

June 9, 1953

C. E. YOST
SPRAY NOZZLE

2,641,509

Filed April 27, 1948

2 Sheets-Sheet 1

Fig. 1.

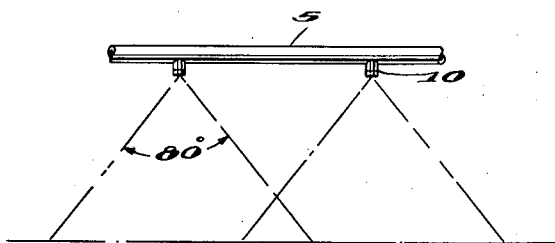


Fig. 2.

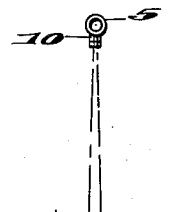


Fig. 3.

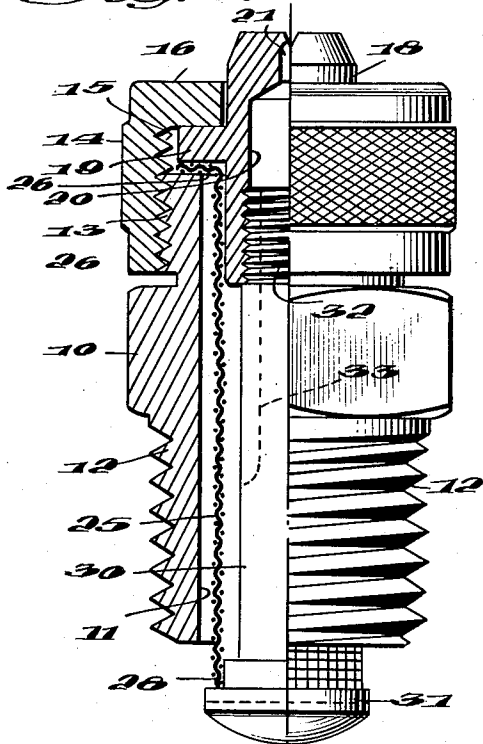


Fig. 5.

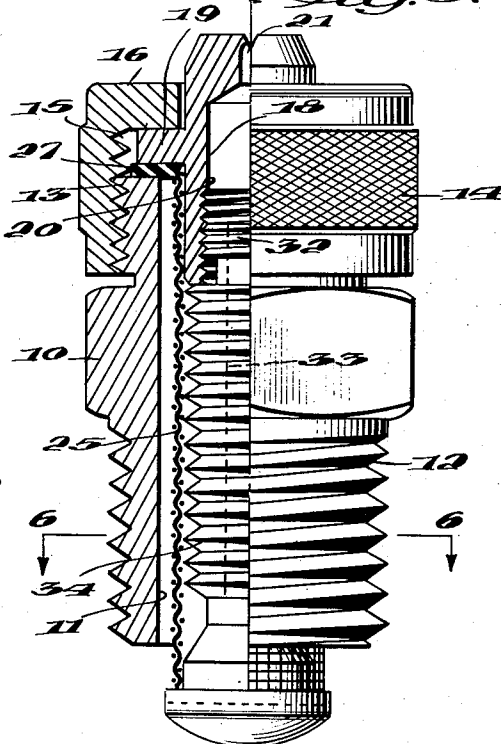
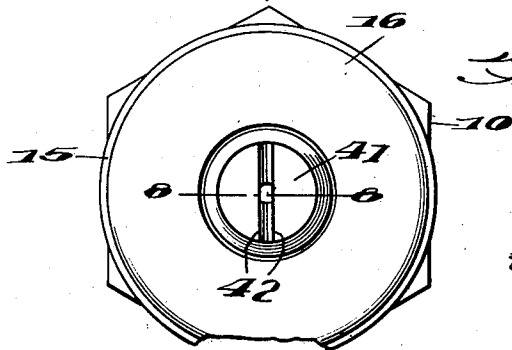


Fig. 4.



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Fig. 6.

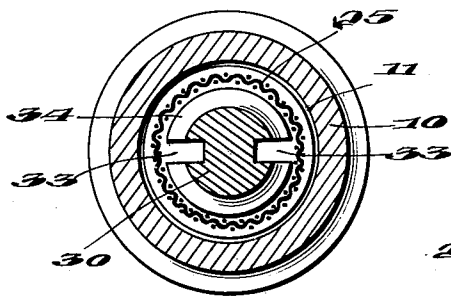


Fig. 7.

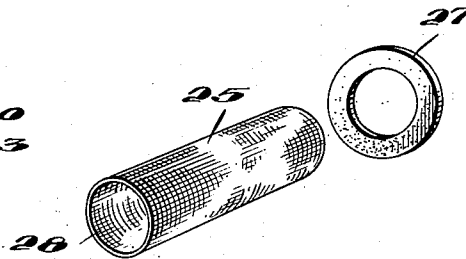


Fig. 8.

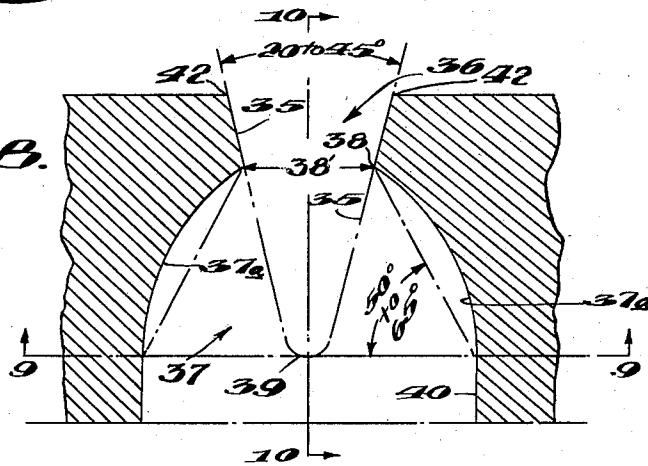


Fig. 9.

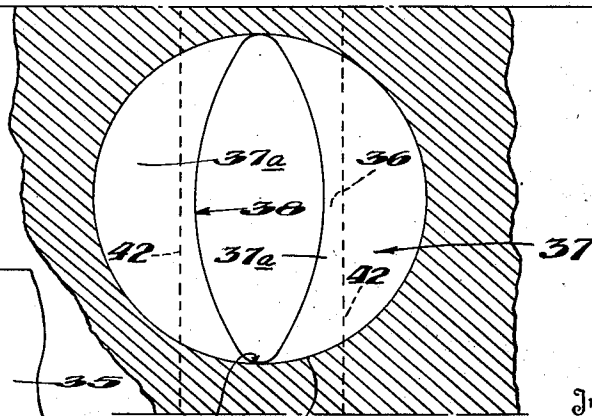
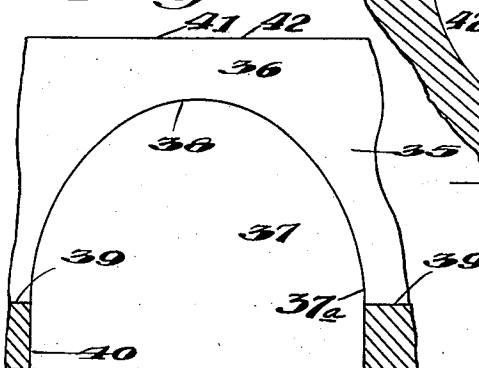


Fig. 10.



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2,641,509

SPRAY NOZZLE

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5 Claims. (Cl. 299-154)

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The present invention relates to spray nozzles such as are used for spraying liquid insecticides, liquid weed exterminators, and liquid fertilizer upon growing plants, ground prepared for planting, and like uses, and the invention aims generally to improve and simplify spray nozzles of that type.

A primary object of the invention is the provision of an improved spray nozzle that will deliver a flat fan-shaped mist or atomized spray of substantially uniform density and of relatively wide spread, for example of approximately eighty degrees spread, to the end that plants and ground may be effectively and economically treated.

A further object of the invention is the improvement and simplification of spray nozzle construction to provide a nozzle that can be economically manufactured and readily disassembled for cleaning and replacement of parts.

A further object of the invention is the provision of a spray nozzle having a readily replaceable nozzle tip adapted to produce a flat fan-shaped atomized spray or mist of predetermined pattern and liquid capacity.

A further object of the invention is the provision of a spray nozzle having a replaceable nozzle tip of novel construction adapted to be economically manufactured.

A still further object of the invention is the provision of a spray nozzle having an improved strainer assembly associated therewith.

The above and other objects of the invention will be apparent to persons skilled in the art from a consideration of the accompanying drawings and annexed specification illustrating and describing two preferred embodiments of the invention.

In the drawings—

Fig. 1 is a diagrammatic view of a portion of a spray rig having a plurality of spray nozzles embodying the invention connected therewith;

Fig. 2 is an edge elevation of the rig and nozzle shown in Fig. 1;

Fig. 3 is an enlarged sectional elevation of a spray nozzle according to one embodiment of the invention;

Fig. 4 is a top plan view of the nozzle shown in Fig. 1;

Fig. 5 is an enlarged sectional elevation of a spray nozzle according to a modified form of the invention;

Fig. 6 is a transverse sectional view as taken on the line 6—6 of Fig. 5;

Fig. 7 is a perspective view of the strainer screen for the nozzle of Fig. 5;

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Fig. 8 is a greatly enlarged sectional view of the discharge orifice of the nozzle tip taken on the line 8—8 of Fig. 4;

Fig. 9 is an enlarged horizontal sectional view of the discharge orifice as taken on the line 9—9 of Fig. 8; and

Fig. 10 is an enlarged transverse section of the discharge orifice as taken on the line 10—10 of Fig. 8.

Referring to the drawings, the improved spray nozzle comprises a body 10 provided with a coaxial spray passage 11 therethrough and having a threaded stem 12 at one end for attachment to a supply pipe 5 of suitable type. The opposite end of the body 10 may be threaded as at 13 to receive the nozzle tip retainer cap 14 having a threaded bore 15 and an inwardly extending retaining flange 16 at one end. The cap 14 is threaded on the threaded portion 13 of the nozzle tip of the body, thus permitting interchangeability of the nozzle tip for a desired capacity of spray, simply by removing the cap 14.

The nozzle tip is preferably formed of a cylindrical body portion 18 having an annular flange 19, preferably intermediate its ends adapted to bear against the end of the body 10 and be engaged by the inwardly extending flange 16 of the cap 14 which holds the tip in assembled relation with the body 10. The tip is provided with an axial fluid passage 20 and an elongated restricted discharge orifice 21 of unique shape and design to provide a flat wide-spread fan-shaped atomized spray as illustrated in Figs. 1 and 2.

The nozzle tip preferably has an associated strainer or screen member to screen and initially diffuse the fluid passing from the fluid passage 11 of the body 10 to the fluid passage 20 of the tip. The screen member 25 may consist of a cylinder of suitable wire screen, for example of 100 or 200 mesh, and may have an outwardly turned flanged rim 26 at one end adapted to overlie the end of the body 10 and be clamped thereon by the flange 19 of the nozzle tip 18 when the latter is assembled with the body 10 by means of the cap 14, as shown in Fig. 3. Alternatively, as shown in Fig. 5, the flange 26 may be omitted and a gasket ring 27 (Fig. 5) of compressible packing material may snugly fit and surround one end of the screen and serve as a flange for securing that end of the screen in the body and form a seal against leakage of fluid between the nozzle flange 19 and the body 10.

The screen or strainer 25 may be assembled with the nozzle tip 18 by means of a central stem 30 having a head 31 fitted within and closing an open end 28 of the screen 25 and an opposite threaded end 32 threaded into the fluid passage 20 of the nozzle tip 18. The body of the stem is provided with a plurality of peripherally open grooves 33 extending from the threaded end 32 longitudinally toward and terminating short of the head 31. The radial depth of the grooves is greater than the depth of the screw threads at the end 32 so as to permit the passage of screened fluid from between the screen and stem, rearwardly of the tip 18 to the fluid passage 20 forwardly of the stem 30. Preferably, the body of the stem 30 may be ribbed or fluted as by a helical thread 34 (see Fig. 5) to provide a support for the fine wire screen throughout a substantial distance between the nozzle tip 18 and stem head 31.

The nozzle tip 18 is provided with a discharge orifice 21 of novel design to produce an atomized fan-shaped spray of predetermined liquid capacity. For example, in weed extermination it is desirable to supply a liquid weed extirminator in a spray of uniform density and predetermined volume under controlled conditions, such as pressure, under which the liquid is projected at a prescribed rate of travel of the spray relative to the turf. For certain types of weeds it is necessary to supply a greater volume of spray and hence it is desirable that the nozzle tip be readily replaceable in the body 10.

According to the present invention the discharge orifice 21 comprises a passage portion formed by a cylindrical bore 40 preferably coaxial with and smaller than the passage 20 of the tip 18 and a joining tapered or substantially semi-spherical passage end portion 37, as produced for example by a ball nosed cutter. Preferably the cutter is of slightly greater depth than diameter so as to produce a tapered passage end portion of decreasing cross-sectional area and having semi-elliptical side walls 37a which taper outwardly in the direction of flow of fluid.

According to the present invention the discharge orifice 21 also includes a transverse discharge slot 36. Such slot has inwardly tapering opposing flat walls 35 which extend inwardly from the outer flat surface 41 of the tip body and intersect tapering or curved walls 37a to produce an irregular elliptical opening having its major at the line of intersection constituting edge 38 and minor axes in different planes and having a minor or terminal diameter 38' substantially less than the maximum width of the slot 36. Slot walls 35 intersect the outer flat surface 41 in parallel opposing straight edges 42. Slot walls 35 increase in thickness in the direction of the outer surface 41 from the center outwardly transversely to their opposite ends 39.

The internal cylindrical bore 40 of the tip 18 is preferably coaxial with the passage 20, which bore 40 terminates short of the outer end of the tip body 18 and substantially in the transverse plane of the bottom of the slot 36 opposite ends 39. This is important in the provision of the desired uniform spray as heavier concentrations at the edges of the spray result when the slot ends 39 of the slot 36 extends inwardly beyond the outer end of the cylindrical bore 40.

The transverse slot 36 is preferably formed by a cutter having tapered sides to produce predetermined tapered walls of an acute angled V-shaped slot extending inwardly of the tip body 18 to approximately the plane of merger of the inner end of passage end portion 37 and the bore 40, as indicated by the line 9—9 of Fig. 8. The inclination of the walls 35 of the slot 36 will preferably be from 10 to 22½ degrees with reference to the longitudinal axis of the tip, as indicated by the line 10—10 of Fig. 8, and must be less than 45 degrees to produce a satisfactory spray pattern. Stated another way, the included angle between the tapered walls 35 will vary from 20 to 45 degrees. The included angle of inclination of the walls 35 will be greater, within the limits of 20 to 45 degrees, as the predetermined capacity of the nozzle is greater.

The walls 37a of the semi-spherical or semi-elliptical passage portion 37 of the orifice 21 taper from the plane of the inner edge 39 of the slot 36 to intersect the slot 36 intermediate the inner and outer edges thereof, so that the minor or terminal diameter 38 thereof is disposed in a plane spaced outwardly of the major diameter thereof which is disposed in the plane of the ends 39 of the slot 36. The tapered walls 37a may be produced by a tapered cutter or by a less than spherical ball nose cutter, having a diameter less than its depth, so that the angle of inclination of the tapered walls 37a, as measured by the chord of an arcuate face, will be greater than 45 degrees with reference to the transverse plane at the bottom of the slot through the slot ends 39 of the slot, as illustrated in Fig. 8. The angle of inclination of the chord of the arcuate face of the walls 37a with the transverse plane intersecting the slot ends 39 will vary between approximately 50 and 65 degrees according to the predetermined capacity of the nozzle tip.

The discharge orifice 21, formed as just described, produces a thin, substantially flat, fan-shaped spray of substantially uniform density. A predetermined capacity of discharge may readily be determined by the angle of inclination of the walls 35 and the chordal inclination of the tapered walls 37a of the bore 40. Variations in these two factors within the limits above stated permit the production of replaceable nozzle tips of various capacities ranging from 5 to 100 gallons per hour with a liquid pressure of from 25 to 35 lbs. per sq. in.

For the production of most satisfactory results it is important that the slot bottom defined by the opposite ends 39 of the slot 36 does not extend inwardly beyond the end of the full nozzle shape or the inner end of the tapering passage end portion 37. If the bottom of the slot 36 extends inwardly beyond the inner terminal end of the tapered passage portion 37, a non-uniform spray is produced with heavier streams concentrated at the ends of the fan-shaped spray.

From the above it will be seen that the improved spray nozzle is of simple construction and can be economically manufactured at small cost. The nozzle tip and screen may readily be removed for replacement and cleaning simply by removal of the cap 14 without removal of the entire nozzle body. The novel shape of the discharge orifice can be economically produced and controlled to supply replaceable nozzle tips of various predetermined capacities.

Although I have illustrated preferred em-

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bodiments of the invention, it is to be understood that the invention is not restricted to the details illustrated and described, as the scope of the invention is best defined in the appended claims.

I claim:

1. A spray nozzle comprising a body having a fluid passage portion formed in said body below the outer surface of said body, said passage portion having passage walls which taper outwardly with concave curvature towards said body outer surface and in the direction of flow of fluid through said passage portion, said body being formed with a transverse fluid discharge slot extending inwardly from said body outer surface and terminating in ends located on the opposite sides of said passage portion, said slot having opposing flat walls intersecting said body outer surface in opposing lines of intersection, said opposing walls tapering inwardly towards the direction of flow through said passage portion and intersecting said concave passage walls along a line of intersection which defines an elliptical opening, and the surfaces of said opposing walls of said slot between said outer surface of said body and said concave passage walls increasing in depth from the center of the slot to said ends of the slot.

2. A spray nozzle comprising a body having a substantially flat outer surface and a fluid passage portion of circular cross-section formed in said body below said body outer surface, said passage portion having passage walls which taper outwardly with concave curvature in the direction of flow of fluid through said passage portion, said body being formed with a transverse fluid discharge slot extending inwardly from said body outer surface and terminating in ends located on opposite sides of said passage portion, said slots having opposing flat walls intersecting said body outer surface in opposing parallel straight lines of intersection, said opposing walls tapering inwardly towards the flow of fluid through said passage portion and intersecting said concave passage walls along a line of intersection which defines an elliptical opening.

3. A spray nozzle comprising a body having a substantially flat outer surface and a fluid passage portion formed in said body below said body outer surface, said passage portion having passage walls which taper outwardly with concave curvature in the direction of flow of fluid through said passage portion, said body being formed with a transverse fluid discharge slot extending inwardly from said body outer surface and terminating in ends located on opposite sides of said passage portion, said slot having opposing flat walls intersecting said body outer surface in opposing parallel straight lines of intersection, said opposing walls tapering inwardly towards the flow of fluid through said

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passage portion and intersecting said concave passage walls along a line of intersection which defines an elliptical opening, said opposing walls being disposed at an angle of not less than 10 degrees nor more than $22\frac{1}{2}^\circ$ to the longitudinal axis of said passage portion.

4. A spray nozzle comprising a body having a substantially flat outer surface, a passage portion of circular cross-section formed in said body below said body outer surface, said passage portion having passage walls of elliptical curvature which taper in the direction of flow of fluid through said passage portion, said body being formed with a transverse slot extending inwardly from said body outer surface and terminating in ends located on opposite sides of said passage portion, said slot having opposing flat walls intersecting said body outer surface in opposing straight parallel lines of intersection, said opposing walls tapering inwardly towards the flow of fluid through said passage portion and intersecting said concave passage walls along a line of intersection which defines an elliptical opening.

5. A spray nozzle comprising a body having a substantially flat outer surface, a passage portion formed in said body below said body outer surface, said passage portion having passage walls of elliptical curvature which taper in the direction of flow of fluid through said passage portion, said body being formed with a transverse slot extending inwardly from said body outer surface and terminating in ends located on opposite sides of said passage portion, said slot having opposing flat walls intersecting said body outer surface in opposing straight parallel lines of intersection, said opposing walls tapering inwardly towards the flow of fluid through said passage portion and intersecting said concave passage walls along a line of intersection which defines an elliptical opening, said opposing walls being disposed at an angle of not less than 10 degrees nor more than $22\frac{1}{2}^\circ$ to the longitudinal axis of said passage portion, and said tapering passage walls of elliptical curvature being disposed at an angle of not less than 50 degrees nor more than 65 degrees to a plane normal to the longitudinal axis of said passage portion.

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