

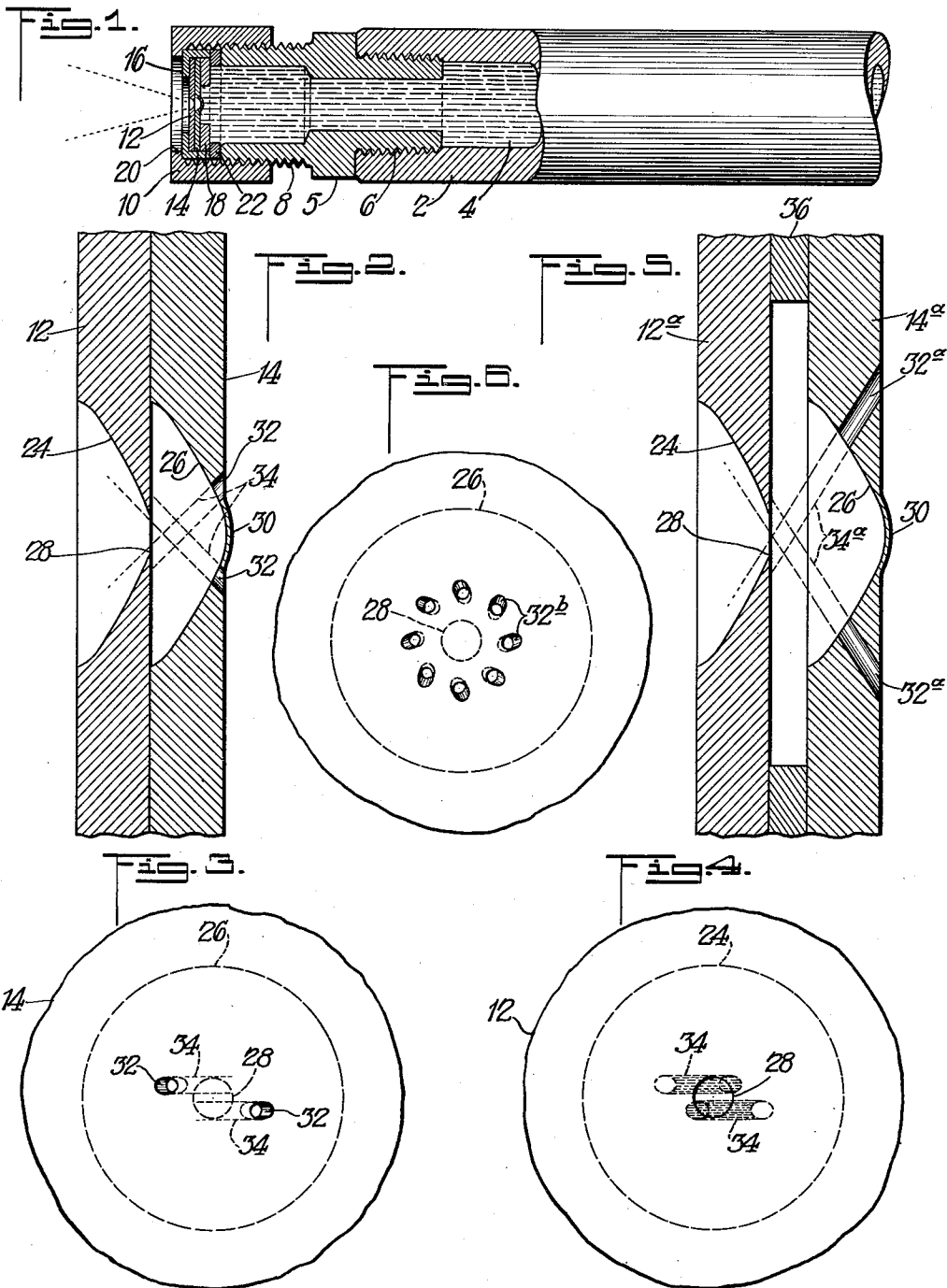
Jan. 9, 1940.

W. F. HAMILTON

2,186,804

NOZZLE

Filed Nov. 4, 1937



INVENTOR
William Fournes Hamilton
BY
Hughes
ATTORNEYS,

UNITED STATES PATENT OFFICE

2,186,804

NOZZLE

William Fownes Hamilton, Altadena, Calif., assignor of one-half to Walter R. Allen, Los Angeles, Calif.

Application November 4, 1937, Serial No. 172,753

3 Claims. (Cl. 299—120)

This invention relates to an atomizer of the mechanical atomization type; that is, one which is capable of converting a liquid into a fine mist without the aid of compressed gas.

A particular advantage of the invention is that it makes possible atomization with a flow considerably below the minimum flow of mechanically atomizing nozzles in use at the present time. The minimum flow available heretofore was approximately 2.5 gallons per hour, whereas nozzles have been made according to the principles of my invention which atomized liquids at the rate of 2 or 3 quarts per hour. It may be possible to achieve even slower rates of atomization with nozzles constructed according to my invention, while higher rates can be handled equally well by simply enlarging the dimensions of the nozzle.

One application of the invention is in the atomization of oil, such as fuel oil, into sufficiently fine mist for smokeless combustion, for instance for orchard heating purposes.

The invention has the advantage of requiring only a moderate pressure to effect atomization.

The invention will be explained in detail with reference to several illustrative forms shown in the accompanying drawing. The dimensions referred to in this description have been found satisfactory for a nozzle designed for a flow of about 2 or 3 quarts per hour; for different rates of flow the dimensions should be modified conformably.

In the drawing

Fig. 1 is an axial section of an atomizing nozzle in accordance with the invention, showing the same inserted in the end of a pipe which appears partly in elevation;

Fig. 2 is an axial section of the two nozzle plates of the atomizing nozzle shown in Fig. 1;

Fig. 3 is an elevational view of the central portion of the nozzle plates seen from the right in Fig. 2;

Fig. 4 is an elevation of the central portion of the spray plate, indicating the direction of the jets from the swirl plate;

Fig. 5 is a view similar to Fig. 2 of a slightly modified form of the nozzle plate unit; and

Fig. 6 is an elevation of the central portion of another modification of the nozzle plates.

As shown in Fig. 1, the nozzle may be designed to screw into the end of a pipe 2 to which liquid 4 is supplied under pressure from a source not shown in the drawing. The nozzle in this case comprises a threaded nipple 5 having an end 6 which screws into the pipe 2 and an end 8 onto

which is screwed a cap 10 which holds the nozzle parts in place. A spray plate 12 and a swirl plate 14 are held in a cup 16 by a washer 18, the assembly being pressed between the lip 20 of cap 10 and a sealing washer 22 which abuts against the end 8 of the nipple 5.

The spray plate and swirl plate shown in Fig. 1 appear in detail in Figs. 2, 3 and 4. Each of these plates is in the form of a disk of sheet metal, for instance, of 0.015" brass. In the example shown each plate is bored part way through, for instance with a number 52 drill, to form the respective concavities 24 and 26. When the plates are placed together, as shown in Figs. 1 and 2, the concavity 26 forms a swirl chamber, as will presently be described. The spray plate 12 is bored through at the apex of the concavity 24 to form the spray hole 28. For a nozzle to atomize 2 or 3 quarts per hour the size of the spray hole should be from 0.004" to 0.012" in diameter. The edge of this spray hole should be of knife-edge sharpness for best results, since any substantial width of surface will cause the issuing mist to coalesce and drip. An exactly round spray hole gives a symmetrical spray free from irregularities. The small burr formed at the edge of the spray hole in the drilling may be polished off if desired. The boring of the swirl plate 14 with the number 52 drill should be stopped about the time it bulges out the metal at the point 30. Swirl passages 32 are then drilled into the concavity 26, for a nozzle of this capacity with a drill having a diameter of 0.004" to 0.006". The passages 32 should be directed, as indicated by dotted lines 34, so as to cause the jets issuing from them to strike the edge of the spray hole. I have found that this direction of the jets gives the most perfect atomization with a minimum pressure; if the direction of the jets is changed so that they strike further from the edge of the spray hole the pressure required for atomization is increased.

Another important factor is the angle of the jets with reference to the central axis of the spray hole. This angle is preferably 45° and should not be less than 35° nor more than 55°. If the angle is less than 35° the swirling of the liquid in the swirl chamber 26 is not sufficiently violent to atomize the liquid, while if the angle is more than 55° the through velocity is decreased. The 45° jets directed toward the edge of the spray orifice give the best results, probably because they combine high through velocity with vigorous swirling within the swirl chamber 26, causing good atomization. The swirl pas-

sages 32 are preferably directed tangentially to the spray hole, in order to produce a swirling motion of the liquid in the swirl chamber with a minimum of eddy currents.

5 For a nozzle to atomize 2 to 3 quarts per hour the distance between the spray hole and the plane of the swirl holes should be within the range of 0.008" to 0.040".

As previously stated, the direction of the jets 10 from the swirl passages 32 toward the edge of the spray hole is essential to the best atomization. Since it is not always possible in mass production methods to drill the passages 32 accurately, it is desirable to provide means for adjusting the 15 spacing between the plates 12 and 14. Any suitable means for this purpose may be employed. In Fig. 5 I have shown the simplest possible means of adjustment, in the form of a spacer ring 36 of requisite thickness between the spray 20 plate 12a and swirl plate 14a. This figure also illustrates the possibility of directing the swirl holes 32a at an angle different from 45° with reference to the axis of the spray hole, the angle in this case being 55°. In accordance with the 25 increased angle the swirl passages 32a are spaced further apart than in Fig. 2, so that the jets 34a will be directed substantially toward the edge of the spray hole 28.

30 It is advantageous to increase the number of swirl passages above two. Fig. 6 shows a pair of nozzle plates, the swirl plate having eight swirl passages 32b all directed tangentially to the spray hole 28 in the spray plate. The larger 35 number of swirl passages gives a more perfectly cone-shaped jet from the spray hole and also provides a continuance of the spray in case of stoppage of one or more swirl passages.

The usefulness of this nozzle for atomizing fuel

oil at a very slow rate has already been mentioned. The same characteristic is of importance when using the nozzle as an atomizer of agricultural sprays. In this work the primary object is to produce a spray which will completely 5 cover the surfaces to be sprayed with a minimum of waste. A nozzle capable of atomizing the spray liquid at a slow rate is least wasteful.

I claim:

1. In an atomizer, a nozzle having forward and 10 rearward walls enclosing a swirl chamber, the forward wall of said swirl chamber being traversed by a spray orifice defined by a knife edge, the rearward wall of said nozzle having swirl 15 passages communicating with said swirl chamber behind said forward wall, said swirl passages being oppositely inclined toward opposed sides of said spray orifice, and means for conducting a liquid under pressure into the rear of said swirl 20 passages.

2. In an atomizer, a pair of plates, means con- 25 fining said plates so as to form between them a swirl chamber, one of said plates being traversed by a spray orifice defined by a knife edge, the other of said plates having at least two swirl pas- 25 sages therethrough located symmetrically with respect to the axis of said spray orifice and oppositely inclined toward opposed sides of said spray orifice, and means for conducting a liquid under 30 pressure to said swirl passages.

3. In an atomizer, a spray plate traversed by a 30 spray orifice defined by a knife edge, and a swirl plate mounted closely parallel to said spray plate and having a concavity on its side facing said spray orifice, said swirl plate having swirl pas- 35 sages oppositely inclined toward opposed sides of said spray orifice, and means for conducting a liquid under pressure to said swirl passages.

WILLIAM FOWNES HAMILTON.