shaped end from the forward end of the body and the body being formed with an external groove which extends lengthwise of the body at one side thereof and at its bottom intersects the first dome shaped end at one side thereof and provides said first spray discharge orifice at the place of intersection of said groove

with said first dome shaped end and the body being formed at the forward end thereof with an external groove which faces forwardly therefrom and at its bottom intersects the second dome shaped end and provides said second spray discharge orifice at the place of intersection of said forwardly facing groove with said second dome shaped end.

2. A spray nozzle as defined in claim 1 in which the first passageway is of larger cross section than the second passageway and the second passageway is farther distant than the first passageway from the side of the body at which the groove extends lengthwise thereof.

3. A spray nozzle as defined in claim 1 in which the dome shaped end of the second passageway is pointed at the top and the orifice which extends down the side thereof continues upwardly at least to the said pointed top thereof.

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