

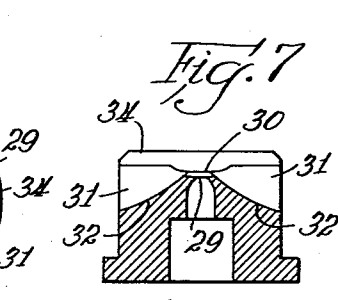
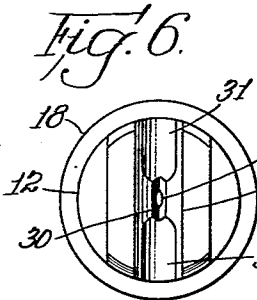
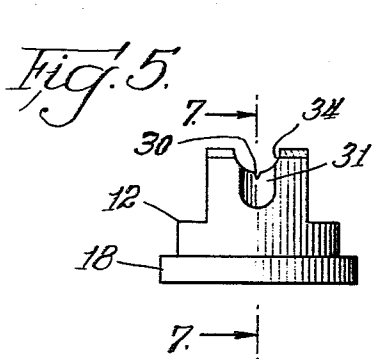
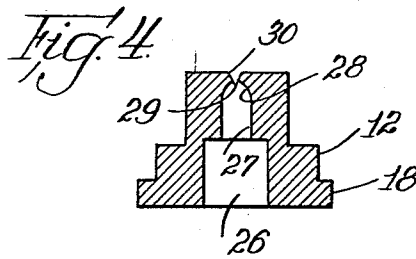
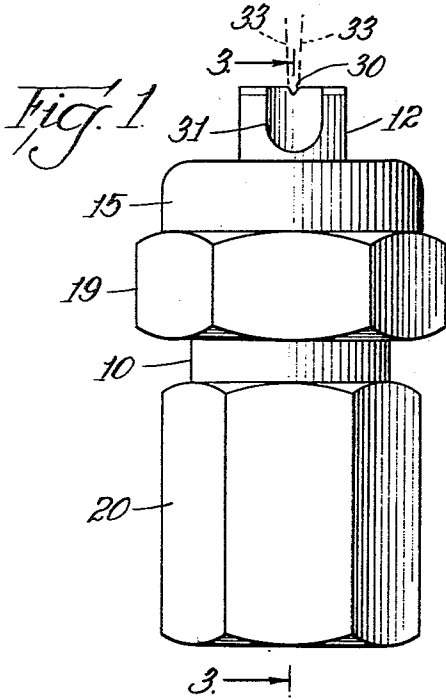
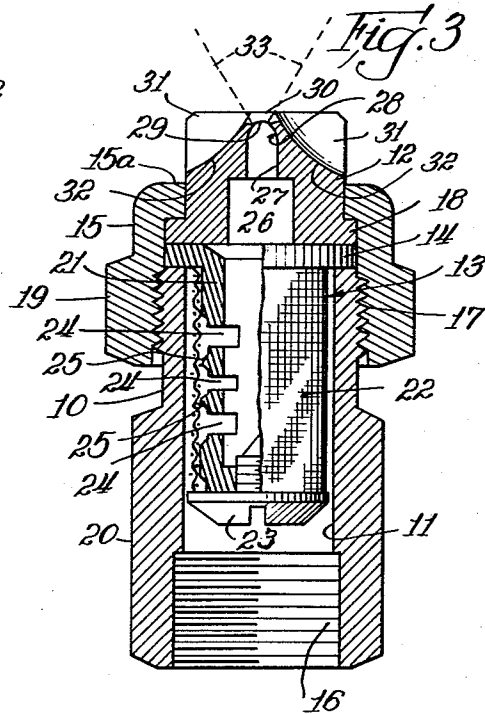
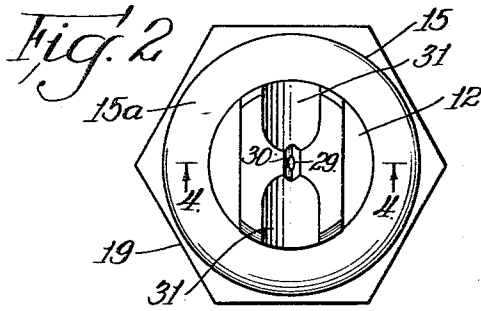
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SPRAY NOZZLE WITH REARWARDLY EXTENDING AIRWAYS

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UNITED STATES PATENT OFFICE

2,683,627

SPRAY NOZZLE WITH REARWARDLY EXTENDING AIRWAYS

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This invention relates to spray nozzles which have a spray orifice through which a spray stream is discharged from the nozzle, and has reference more particularly to the provision of the nozzle, at the orifice end thereof, with channels or grooves which extend rearwardly from the orifice location and supply air to the base of the issuing stream in a direction to accord with the stream flow from the orifice, the present application being a continuation in part of my co-
pending applications Serial No. 81,288, filed March 14, 1949, now Patent No. 2,621,078 and Serial No. 290,507, filed May 28, 1952.

As a spray stream discharges from a nozzle orifice, it imparts to the air around the spray stream, movement therewith in the same direction, and this air movement tends to produce at the base of the spray stream where the latter emerges from the nozzle, an area of low pressure which requires free flow of air thereto to avoid undesirable suction effect on the issuing spray stream.

Many spray nozzles however are made with the end thereof through which the orifice leads, of relatively wide area, usually for orifice protection, and have the orifice exit at or recessed in the nozzle end, and in such nozzles, as heretofore made, air access for relief of the low pressure created at the base of the air stream has been in a direction directly sidewise toward the base of the stream or even in a direction reverse to that of the spray stream flow when the orifice exit is recessed in the nozzle end. In such cases, abrupt change of direction of air flow occurs at the base of the spray stream and this results in incomplete relief of low pressure and creates air turbulence which affects precision of spray discharge, dissociates particles from the spray stream and causes dripping from the nozzle end.

This is particularly disadvantageous in small capacity spray nozzles which produce a relatively fine spray stream, and especially in nozzles which have an orifice of narrow elongated cross section for producing a thin flat fan shaped spray, as the thin edge portions of the spray are quite susceptible to disturbance by the air turbulence and the uniformity of the spray throughout the fanwise expanse thereof is readily affected thereby.

Necessarily the above mentioned abrupt change in the direction of relief air flow has some retarding effect on the exterior of the spray stream, and freedom of air flow and unretarded stream flow would be facilitated by introducing the relief air in a manner so that its direction of flow

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to the base of the stream is in a direction corresponding to that of the spray stream.

The principal objects of the present invention are to introduce the relief air in such nozzles in such manner that its direction of flow to the base of the spray stream is in a direction corresponding to that of the spray stream discharge; to supply the relief air to the base of the spray stream at a place close to the orifice exit; to provide an air relief construction which is particularly advantageous in fan shape spray nozzles; to permit the spray orifice to be recessed in the end of the nozzle without affecting the direction and proximity of supply of relief air to the base of the spray stream; and in general to avoid reduction of air pressure and air turbulence at the base of the spray stream in nozzles which have a relatively large end area within which the orifice is located, these and other objects being accomplished as explained hereinafter and as shown in the accompanying drawing, in which:

Fig. 1 is a side view of a spray nozzle having the discharge end or tip thereof made in accordance with this invention;

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

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

Fig. 4 is a sectional view of the nozzle tip taken on the line 4—4 of Fig. 2;

Fig. 5 is a side view of a nozzle tip showing a modification of the invention;

Fig. 6 is an end view of the nozzle tip of Fig. 5; and

Fig. 7 is a sectional view of the nozzle tip of Figs. 5 and 6, taken on the line 7—7 of Fig. 5.

Referring to the drawing, the nozzle illustrated therein is of a type for producing a thin, flat, fan-shaped spray 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 12 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

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is of collar nut type with the outer end of the collar turned in as at 15a to engage over an annular flange 13 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 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 the 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 rounded or dome shaped outer end 28 through which the spray orifice 29 is formed.

The orifice 29 is recessed in the end of the nozzle at the bottom of a groove 30 which extends crosswise of the nozzle end and at its bottom cuts through and intersects the rounded outer end of the chamber or passage 27 to form the orifice 29, the groove 30 being of acutely angled V-shaped cross section so that the orifice 29 produced by its intersection with the rounded outer end of the chamber or passage 27 will be of the long narrow shape required to produce a flat fan-shaped spray.

In nozzles of the type above described, and especially those of small capacity in which the orifice is small and precision of spray is of particular importance, it is customary to construct the nozzle or the nozzle tip thereof with an end face of relatively large area within which the orifice 29 is located, so as to safeguard the nozzle orifice and the nozzle end or tip portions in the immediate vicinity of the spray stream from any damage which might affect the precision of the spray stream, and because of this relatively wide area of the end face, and the consequent side-wise flow of air to the base of the spray stream, incomplete air relief, and air turbulence, occurs which detrimentally affects the precision of the spray stream as above explained.

To avoid this objectionable effect on the issuing spray stream, I have provided, in accordance with the present invention, facilities which not only supply adequate air to the orifice exit zone for relief purposes but deliver the air thereto in close proximity to the orifice exit and in a direction corresponding to that of the spray stream discharge so that there is no detrimental change in direction of air flow at the base of the spray stream and objectionable low pressure and air turbulence are substantially eliminated at that place.

For this purpose, the illustrated nozzle is provided at opposite sides of the nozzle tip 12 with

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relatively large grooves 31, which slope rearwardly from the discharge end of the nozzle tip and open outwardly through the opposite sides of the nozzle tip as shown, these grooves having their inner ends located in close proximity to the respective opposite ends of the orifice 29, and arranged so that the air supplied through said grooves, flows past the orifice location in a direction corresponding to that of the spray stream flow from the orifice 29, and in such close proximity to the orifice that the air flow is free and unretarded and no objectionable low pressure, or air turbulence, occurs around the spray stream.

Preferably, the grooves 31 are curved from end to end, as indicated at 32, so that the air flowing therealong is gradually deflected to the desired direction of flow past the nozzle orifice location, and the inner ends of these grooves are preferably arranged as close to the ends of the orifice 29 as adequate stock requirements at the orifice ends will allow.

Thus as the spray stream, indicated by dotted lines at 33, emerges from the orifice 29, the air flow therearound is in substantially the same direction, and accordingly the issuing stream is not subjected to any abrupt change of direction of air flow or air turbulence to disturb the integrity or shape of the spray stream.

In such nozzles, it is often times desirable to recess the orifice quite deeply in the nozzle end or tip for greater protection of the orifice, and in nozzles of the flat fan-shape spray type it has been customary, for that purpose, to provide the nozzle or nozzle tip with a groove of substantial depth which extends across the discharge end of the nozzle or nozzle tip, and to locate the spray orifice at the bottom of this deep groove substantially midway between the ends thereof.

Such nozzles have been made with a deep groove of V-cross section extending directly across the nozzle end or the nozzle tip end from side to side thereof, and having a spray orifice in the bottom at the apex of the deep V-cross section groove, and they have also been made in accordance with the invention of my aforesaid application Serial No. 81,288 with a deep round bottom groove of substantial width which, in like manner, extends across the nozzle end or the nozzle tip end from side to side thereof, and has a small V-shaped orifice forming groove in the bottom thereof.

In such nozzles, the place of emergence and the base of the spray stream are at the bottom of the deep orifice protecting groove, and the air supply for relieving the low pressure, which the spray stream discharge tends to produce around the base of the spray stream, flows inwardly through the opposite end portions of the orifice protecting groove in a direction crosswise of the path of discharge of the spray stream so that the above explained objectionable abrupt change of direction of air flow, and air turbulence, occur at the base of the spray stream.

The present invention is applicable to such deep orifice protecting groove nozzles to avoid abrupt change of direction of air flow and air turbulence at the base of the issuing spray stream by merely providing such nozzles with grooves 31 which slope rearwardly from the orifice 29 at the opposite sides thereof and lead respectively into the bottom of the opposite end portions of the transversely extending orifice protecting groove, as indicated in Figs. 5, 6 and 7.

In said figures, in which the same reference numerals are employed to designate parts which

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correspond to those of the structure of Figs. 1, 2, 3 and 4, a round bottom orifice protecting groove 34 is employed having a small V-shaped orifice forming groove 30 at the bottom thereof, in accordance with the invention of my application Serial No. 81,288.

In accordance with the present invention, that round bottom groove 34 has the rearwardly sloping grooves 31 extending downwardly from the bottom of the respective end portions of the round bottom groove 34, the grooves 31 and 34, in effect, intersecting one another substantially at the level of the nozzle orifice 29.

Thus, there is a flow of air inwardly and upwardly through the rearwardly sloping grooves 31, and the air thus supplied is deflected by the longitudinally curved bottom 32 of the grooves 31 so that the flow of air past the orifice zone corresponds sufficiently to that of the stream issuing from the orifice 29 to avoid any objectionable low pressure or air turbulence around the base of the spray stream in the same manner as in the structure of Figs. 1, 2, 3 and 4.

The orifice protecting groove 34 may be of other cross sectional shapes, and the grooves 30 may be of less width than the orifice protecting groove 34, as shown, or may be of the same width as, or even greater width than that of the orifice protecting groove, and the orifice 29 need not be of the cross sectional shape shown herein, although the rearwardly extending air supply grooves 31 are particularly advantageous with nozzles having orifices of narrow elongated shape for producing flat fan-shape sprays and especially in small capacity nozzles of that type.

The provision of the nozzles with the rearwardly extending grooves 31 also has an advantage, as indicated in my above mentioned application Serial No. 290,507, that it minimizes the amount of stock required to be removed by the cutter in producing the small V-shaped grooves 30.

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 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 having an elongated narrow orifice through which a spray stream is dischargeable outwardly from the interior of the nozzle to the exterior thereof in a flat fan shaped spray, said nozzle having two channels at opposite sides respectively thereof which converge toward one another in the direction of spray discharge, each said channel having one end thereof directed outwardly through the side of the nozzle to the exterior thereof at a place rearwardly distant from the plane of the orifice and said channels having their other ends closer to one another and at the opposite sides respectively of and directed forwardly beyond a nozzle portion which is recessed and divergently tapered outwardly in the direction of the spray discharge, the said elongated orifice being in the bottom of said recessed portion and said orifice extending in its direction of elongation between and having its opposite ends in close proximity respectively to the aforesaid closer other ends of the channels and said orifice being substantially central of the width of said closer other ends and of a width substantially less than that of said closer other ends, so that the fan shaped spray discharged from the orifice is sub-

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stantially midway of the width of and presented edgewise toward said closer other ends.

2. A spray nozzle of the class described having an elongated narrow orifice through which a spray stream is dischargeable outwardly from the interior of the nozzle to the exterior thereof in a flat fan shaped spray, said nozzle having two channels at opposite sides respectively thereof which converge toward one another in the direction of spray discharge, each said channel having one end thereof directed outwardly through the side of the nozzle to the exterior thereof at a place rearwardly distant from the plane of the orifice and said channels having their other ends closer to one another and at the opposite sides respectively of and directed forwardly beyond a nozzle portion which is recessed and divergently tapered outwardly in the direction of the spray discharge, the said elongated orifice being in the bottom of said recessed portion and said orifice extending in its direction of elongation between and having its opposite ends in close proximity respectively to the aforesaid closer other ends of the channels and said orifice being substantially central of the width of said closer other ends and of a width substantially less than that of said closer other ends, so that the fan shaped spray discharged from the orifice is presented edgewise toward said closer other ends substantially midway of the width thereof, the said recessed nozzle portion having therearound four spaced apart nozzle portions between which the channels are interposed and each of which said four portions extends forwardly in the direction of spray discharge and has the forward extremity thereof at least as far forward in the direction of spray discharge as the place where the spray stream emerges from the nozzle.

3. A spray nozzle of the class described having an elongated narrow orifice through which a spray stream is dischargeable outwardly from the interior of the nozzle to the exterior thereof in a flat fan shaped spray, said nozzle having a portion thereof tapered outwardly in the direction of spray discharge therefrom to a narrow neck portion which has an elongated orifice extending crosswise thereof and has an enlargement at each end thereof and integral therewith and located respectively at opposite sides of the elongated orifice, each enlargement having portions thereof extending oppositely from the respective end of said neck portion in the direction of the length of the elongated orifice and continued rearwardly along said tapered portion of the nozzle and together with the oppositely extending rearwardly continued portions of the other enlargement forming two channels at the opposite sides respectively of said externally tapered portions, each of which extends along said externally tapered portion to said narrow neck portion in a direction toward the central axis of spray stream discharge, each said channel having one end thereof directed outwardly through the side of the nozzle to the exterior thereof at a place rearwardly distant from the plane of the orifice and said channels having their other ends closer to one another and at the opposite sides respectively of and directed forwardly beyond said narrow neck portion with the said elongated orifice extending in the direction of its length between and having its opposite ends in close proximity respectively to the aforesaid closer other ends of the channels, said orifice being substantially central of the width of said

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closer other ends and of a width substantially less than that of said closer other ends, so that the fan shaped spray discharged from the orifice is substantially midway of the width of and presented edgewise toward said closer other ends.

4. A spray nozzle of the class described having an elongated narrow orifice through which a spray stream is dischargeable outwardly from the interior of the nozzle to the exterior thereof in a flat fan shaped spray, said nozzle having a portion thereof externally tapered outwardly in the direction of spray discharge therefrom to a small forward end in which the elongated orifice extends crosswise thereof and said nozzle having two channels at opposite sides respectively thereof which extend along said externally tapered portion at opposite sides thereof to said small forward end thereof, each in a direction toward the central axis of spray stream discharge, each said channel having one end thereof directed outwardly through the side of the nozzle to the exterior thereof at a place rearwardly distant from the plane of the orifice and said channels having their other ends closer to one another and at the opposite sides respectively of and directed forwardly beyond said small forward end with the said elongated orifice extending in its direction of elongation between and having its opposite ends in close proximity respectively to the aforesaid closer other ends of the channels, said orifice being substantially central of the width of said closer other ends and of a width substantially less than that of said closer other ends, so that the fan shaped spray discharged from the orifice is substantially midway of the width of and presented edgewise toward said closer other ends, said channels being concavely curved in the direction of their length and having their said closer other ends leading forwardly beyond said small forward end of the tapered portion in directions unopposed to one another.

5. A spray nozzle of the class described having an elongated narrow orifice through which a spray stream is dischargeable outwardly from the interior of the nozzle to the exterior thereof in a flat fan shaped spray, said nozzle having a portion thereof externally tapered outwardly in the direction of spray discharge therefrom to a small forward end in which the elongated orifice extends crosswise thereof and said nozzle having two channels at opposite sides respectively thereof which extend along said externally tapered portion at opposite sides thereof to said small forward end thereof, each in a direction toward the central axis of spray stream discharge, each said channel having one end thereof directed outwardly through the side of the nozzle to the exterior thereof at a place rearwardly distant from the plane of the orifice and said channels having their other ends closer to one another and at the opposite sides respectively of and directed forwardly beyond said small forward end with the said elongated orifice extending in its direction of elongation between and having its opposite ends in close proximity respectively to the aforesaid closer other ends of the channels, said orifice being substantially central of the width of said closer other ends and of a width substantially less than that of said closer other ends, so that the fan shaped spray discharged from the orifice is substantially midway of the width of and presented edgewise toward said closer other ends, the said orifice being recessed in the small forward end

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of said externally tapered portion in and midway of the length of a small groove which is of substantially less width than and extends between and has the opposite ends thereof opening into said closer other ends of the channels.

6. A spray nozzle of the class described having an elongated narrow orifice through which a spray stream is dischargeable outwardly from the interior of the nozzle to the exterior thereof in a flat fan shaped spray, said nozzle having a portion thereof externally tapered outwardly in the direction of spray discharge therefrom to a small forward end in which the elongated orifice extends crosswise thereof and said nozzle having two channels at opposite sides respectively thereof which extend along said externally tapered portion at opposite sides thereof to said small forward end thereof, each in a direction toward the central axis of spray stream discharge, each said channel having one end thereof directed outwardly through the side of the nozzle to the exterior thereof at a place rearwardly distant from the plane of the orifice and said channels having their other ends closer to one another and at the opposite sides respectively of and directed forwardly beyond said small forward end with the said elongated orifice extending in its direction of elongation between and having its opposite ends in close proximity respectively to the aforesaid closer other ends of the channels, said orifice being substantially central of the width of said closer other ends and of a width substantially less than that of said closer other ends, so that the fan shaped spray discharged from the orifice is substantially midway of the width of and presented edgewise toward said closer other ends, said nozzle having a relatively large groove extending across the small forward end of the said externally tapered portion and with which the said channels communicate at their said closer other ends and said large groove having said orifice recessed in the bottom thereof in and midway of the length of a small groove which is of substantially less width than said large groove and has the opposite ends thereof opening into said closer other ends of the channels, said large groove and small groove and orifice and channels all being in the same plane.

7. A spray nozzle of the class described having therein a passage which extends outwardly toward the exterior of the nozzle and has the outer end thereof of rounded dome shape with an elongated orifice extending crosswise thereof through which a spray stream is dischargeable outwardly from the passage to the exterior of the nozzle in a flat fan shaped spray, the portion of the nozzle through which said passage extends being externally tapered in the direction of the length of said passage to a small forward end in which the elongated orifice extends crosswise thereof and said nozzle having at opposite sides thereof and at opposite sides respectively of said passage two channels which extend along said externally tapered portion to said small forward end thereof, each in a direction toward the central axis of spray stream discharge from the orifice, each said channel having one end thereof extending laterally at one side of said passage and directed outwardly through the side of the nozzle to the exterior thereof at a place rearwardly distant from the plane of the orifice and said channels having their other ends at the dome shaped end of the passage and closer to one another and at the opposite sides respectively

tively of and directed forwardly beyond said small forward end with the said elongated orifice extending in its direction of elongation between and having its opposite ends V-shaped and in close proximity respectively to the aforesaid closer other ends of the channels, said orifice being substantially central of the width of said closer other ends and of a width substantially less than that of said closer other ends, so that the fan shaped spray discharged from the orifice is substantially midway of the width of and presented edgewise toward said closer other ends, said channels being concavely curved in the direction of their length and having their said closer other ends leading outwardly beyond said small forward end of the tapered portion in directions unopposed to one another, the said orifice being recessed in the small forward end of said externally tapered portion in and midway of the length of a small groove which is of substantially less width than and extends between and has the opposite ends thereof opening into said closer other ends of the channels.

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