March 10, 1942. W. A. SIMANTON 2,275,691

APPARATUS FOR ATOMIZING LIQUIDS

Filed Jan. 24, 1941

FIG. 1.

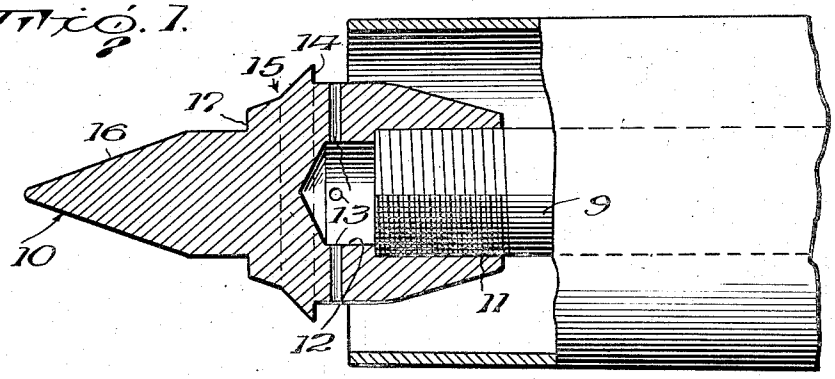
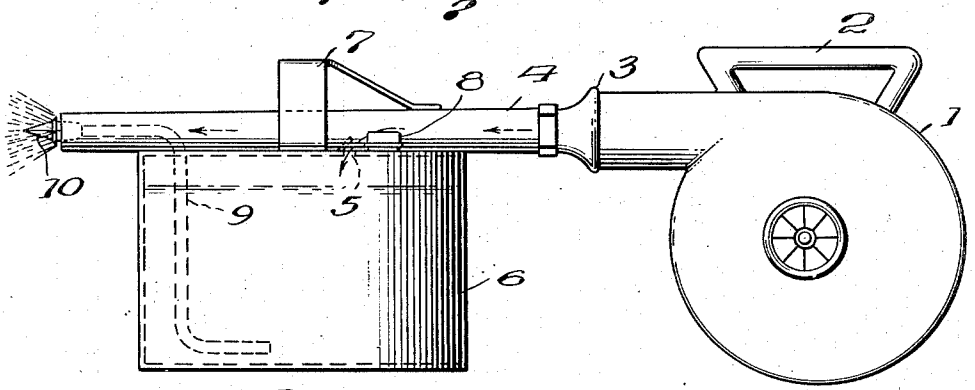



FIG. 2.



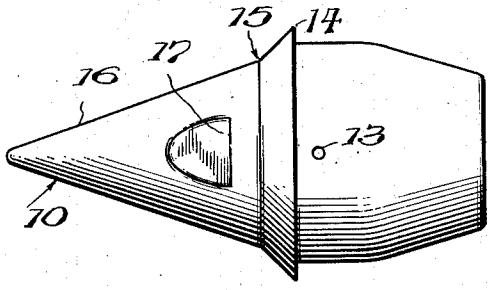




FIG. 3.

Inventor

W. A. Simanton,

By A. M. Houghton

Attorney

Patented Mar. 10, 1942

2,275,691

# UNITED STATES PATENT OFFICE

2,275,691

## APPARATUS FOR ATOMIZING LIQUIDS

William A. Simanton, Oakmont, Pa., assignor to Gulf Research & Development Company, Pittsburgh, Pa., a corporation of Delaware

Application January 24, 1941, Serial No. 375,852

5 Claims. (Cl. 299—140)

This invention relates to apparatus for atomizing liquids; and it comprises an apparatus for spraying liquids including a conical nozzle tip having near its base a sharp-edged flange cooperating with the tip to define an annular reentrant zone downstream with respect to the flange, a central passage for feeding liquid to be sprayed and lateral passages leading therefrom, the lateral passages opening on the upstream side of the sharp-edged flange, and means for supplying liquid to the central passage and for supplying a blast of air over said flange; all as more fully hereinafter set forth and as claimed.

Heretofore, considerable difficulty has been experienced in obtaining, in portable apparatus, the degree of atomization which is necessary for the most efficient spraying of liquids. The most widely used spraying apparatus of the prior art has been of two general types. The first of these types has a relatively small orifice at the end of the spraying unit through which high pressure liquid, or air and liquid pass. The second type employs a large volume of high velocity air at low pressure and effects atomization by impact against a stream of liquid flowing from an orifice of the type having no obstructions impeding the forward flow of the liquid. The disadvantage of the first type is that although a fine spray is obtained, it is impossible to project it to any great distance beyond the apparatus, unless inconveniently high pressures are employed; above, say 20 pounds. Such pressures are difficult to obtain in portable equipment with fractional horsepower motors. With the second type, atomization is relatively poor. The stream of spray blown from the nozzle is made up of large droplets which do not remain suspended in the air for any great length of time.

Among the objects achieved in the herein described invention is the provision of a spraying apparatus capable of forming a relatively fine spray and projecting it a great distance from the nozzle.

This and other objects are achieved by the provision of a nozzle having a conical tip which is skirted by a sharp-edged flange that functions to spread out the air and liquid by the force of their impact against the flange immediately after they contact each other. The continued blast of air forces the intermingled liquid over the sharp-edged flange where it is subjected to a disrupting air turbulence due to the Venturi effect caused by expansion of the air stream as it flows over the flange and into the region beyond the flange. The released air envelops the atomized liquid and projects it with considerable force as a fine mist.

The invention, while advantageous in all sorts of spraying systems, is especially suited for spraying liquids of relatively low viscosity typified by water and kerosene.

In the accompanying drawing I have shown more or less diagrammatically, an example of a specific embodiment of the invention as embodied in an insecticide spraying unit. In the showing,

Fig. 1 is a view in central longitudinal section of my nozzle tip fixed at the end of an inner liquid passage at a particular position relative to the outer air passage,

Fig. 2 is a side elevation of a complete sprayer unit embodying the invention, comprising a nozzle and conduit connections thereto, spray tank and motor-fan, and

Fig. 3 is a view of the nozzle tip alone, in plan.

Referring to the drawing, reference character 1 indicates the motor-fan unit of the spraying apparatus, having a handle 2 attached thereto, the outlet of the motor-fan unit 1 being connected by a collar 3 to a conduit 4. Located in conduit 4 is a deflector or by-pass 5 for applying air pressure from the conduit to a tank 6 secured to the conduit. A handle 7 is provided. An opening 8 is provided in the tank for filling the container with liquid to be sprayed. Leading from the tank 6 is a pipe 9 which is located within the conduit 4 so as to define concentric outer and inner passages, for air and liquid respectively. The tank and blower construction is more or less conventional and equivalent arrangements may be used.

The nozzle tip 10 is connected to pipe 9 by means of an internally threaded sleeve portion 11. An interior cavity or passage 12 is formed in the tip immediately downstream of the threaded area of the sleeve. Leading from the cavity 12 are a plurality of lateral passages 13 (shown as four in number) which open on the outer periphery of the nozzle tip.

Skirting the outer periphery of the nozzle tip at a point downstream with respect to the outlets of lateral passages 13 is a sharp-edged flange 14, of steeper walls than the conical portion 16 of the tip, so as to define an annular reentrant zone 15. This construction gives a Venturi effect as hereinafter described. Notches 17 are provided in the conical portion 16 to facilitate the removal of the tip by a wrench or similar tool.

In operation the sprayer unit functions as follows: Motor-fan unit 1 blows air under low pressure down through conduit 4. A portion of this

air passes through by-pass 5 into tank 6 and exerts pressure on the liquid therein to force it out through the inner liquid passage 9. The liquid flows from tube 9 into the nozzle cavity and then out through lateral passages 13. The liquid emerging from the lateral passages strikes the main air blast blown through the passage 4 causing it to strike against flange 14, the impact of which spreads the liquid out. The blast of air forces the liquid to be blown over the sharp-edged flange where it is subjected to a disrupting air turbulence. This turbulence is caused by the Venturi effect of the flanged edge 14 which causes a temporary rise of air pressure and a sudden drop beyond the flange in the region of the reentrant zone 15. The released air envelops the atomized liquid and distributes it with considerable force past the conical section 16 in an outwardly diverging conical stream of mist.

The change in diameter of the conical tip from the edge of flange 14 past the reentrant portion 15 to the point 16 is of considerable importance as it forms an air flow pattern for the zone of turbulence which breaks up the mist and prevents the liquid from wetting the tip. The length and shape of the conical section is also of importance inasmuch as an excessively long conical tip will be wet by the spray due to coalescence of the liquid particles into large droplets which are blown off at the point. An excessively short conical tip will cause too coarse a spray; though the tip can be somewhat shorter than that shown. The dimensions shown are good. The nozzle tip is shown embodied in one particularly good form of spraying apparatus, but it is useful in other relations. It can be embodied in any suitable material, metallic or nonmetallic.

While I have described in detail the operation of the atomizer of my invention only in its application to the spraying of liquids in a portable sprayer unit, the invention can be utilized in other kinds of apparatus, as in fuel oil burners and carburetors; especially where projection of a finely divided spray of low-velocity liquid is to be provided, with a low pressure source.

What I claim is:

1. A nozzle tip comprising a substantially conical body having a cavity therein adjacent its base, an annular knife-like flange surrounding the conical body adjacent its base and rising steeply from the base to said sharp edge to present a substantially perpendicular surface, and at least one liquid passage in the body leading from said cavity to a point adjacent the upstream side of the flange.

2. In combination, a nozzle tip comprising a substantially conical body having a liquid-receiving cavity therein adjacent its base, an annular sharp-edged flange surrounding the conical body adjacent its base and at least one liquid passage in the body leading from said cavity to a point adjacent the upstream side of the flange, and an air conduit of interior diameter somewhat greater than the base of the nozzle, terminating in a plane spaced slightly upstream with respect to the flange.

3. In a conical nozzle tip, a sharp-edged flange adjacent the base of the conical tip and cooperating with the tip to define an annular reentrant zone downstream with respect to the flange, said flange presenting a continuous surface substantially perpendicular with respect to the base of the nozzle tip and terminating in a circular knife-like edge, a central passage for feeding liquid to be sprayed and lateral passages leading therefrom, said lateral passages opening on the upstream side of the sharp-edged flange.

4. In a nozzle, a conical nozzle tip having a sharp-edged flange of approximately triangular cross-section skirting the outer periphery thereof and cooperating with the said tip to define an annular reentrant zone downstream with respect to the flange, said flange presenting a continuous upstream surface rising steeply from the base of the nozzle tip, a central passage for feeding liquid to be sprayed and lateral passages leading therefrom, said lateral passages opening on the upstream side of the sharp-edged flange, and means for delivering a blast of air surrounding the tip adjacent the flange.

5. A nozzle tip adapted to be attached to the end of a liquid conduit disposed within an air conduit, having at least one port for leading liquid from said liquid conduit through the outer, upstream surface of said tip, an annular surface substantially perpendicular to the principal axis of said conduits on the downstream side of said port, and a downstream portion tapering sharply from the periphery of said annular surface substantially to a point and forming an annular reentrant zone.

WILLIAM A. SIMANTON.