Jan. 22, 1957 C. S. CORL 2,778,688

SPRAYING APPARATUS

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Fig. 1

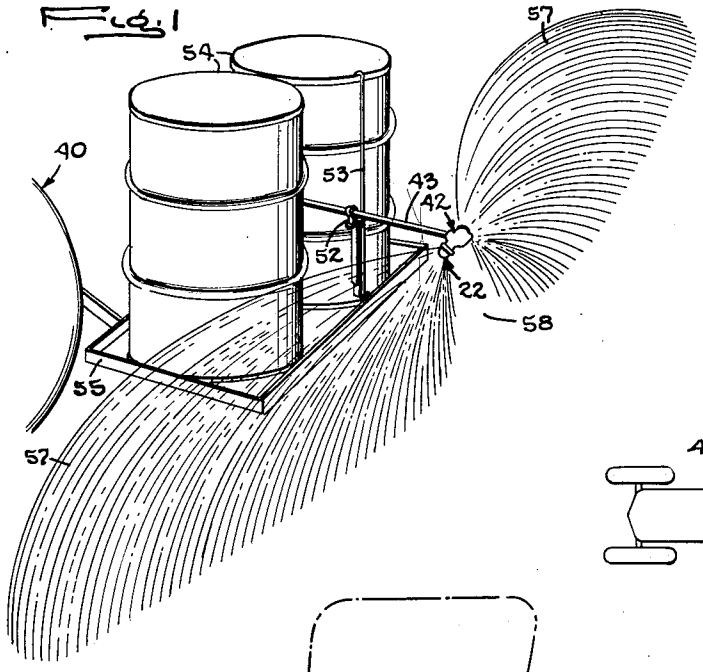


Fig. 2

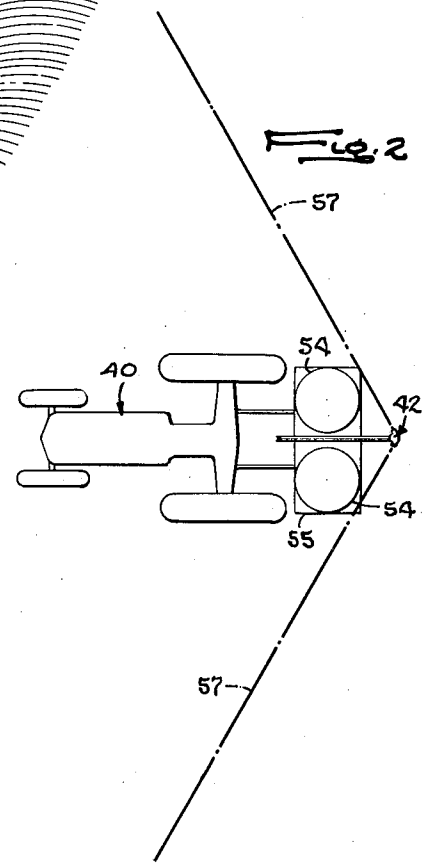
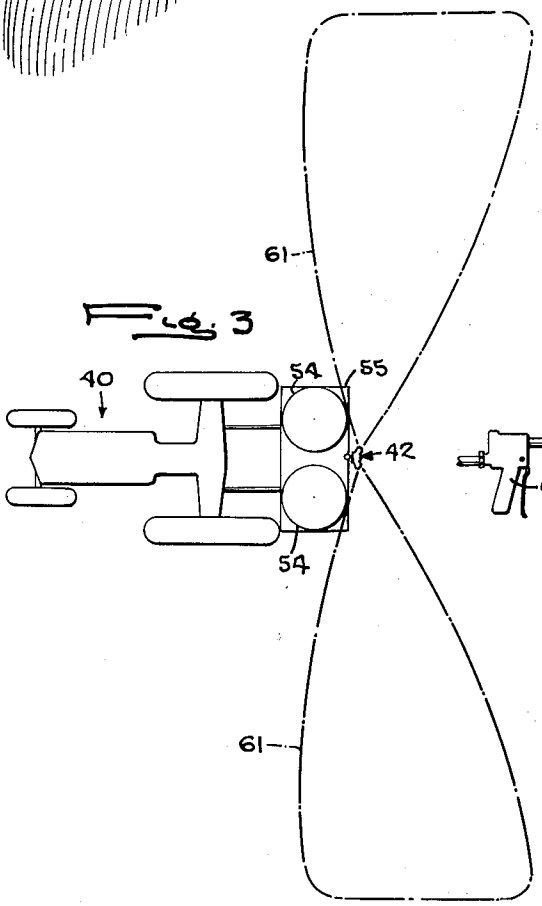


Fig. 3



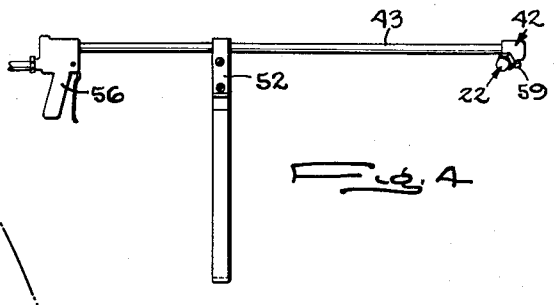


Fig. 4

INVENTOR
Cady S. Corl
By Carlson, Pitzner, Hubbard & Wolfe
ATTORNEY

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Fig. 5

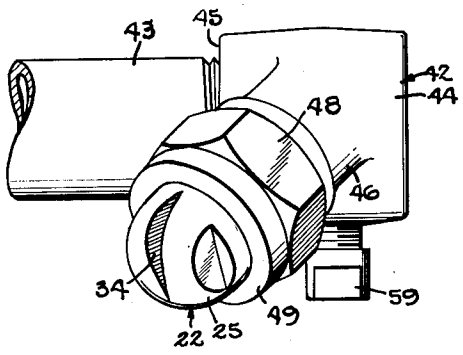


Fig. 6

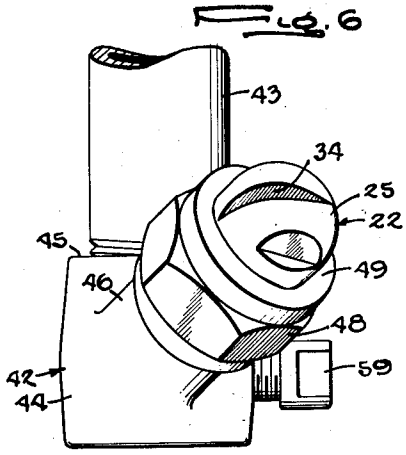


Fig. 7

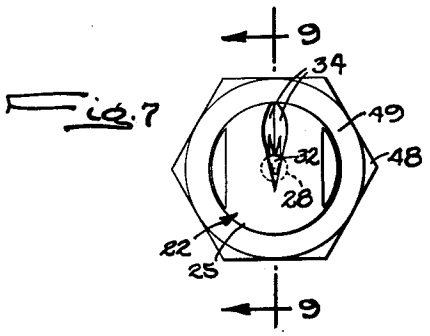


Fig. 9

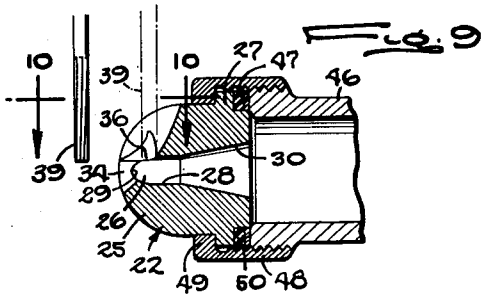


Fig. 8

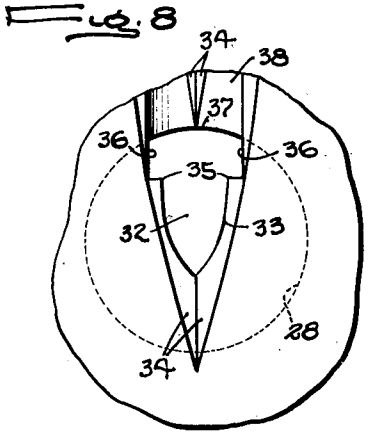
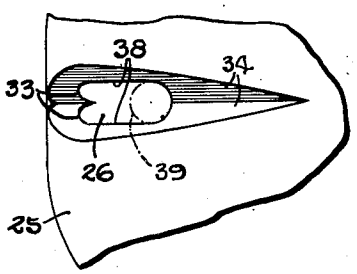


Fig. 10



INVENTOR
Cady S. Corl
By Cullen, Pitzner, Hurford & Wolff
ATTORNEY

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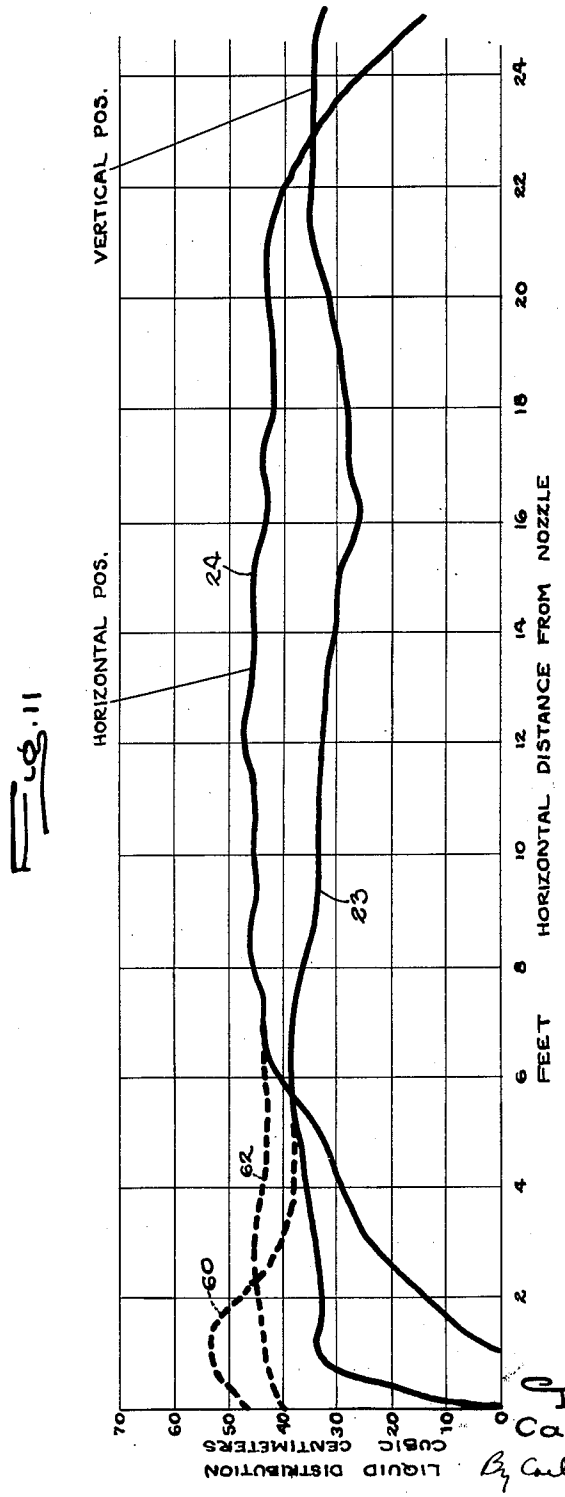


Fig. 11

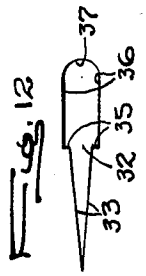


Fig. 12

INVENTOR
Cady S. Corl
By Carlson, Pilgrim, Hutchard & Wolfe
ATTORNEYS

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2,778,688

SPRAYING APPARATUS

Cady S. Corl, Minneapolis, Minn., assignor to Hanson Equipment Company, South Beloit, Ill., a corporation of Illinois

Application April 8, 1953, Serial No. 347,480

3 Claims. (Cl. 299—154)

This invention relates to spray nozzles of the type having an elongated orifice opening eccentrically from an internal dome-shaped recess or cavity for producing a flat fan-shaped spray pattern. Such nozzles are particularly useful outdoors in mobile spraying units and are adapted to be mounted on a vehicle with their spray patterns directed laterally from the vehicle in a vertical plane. Nozzles of this type used heretofore have been unsatisfactory because the swath or strip covered by the spray in the forward movement of the vehicle is narrow and the distribution of liquids by the nozzles varies widely throughout the area covered by the spray. That is, more liquid falls in some areas adjacent the vehicle than falls in remote areas covered by the outer end portion of the spray. Moreover, the spray from such prior art nozzles is in a vertical plane and therefore is subject to drifting and a resulting unevenness of liquid distribution caused by wind.

The primary object of the invention is to overcome the foregoing objections of nozzles of the above character and provide an improved nozzle construction which produces a spray pattern covering a substantially wider swath and distributing liquid more uniformly at different distances from the nozzle than spray patterns of the prior art nozzles.

Another object is to provide a novel nozzle construction for producing a flat fan-shaped spray pattern which provides substantially uniform distribution of liquid when directed in a generally horizontal plane as well as a vertical plane and therefore is comparatively unaffected by wind conditions unfavorable to the use of prior nozzles.

A more detailed object is to achieve the foregoing results by shaping one end portion of the eccentric nozzle orifice as a V and the other end portion of the orifice as a U wider than the maximum width of the V-shaped end portion.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a perspective view of a spraying unit showing the vertical spray patterns of a cluster of two nozzles embodying the novel features of the present invention.

Fig. 2 is a schematic plan view of a vehicle and the spraying unit thereon with the nozzle cluster in the same position as shown in Fig. 1.

Fig. 3 is a schematic plan view similar to Fig. 2 and showing the cluster adjusted for spraying in a horizontal plane.

Fig. 4 is a side elevational view of the cluster and its mounting with the nozzles positioned for spraying in a vertical plane.

Fig. 5 is a fragmentary enlarged view similar to Fig. 4.

Fig. 6 is a view similar to Fig. 5 with the nozzles positioned for horizontal spraying.

Fig. 7 is an end view of a nozzle.

Fig. 8 is a fragmentary view similar to Fig. 7 but enlarged to ten times the actual size of the nozzle.

Fig. 9 is a sectional view taken along the line 9—9 of Fig. 7 and showing the actual size of the improved nozzle.

Fig. 10 is a fragmentary sectional view taken along the line 10—10 of Fig. 9.

Fig. 11 is a chart illustrating the distribution patterns of the improved nozzle used in different positions.

Fig. 12 is a development view of the eccentric orifice of the nozzle.

The present invention relates to spray nozzles of the type adapted to produce a flattened fan-shaped spray pattern 57 and comprising generally a cylindrical solid body 25 adapted on its exterior for connection with a source of liquid under pressure and having an internal recess or cavity 26 opening axially from one end of the body for communication with the source of pressure liquid. At its other or outer end portion, the cavity is dome-shaped and opens to the exterior of the body through an elongated orifice 32 opening eccentrically from the dome and defined by the lines of intersection between the internal walls forming the recess and external walls 34 defining a V-shaped groove on the exterior of the body.

Liquid discharged under pressure from a nozzle of the type just described radiates from the orifice 32 in a flattened fan-shaped spray pattern which, in service use, projects laterally from a moving vehicle to cover a swath or strip extending longitudinally of the vehicle path. Prior art nozzles of this type have been objectionable because the distribution of liquid throughout the swath covered by this spray pattern is uneven, that is, widely differing amounts of liquid fall at points spaced horizontally different distances from the nozzle in the plane of the pattern. Such prior nozzles are unsatisfactory for the additional reason that the spray pattern is effective to the limited degree only when disposed in a vertical plane. Thus, when prior nozzles are used outdoors, the full pattern is exposed to horizontal winds which cause drifting of the spray and an even greater unevenness of liquid distribution.

To overcome the foregoing disadvantages of prior art nozzles, the present invention in one of its aspects contemplates a construction of the nozzle 22 by which liquid is thrown farther and distributed more uniformly than is possible with the prior nozzles and which has a spray pattern substantially as effective in a horizontal plane as in a vertical plane. The results achieved with the improved nozzle are illustrated in Fig 11 where the curves 23 and 24 represent the liquid distribution of the improved nozzle when spraying in vertical and horizontal planes respectively. It will be seen from the curve 23 that the improved nozzle, when spraying in a vertical plane, distributes liquid substantially uniformly from a distance of one foot from the nozzle to a point spaced farther than twenty-five feet from the nozzle. When in a generally horizontal plane, the spray from the improved nozzle (see curve 24) falls substantially uniformly from a point spaced approximately three feet from the nozzle to a point approximately twenty-four feet from the nozzle.

Referring now to Figs. 1 to 10 and 12, the nozzle 22 comprises the body 25 of circular cross section having the internal dome-shaped recess 26 (Fig. 9) in a rounded outer end portion of the body and an exterior mounting flange 27 adjacent the other or inner end of the body. The recess 26 is defined by a cylindrical wall 28 and a rounded end wall 29 both coaxial with the body and merging with each other at the outer end of the cylindrical wall. At its inner end, the cylindrical wall merges with a conical wall 30 extending through the inner end portion of the body and defining an inlet to the recess.

Liquid is discharged from the recess 26 through the elongated orifice 32 which opens eccentrically from the

recess and is defined at one end by the lines 33 of intersection between the rounded recess wall 29 and the two walls 34 defining the V-shaped external groove which is symmetrical about a plane including the axis of the recess 26. The groove extends into the top and one side of the rounded outer end portion of the body 25 and is formed by a milling cutter (not shown) of V-shaped cross section in the manner described in Patent No. 2,619,388. The groove walls intersect the rounded dome wall 29 at a point adjacent but spaced from the top of the dome and the lines 33 of intersection diverge from this point and curve first upwardly across the dome top and then downwardly on the other side thereof as shown in Figs. 8 and 12 to points 35 approximately midway between the orifice ends.

The other end portion of the orifice 32 of the improved nozzle 22 is U-shaped as shown in full in Figs. 10 and 12. Thus, from the points 35 of termination of the diverging defining edges 33 of the improved orifice 32, the latter is defined by two laterally spaced generally parallel edges 36 which substantially merge with the ends of the diverging edges and extend therefrom downwardly along the side of the rounded wall 29 and the cylindrical wall 28 to points spaced a short distance from the intersection between the bottom of the V-shaped groove and the cylindrical wall 28. At these points, the laterally spaced edges 36 merge with a rounded edge 37 defining the end of the orifice.

In the present instance, the U-shaped end portion of the orifice 32 is defined by the intersection between the cylindrical and rounded recess walls 28 and 29 and the walls 38 of a U-shaped groove symmetrical about the plane of the V-shaped groove and located on the side of the dome axis opposite the V-shaped orifice end. The U-shaped groove is formed by a cylindrical milling cutter 39 which, while it is being rotated about an axis normal to the dome axis, is moved longitudinally of the latter. The cutter is moved into cutting engagement with the V-shaped groove walls 34 from a position shown in full in Fig. 9 above the dome top to a position shown in phantom in Figs. 9 and 10 in which the cutter has been moved in to the point of intersection between the bottom of the V-shaped groove and the cylindrical recess wall 28, so that the latter is intersected at this same point by the bottom of the U shaped groove. Then, the cutter is retracted along the dome axis and out of engagement with the nozzle body 25. During the cutting movement, the outer end of the cutter is spaced radially from the dome axis a short distance as shown in Fig. 9. The diameter of the cutter is approximately .075 of an inch or slightly larger than the maximum spacing between the diverging orifice edges 33 so that, instead of merging precisely with the latter adjacent the midpoint of the orifice, the parallel orifice edges 36 in this instance are offset outwardly from the diverging edges a slight distance as shown in Figs. 8 and 15.

The substantial improvement in the distance to which liquid is thrown by the new nozzle and in the uniformity of distribution of the liquid as compared to the prior art nozzles is believed to be due to more favorable sizing and proportioning of drops of different size as an incident to discharge of liquid from the orifice 32. In general, the distance to which liquid is thrown from a nozzle is determined by the size of the drops produced by the action of the nozzle on the liquid. That is, the drops travel a distance proportional to their size. Thus, it is believed that the shape of the improved nozzle 22 results not only in an increase in the size of some drops to increase the range of the nozzle but also in proportioning the numbers of drops of different sizes to provide more even liquid distribution. In other words, a large number of small drops are produced to cover the area adjacent the nozzle while the numbers of larger drops which are thrown farther diminish in proportion to the size of the drops, the largest drops being the least in number.

Since the nozzle orifice 32 opens eccentrically or from one side of the dome-shaped recess 26, the spray pattern of the improved nozzle 22 is discharged at an angle with respect to the dome axis. For this reason it is necessary, in order to achieve the distribution shown by the curve 23 when spraying in a vertical plane, to support the improved nozzle with its rounded end lowered and its axis tilted downwardly from the horizontal as shown in Fig. 5, the orifice 32 lying in a vertical plane and opening in a horizontal direction from the dome-shaped recess 26 with the U-shaped orifice end above the V-shaped end. The liquid distribution shown by the curve 24 for horizontal spraying is achieved by raising the rounded end of the nozzle and positioning the orifice in a generally horizontal plane as shown in Fig. 6. To direct the horizontal spray pattern in a particular direction, it is necessary to support the nozzle with its axis extending at a slight angle in a horizontal plane with respect to the desired direction.

Means is provided to mount the improved nozzle 22 on a vehicle 40 to facilitate location of the nozzle in the two positions just described for spraying laterally from the vehicle as the latter is moving. This means comprises a hollow fitting 42 which is secured to a supply pipe 43 and which so positions the nozzle relative to the pipe that, when the latter projects horizontally from the rear of a vehicle 40 and along the longitudinal axis of the vehicle as shown in Figs. 1 and 2, the nozzle is located automatically in its vertical spraying position and, when the pipe is disposed vertically as shown in Figs. 3 and 6, the nozzle is located automatically in its horizontal spraying position. For this purpose, the nozzle projects downwardly and forwardly from the fitting with its axis extending obliquely of the pipe axis and with the plane defined by the dome axis and the end points of the orifice 32 disposed vertically when the pipe is disposed horizontally. Then, when the pipe is moved into a vertical position, the nozzle automatically projects upwardly and rearwardly from the fitting so that its spray pattern extends laterally from the vehicle as shown in Fig. 3.

The fitting 42 shown in the drawings is especially adapted to support two of the improved nozzles 22 in symmetrical relation on opposite sides of the pipe axis for spraying laterally in opposite directions from the vehicle 40. In this instance, the fitting comprises a hollow central body 44 apertured at one end 45 and internally threaded to receive in coaxial relation the externally threaded projecting end of the pipe 43. Extending outwardly from the opposite sides of the body in symmetrical relation about the axis of the aperture are two hollow projections 46 whose axes extend obliquely of the aperture axis and diverge toward the apertured end of the body. On its outer end portion, each projection terminates in an abutment 47 (Fig. 9) and is threaded exteriorly to receive a clamping nut 48. The latter is adapted to receive the rounded end of the nozzle body 25 and has on its outer end an inturned flange 49 engageable with the outer side of the mounting flange 27 of the nozzle body. After the nozzle has been adjusted angularly relative to its supporting projection 46 to locate its orifice in a vertical plane as described above when the axes of the fitting and the supply pipe are horizontal, the nut 48 is turned down on the fitting projection to clamp the mounting flange 27 of the nozzle 22 between the nut flange 49 and the abutment 47 on the end of the projection. To prevent leakage, suitable washers 50 may be inserted between the nozzle flange and the abutment.

The supply pipe 43 may be mounted on the vehicle in any suitable manner for adjustment into either its vertical position or its horizontal position. In this instance, the mounting comprises an adjustable clamp 52 engageable with an intermediate portion of the pipe and is secured to a vertical rod 53 (Fig. 1) by which barrels 54 of liquid to be distributed are secured to a platform 55 projecting rearwardly from the vehicle. At its inner end, the supply pipe is connected through a manually actuated

valve 56 (Fig. 4) to a pump (not shown) which delivers liquid under pressure from the barrels to the valve.

With the supply pipe 43 clamped in its horizontal position along the longitudinal axis of the vehicle 40 and the improved nozzles 22 secured to the fitting 42 as described above, liquid discharged under pressure from the nozzles will form the spray patterns indicated at 57 in Figs. 1 and 2, the distribution of liquid by each nozzle following the curve 23 in Fig. 11. These patterns are disposed in the vertical planes of the nozzle orifices 32 and diverge toward the front of the vehicle at an angle corresponding to the divergence of the axes of the projections 46 toward the apertured end 45 of the fitting body 44.

Since only a small amount of liquid falls directly below and adjacent each nozzle and due to the spacing of the nozzle by the fitting 44, the inner ends of the patterns 57 are separated by a small gap 58 where no liquid falls. To fill this gap, a third nozzle 59 adapted to produce a mist directed downwardly between the patterns is added to the cluster of the two improved nozzles 22. The third nozzle 59, which may be of the type described in Patent No. 2,621,078, is threaded into an aperture in the bottom of the fitting as shown in Fig. 5. When the third nozzle 59 is added to the cluster, its spray combines with that of each of the improved nozzles as shown by the dotted curve 60 in Fig. 11 to provide a substantially uniform distribution of liquid from a point directly beneath the fitting 42 throughout the swath of the improved nozzle.

To condition the nozzle cluster for spraying in a horizontal plane, the clamp 52 is loosened and the supply pipe 43 is simply rotated through 180 degrees about its own axis and swung angularly through 90 degrees into its vertical position shown in Figs. 3 and 6, the positions of the improved nozzles 22 and the mist nozzle 59 relative to each other remaining the same. The spray patterns 61 of the improved nozzles in this position extend outwardly from the nozzles in a generally horizontal direction as shown in Fig. 3 since the axes of the nozzles project rearwardly. The spray of the mist nozzle 59 combines with that of each improved nozzle to fill in the gap between the spray patterns 61 and distribute liquid uniformly as shown by the dotted curve 62 in Fig. 11.

From the foregoing, it will be apparent that the results achieved with the improved nozzle 22 and its novel orifice 32 far exceed those of prior art nozzles. Not only does the new nozzle throw liquid farther than prior nozzles in a vertical plane under similar conditions including liquid pressure, but also, it distributes the liquid more evenly throughout the area covered. Moreover, the new nozzle is substantially as effective when spraying in a horizontal plane.

I claim as my invention:

1. A spray nozzle comprising a body having an internal recess defined by a wall including an outwardly curving arcuate portion, external surfaces on said body intersecting said wall along lines defining an elongated orifice extending around said arcuate wall portion and having a U-shaped end portion and a V-shaped end portion, the edges of said V-shaped end portion diverging toward said U-shaped end portion and the laterally spaced defining edges of the U-shaped portion being spaced apart a distance greater than the maximum spacing of the diverging edges and connected to the latter along transverse lines of intersection extending inwardly from the ends of the spaced edges of the U-shaped end portion to the diverging edges.

2. A spray nozzle comprising a body having an internal recess defined by a wall including an outwardly curving arcuate portion, external surfaces on said body defining a groove V-shaped cross section and intersecting said arcuate portion of said wall to define a V-shaped end portion of an elongated orifice, and other external surfaces on said body defining a groove of U-shaped cross section and intersecting said wall to define the other end portion of said orifice which is U-shaped, the diverging defining edges of said V-shaped end portion of said orifice terminating at points intermediate the orifice ends and said other end portion having laterally spaced defining edges terminating adjacent but spaced outwardly from the ends of the diverging edges.

3. A spray nozzle comprising a body having an internal recess defined by a wall including an outwardly curved portion, external surfaces on said body intersecting said wall along lines defining an elongated orifice extending around said arcuate wall portion and having a V-shaped end and a U-shaped end, the width of said orifice from said V-shaped end to said U-shaped end first increasing gradually to a point intermediate the ends, then increasing abruptly to a greater width, and finally remaining constant at the greater width throughout the remainder of the orifice length to the U-shaped end.

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