

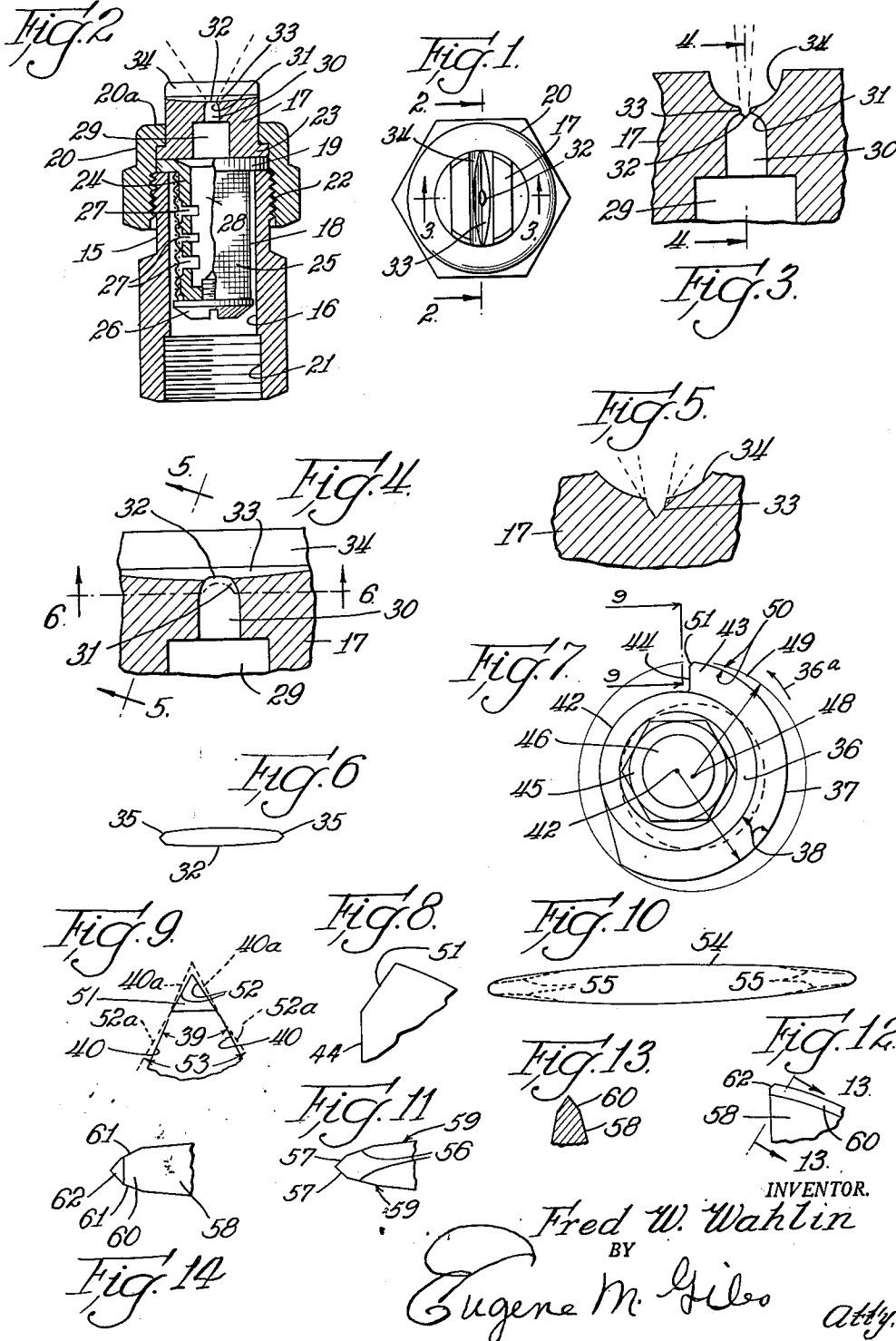
Feb. 8, 1955

F. W. WAHLIN
METHOD OF MAKING SPRAY NOZZLE ORIFICE
WITH PLURAL TAPERED ENDS

2,701,412

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2 Sheets-Sheet 1



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Fig. 15.

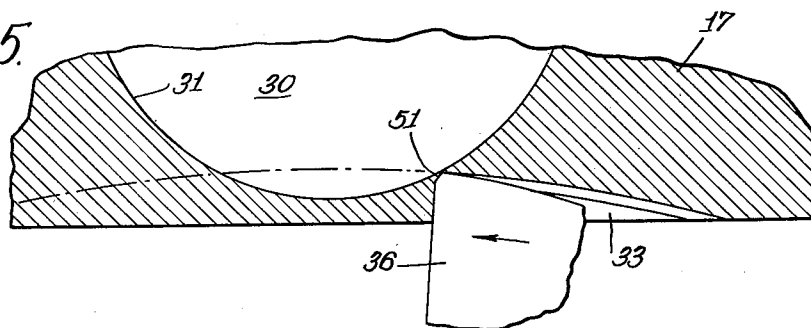


Fig. 16.

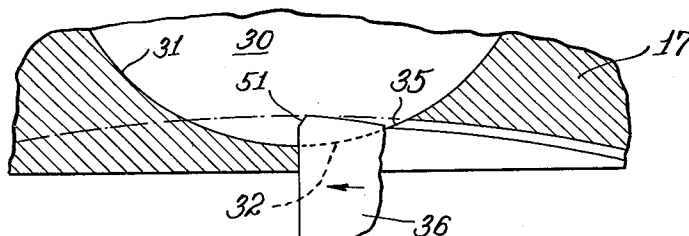


Fig. 17.

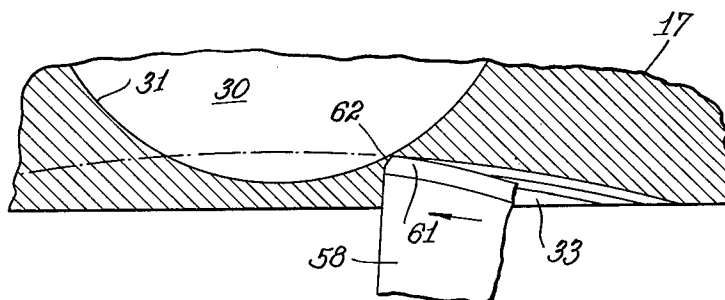
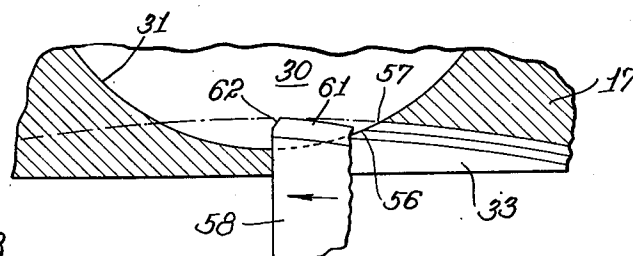


Fig. 18.



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METHOD OF MAKING SPRAY NOZZLE ORIFICE WITH PLURAL TAPERED ENDS

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2 Claims. (Cl. 29—157)

My invention relates to spray nozzles of the type which have a long narrow orifice for producing a flat fan shaped spray, and has reference more particularly to a method of increasing the width of the extremities of the orifice.

In the manufacture of such nozzles it is customary to provide the nozzle with a passage which extends outwardly toward the discharge end of the nozzle and terminates near the discharge end in a convexly rounded or somewhat dome shaped end in which the orifice is formed by cutting an acutely angled V-shaped groove across the nozzle discharge end with an acutely angled V-edged rotary cutter so that the bottom of the groove cuts through and intersects the rounded or dome shaped outer end of the passage.

Because of the convex contour of the outer end of the passage at the place where the orifice producing groove is cut therethrough, the orifice is of convexo-convex shape and the opposite ends thereof are quite sharply tapered, and by reason of the thus tapered ends of the orifice the fan shaped spray produced thereby is thinned out at the opposite edges and does not have sufficient spray volume at these places.

This can be corrected in orifices of large size and capacity by shaping the extreme edge of the cutter in the appropriate transverse shape to widen the ends of the orifice as required, but in nozzles of small capacity in which the orifice is quite small and very narrow, it is practically impossible to grind the relatively minute extremity of the cutter edge to the required transverse shape with sufficient precision to produce the desired orifice end shape.

The principal objects of my invention are, to provide small fan shape spray orifices of spray nozzles with more abruptly tapered ends than heretofore; to permit such orifice ends to be produced with successive minute portions thereof of different and increased angularity; and to provide a method by which such minute differences in shape of the ends of the orifice may be readily provided; these and other objects being accomplished as explained hereinafter and as shown in the accompanying drawing in which:

Fig. 1 is a view looking at the discharge end of a nozzle of the type to which this invention relates;

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

Fig. 3 is an enlarged sectional view on the line 3—3 of Fig. 1, of a fragmentary portion of the discharge end of the nozzle;

Fig. 4 is a sectional view of the portion of the discharge end of the nozzle shown in Fig. 3 and taken on the line 4—4 thereof;

Fig. 5 is an enlarged fragmentary sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a view showing the shape of the orifice of Figs. 1, 2, 3 and 4, greatly enlarged, and taken on the line 6—6 of Fig. 4;

Fig. 7 is a side view of the cutter employed for making the orifice of the Fig. 6 shape;

Fig. 8 is a side view, greatly enlarged, of the extreme end of the cutter of Fig. 7;

Fig. 9 is a front view of the cutter end of Fig. 8 as seen from the line 9—9 of Fig. 7;

Fig. 10 is a view showing comparatively, in full lines, the shape of the spray produced by the orifice of Fig. 6 made by the cutter of Fig. 10, and in dotted lines the thinned out edges of the spray as produced by an ori-

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fice made by a cutter like that of Fig. 7 but without the beveled cutting extremity;

Fig. 11 shows another form of orifice end that may be made in accordance with my invention;

Fig. 12 is a side view of the cutter end for producing the orifice end of Fig. 11;

Fig. 13 is a sectional view of the cutter end of Fig. 12 taken on the line 13—13 thereof;

Fig. 14 is an enlarged front view of the cutter end of Fig. 12;

Figs. 15 and 16 are greatly enlarged views of an orifice end portion of the nozzle showing the cutter end of Figs. 8 and 9 in the operation of cutting an orifice like that of Fig. 6, the cutter end being shown in Fig. 15 in the position of cutting the metal at one end of the orifice and said cutter end being shown in Fig. 16 in the position of cutting the metal at the center of the length of the orifice; and

Figs. 17 and 18 are views similar to those of Figs. 15 and 16 but showing the cutter end of Fig. 12 in the position of cutting an orifice having ends like that shown in Fig. 11, the Fig. 12 cutter end being shown in Fig. 17 in the position of cutting the metal at one end of the orifice and said cutter end being shown in Fig. 18 in the position of cutting the metal at the center of the length of the orifice.

Referring to the drawing, the nozzle shown therein comprises a body 15 having a large cylindrical opening 16 therethrough, a flat sided nozzle tip 17 which is secured to the outer end of the body 15, a strainer 18 in the opening 16 of the body and having an annular flange 19 at the outer end thereof interposed between the nozzle tip 17 and the outer end of the body 15, and a clamping member 20 by which the nozzle tip 17 is secured to the body 15.

The body 15 is internally threaded at 21 at its end remote from the tip 17 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 22 for threaded connection therewith of the clamping member 20 which is of collar nut type with the outer end of the collar turned in as at 20^a to engage over an annular flange 23 at the base of the nozzle tip for clamping the latter against the outer end of the strainer 18 and the strainer flange 19 against the outer end of the nozzle body.

The strainer 18 has a hollow cylindrical body 24 surrounded by a screen 25 which is secured thereon by a screw 26 which is threaded into the lower end of the body 24 and has a large head against which the lower end of the screen 25 abuts, and the strainer body 24 has a number of slots 27 extending through the wall thereof which are suitably arranged so that liquid passing through the screen 25 is supplied through the slots 27 to the chamber 28 in the strainer body 24.

The nozzle tip 17 has a bored out cavity 29 communicating with the chamber 28 of the strainer body 24 and leading to a relatively small diameter bore 30 with rounded or dome shaped outer end 31 through which the spray orifice 32 is formed.

This orifice 32 is formed by cutting a small groove 33 in the end of the nozzle tip 17 so that it cuts through and intersects the rounded outer end 31 of the nozzle chamber or passage 30, an acutely angled V-shaped rotary cutter, being employed to form the groove 33, the nozzle tip 17 preferably being provided with a relatively large round bottom groove 34 extending thereacross and in the bottom of which the small groove 33 is located.

The cutter employed for making the small groove 33, which forms the orifice 32, is generally of rotary type with cutter face of V-shape, which, because of the dome shape 31 of the outer end of the passage 33, forms an orifice the opposite sides of which are of convex contour, and if the taper of the cutting end portion of the cutter which cuts the groove 33 is constant, these convex contoured sides of the orifice converge at the opposite ends of the orifice to a V-shape which produces an undesirable thinning out of the edge portions of the fan shaped spray produced by the orifice.

According to my invention the orifice 32 is formed, as shown in Fig. 6, with the extreme ends of the orifice blunted, as indicated at 35 by constructing the cutter at

the extreme tip thereof to cut the groove 33 with an increased degree of angularity, in cross section, at the opposite ends of the orifice 32, this being accomplished by an alteration of the cutter tip in a manner which permits appropriate blunting of the ends of the orifices of spray nozzles of such small orifice size that the shaping thereof at the ends to avoid thinned out spray edges has not been possible heretofore.

To accomplish this blunting of the ends of the orifice 32, a slightly modified conventional rotary type single cut V-edged cutter, such as shown at 36 in Fig. 7, is employed having a single cutting place at the leading end of a peripheral edge portion 38 (see Fig. 7) which extends only part way around the cutter 36 and is tapered in cross section to a sharp edge 37 so that the edge portion 38 throughout its peripheral length is of the same sharp edged V-shape in cross section.

The included angle of this V-shaped portion 38 is indicated at 39 in Fig. 9 and the cross sectional taper thereof is shown by the full lines 40 and the dotted line continuations 40^a thereof in Fig. 9, the full lines 40 of Fig. 9 and the full lines 52 thereof (which have a greater included angle as indicated at 53) conjointly showing the double tapered shape of the cut made by the cutter 36 by reason of the hereinafter explained bevel or negative rake 51 of the outer tip or apex of the cutting end portion 43 of the cutter and the eccentric mounting of the cutter.

This cutter 36 is ground with the tapered portion 38 and edge 37 thereof concentric with the cutter center 42 and gashed at one side, as shown at 42, to provide the projecting cutter bit portion 43, the front or cutting face 44 of which is initially of the tapered V-shape indicated conjointly by the lines 40 and 40^a of Fig. 9.

For the cutting operation this cutter 36 which is rotated in the direction indicated by the arrow 36^a in Fig. 7, is mounted in a fixed manner by a clamping nut 45 on an eccentrically offset extension 46 of a cutter operating shaft or arbor the center of rotation of which is at 48 so that the extreme cutting tip end of the portion 43 rotates in a circular path, indicated at 49, around the center 48, and the trailing peripheral edge 37 of the cutter, although concentric with the cutter center 42 is eccentric with respect to the center of rotation 48 and diverges inwardly from the circular path 49 as indicated at 50 in Fig. 7 so as to provide clearance for the trailing face or faces of the cutter.

In order to form the orifice 32 with the blunt ends 35, having an increased degree of angularity the extreme tip of the cutter portion 43 of the cutter 36 is beveled, as indicated at 51 to provide a negative rake at this place, which, by reason of the divergence 50 of the trailing edge 37 of the cutter from the circular path 49 of rotation of the cutter tip locates the extreme cutting tip or apex of the bevel 51 of the cutter nearer to the center 48 of rotation of the cutter than the apex to which the unbeveled portion of the front face 44 of the cutter converges, as indicated by the dotted lines 40^a of Fig. 9, and thus the bevel 51 cuts to a reduced depth and imparts to the bottom of the groove 33 a greater degree of cross sectional angularity than that of the groove walls thereabove as is shown particularly in Figs. 8 and 9 in which the full lines 52 show the front cutting perspective of the negative rake portion 51 of the cutter, and the dotted lines 52^a represent continuations of these lines 52, and the reference numeral 53 indicates the cutting angle of the rake portion 51 and also the angularity of that part (the bottom portion) of the groove 33 made by the negative rake tip 51.

This negative rake portion 51 is extremely short or minute compared to the overall depth of the cut made in the rounded outer end 31 of the nozzle passage 30 so that only the extreme ends of the orifice 32 are affected by the negative rake 51 of the cutter and thus the bluntness or increased degree of angularity 35 of the orifice ends is confined to the extremities thereof, as shown in Fig. 6.

By reason of this bluntness 35 the orifice 32 produces a fan shaped spray pattern, such as shown in the full lines 54 in Fig. 10, with increased fullness at the spray edges and accordingly desired greater spray volume at these places than an orifice made by a cutter without the negative rake 51, as is indicated by the dotted lines 55 in Fig. 10 which show comparatively the shape of the spray edges provided by the latter orifice.

This negative rake 51 is particularly advantageous as the cutter may be readily made and ground with the nega-

tive rake so as to shape the orifice ends 35 with a high degree of precision in the extremely short portion of orifice length required and heretofore it has not been possible to accomplish such shaping of the orifice ends and especially in small volume nozzles with very small orifices.

By employing the negative rake with a cutter having an edge portion of two different tapers in cross section, as shown in Figs. 12 and 13, the end portions of the orifice may be made with several successive portions each of different and increased degree of angularity as shown in Figs. 11, 12, 13 and 14 in which Fig. 11 shows such orifice end with a portion 56 thereof of increased degree of angularity and the extreme tip portion 57 thereof of still further increased degree of angularity.

To make an orifice with such two stage increase in angularity at the ends a cutter 58 is employed, the opposite sides 59 of which are of the appropriate angularity to produce an orifice of the desired shape between the opposite angled orifice end portions 56, 57 and a narrow margin 60 thereof along the periphery of the cutter is ground, as shown at 61 in Fig. 14, to the required angularity to produce the tapered portion 56 of the orifice ends.

Then the extreme tip of the tapered cutting end of the tapered portion 60 is provided with a negative rake 62, as shown in Figs. 12 and 14, which in the same manner as the negative rake 51 of the previously described cutter, imparts the increased angularity 57 to the extreme outer end of the orifice at the outer end of the tapered portion 56 thereof.

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. The method of making a spray nozzle with an elongated orifice for producing a flat fan shaped spray, which said method comprises providing a rotary cutter with an outwardly projecting peripherally elongated V-shaped groove cutting portion along the margin having a cutting face at the front of the V-shape contour and a corresponding V-shaped edge trailing peripherally rearward from said face at a progressively decreasing distance from the center of rotation of the cutter, and beveling the apex portion of said cutting face rearwardly to an apex point of said trailing edge less remote from the center of rotation of the cutter than the apex point toward which the unbeveled portion of said V-shaped face converges, constructing the nozzle with a passage therein leading outwardly toward the discharge end of the nozzle and terminating in a rounded outer end, and while rotating the cutter about its said axis of rotation cutting in said nozzle discharge end with both the beveled and unbeveled portions of said cutting face of the cutter an orifice forming groove which intersects the rounded outer end of the said nozzle passageway to a depth which greatly exceeds the depth of cut made by the aforesaid beveled apex portion of the cutting face and conforming the end extremities only of the orifice to the shape of cut made by the beveled apex portion of the cutting face of the cutter.

2. The method of making a spray nozzle with an elongated orifice for producing a flat fan shaped spray, which said method comprises providing a rotary cutter with an outwardly projecting peripherally elongated generally V-shaped groove cutting portion along the margin having the apical portion thereof of a greater degree of angularity than the angularity of the portion thereof nearer the center of rotation of the cutter and having a cutting face at the front of corresponding generally V-shape contour and a corresponding generally V-shaped edge trailing peripherally rearward from said face at a progressively decreasing distance from the center of rotation of the cutter, and beveling the outer extremity of said apical portion of said cutting face rearwardly to an apex point of said trailing edge less remote from the center of rotation of the cutter than the apex point toward which the unbeveled part of said apical portion of said generally V-shaped face converges, constructing the nozzle with a passage therein leading outwardly toward the discharge end of the nozzle and terminating in a rounded outer end, and while rotating the cutter about its said axis of rotation cutting in said nozzle discharge end with said cutting face of the

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cutter an orifice forming groove which intersects the rounded outer end of the said nozzle passageway to a depth which greatly exceeds the depth of cut made by the aforesaid apical portion of the cutting face and conforming the end extremities only of the orifice to the shape of cut made by said apical portion of the cutting face of the cutter.

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