

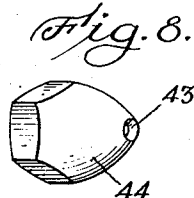
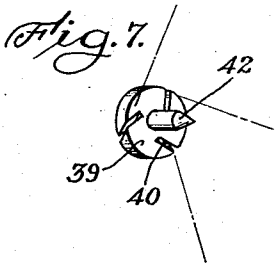
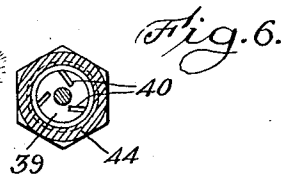
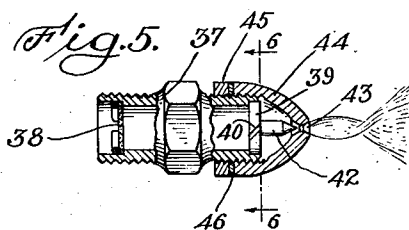
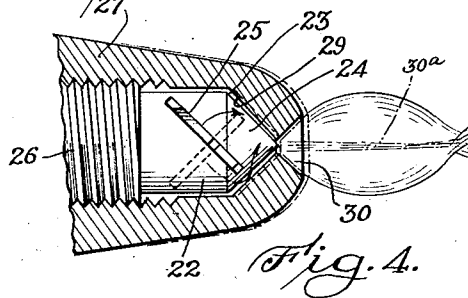
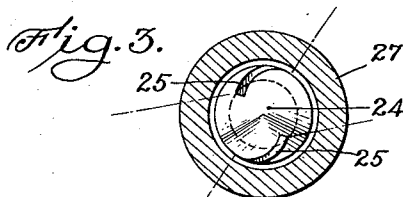
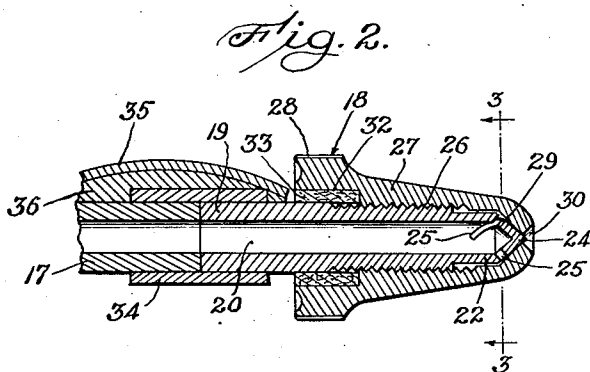
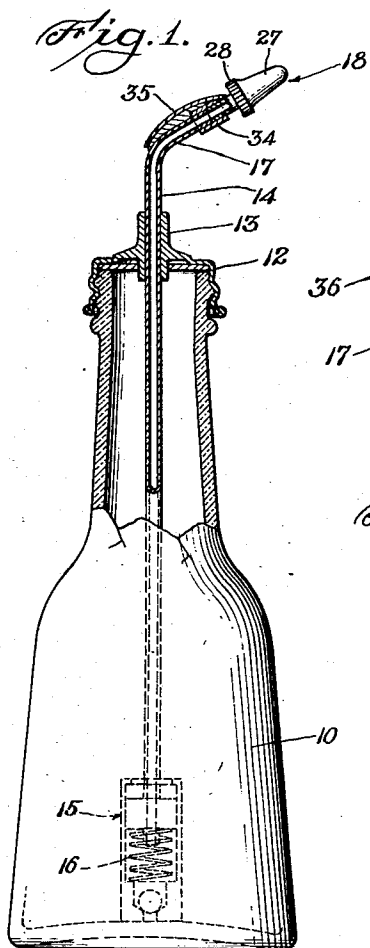
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2,176,356

FLUID SPRAYING APPARATUS

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UNITED STATES PATENT OFFICE

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FLUID SPRAYING APPARATUS

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9 Claims. (Cl. 299—97)

This invention relates to improvements in apparatus of the type which is operative by the force of fluid under pressure to emit a spray thereof.

5 The general object of the invention is to provide an atomizing device which is efficient in operation, and which is simple in construction so that it may be manufactured by quantity production methods and sold at low cost.

10 Another object is to provide an atomizer having manipulating means of structurally improved and simplified character.

15 Another object is to provide an atomizer equipped with a nozzle construction embodying a whirler head and spray cap assembly having an atomizing chamber therebetween enabling all gradations of spray from a very fine mist to a formed solid stream by varying the dimensions of the chamber.

20 Another object is to provide a fluid atomizing structure including an improved spray head embodying a plurality of angularly related saw-cut slots for imparting a whirling motion to the fluid forced from the structure.

25 Another object is to provide an improved atomizing nozzle construction having improved packing means between the spray cap and the spray head.

30 Another object is to provide an improved atomizer having a novel spray nozzle arranged to minimize accumulation of spraying material therein when not in use, and permitting the material to drain back into the fluid duct.

35 A further object of the invention is to provide an improved and simplified spraying nozzle and fluid duct combination.

40 Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is an elevational view partially in section of a preferred type of atomizer embodying the principles of the invention.

45 Fig. 2 is an enlarged sectional view of the atomizing nozzle and the immediately adjacent parts of the device.

Fig. 3 is a sectional view taken substantially along line 3—3 of Fig. 2.

50 Fig. 4 is an enlarged fragmental view partially in section of the spray cap and whirler tip of the spray nozzle.

Figs. 5 to 8, inclusive, show a modified form of spray nozzle.

55 While the invention is susceptible of various modifications and alternative constructions, I

have shown in the drawing and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

By way of illustration, the invention is shown as embodied in practical form in a manually operable spraying device of the type in which atomization is effected by passing the fluid forcibly through a spray nozzle. Fluid to be sprayed is carried in a container 10 having a closure cap 12 which is provided with an axially arranged bearing 13 for guiding a reciprocable tubular fluid delivery duct 14 that extends outwardly beyond one end of the cap. By moving the delivery duct inwardly, fluid is forced there-through by a piston mechanism 15 which is associated with the inner end thereof and which is biased by a spring 16 to maintain the duct in extended position and the piston in its initial position.

Upon its outer end the delivery duct has an angular portion 17 which carries a spray-creating nozzle assembly 18 of new and improved construction and arranged to create a formed whirling spray stream that may be projected effectually toward the object to be sprayed. This spray assembly comprises in one part a tubular head 19 preferably of annular section and having a chamber 20 which is open at its rear end and in communication with the outer angular end portion 17 of the fluid delivery duct. The forward end of the head is closed and is provided with a whirler tip 22 which is partially tapered from a peripheral ridge 23 to provide an axial point 24. Preferably the forward end of the chamber 20 is of tapered form complementary to the shape of the tip. Fluid passing from the delivery duct into the chamber 20 is emitted from the forward end of the head through whirler slots 25 which are disposed at an angle relative to the axis of the head and to one another in order to direct the fluid laterally of the head in the form of thin sheet-like streams extending in the planes of the respective slots. As may be best seen in Figs. 3 and 4, the slots open into the chamber 20 and extend toward the center diagonally to the axis of the head in angularly intersecting relation to the peripheral ridge 23 so that the streams of fluid will extend fan-shape laterally and forwardly as shown diagrammatically in broken outline. Preferably the slots

are formed on straight lines with parallel walls as by a simple saw-cutting operation.

Rearwardly of the slots 25, the head 19 is of slightly greater diameter and is provided with threads 26 adapted to receive a tapered atomizing cap 27 which is internally threaded and screwed onto the head. In order to facilitate manipulation of the cap it is provided with a milled base portion 28. Within the atomizing cap is a tapered atomizing chamber 29 arranged to receive the whirler tip 22.

Some fluids that may be used with an atomizer of the present type may have a tendency to jelly or solidify when standing in small quantity, and the chamber 29 is therefore preferably dimensioned complementary to the whirler tip so as to be substantially completely filled by the tip when the atomizing cap is screwed down tightly over the head in the non-operating or closed condition of the device, thus avoiding any accumulation of fluid when the device is not in use. In this closed condition, a sharply outwardly flaring axial discharge port 30 in the cap is adapted to receive the point 24 in fluid sealing relation. The elimination of space wherein fluid might accumulate in the nozzle is of particular value during shipment or storage of filled devices where they may be placed in a tilted position to cause the fluid to flow from the delivery duct into the nozzle. While the atomizing device is in use the improved construction is such that any small amount of fluid remaining in the nozzle after a spraying operation will immediately flow back into the delivery duct through the slots 25. The latter feature also assures that at the start of a spraying operation there will be no drip or spatter of accumulated material as experienced with prior constructions.

As the atomizing cap is moved from the closed condition forwardly relative to the head 19, the point 24 is removed from sealing relation to the port 30, and fluid which is directed laterally and forwardly from the slots 25 against the inner wall of the chamber 29 pursues a whirling path (Fig. 4) through the chamber toward the port, from which the fluid is emitted at a velocity depending upon the pressure of the fluid within the head and the area of the atomizing chamber 29 surrounding the whirler tip 22. Accordingly, when the area of the chamber is quite restricted and of less flow area than the combined flow area of the slots 25, the fluid will move through the atomizing chamber with great turbulence and pass through the port 30 at high velocity in the form of a very finely atomized spray or mist. The whirling motion imparted to the fluid by the slots 25 continues after the fluid leaves the port 30, thereby assuring that the spray will strike a target in the same finely divided condition as when it leaves the nozzle assembly.

By moving the atomizing cap to increase the flow area of the chamber 29 and thereby reducing the resistance to the flow of liquid therethrough, a spray of coarser character may be provided. In this manner any desired character of spray from a fine mist to a very coarse spray of relatively large particles may be provided selectively by adjusting the atomizing cap longitudinally on the head 19. When the flow area within the chamber 29 equals the flow area of the whirler slots 25 as when the cap is moved to the broken line position in Fig. 4, the fluid will no longer be broken up into a spray but will leave the port 29 as a thin, formed solid stream 30a which may be projected to a considerable distance, depending upon the pressure

which may be created on the liquid by the piston mechanism 15.

In order to prevent leakage of fluid from the nozzle assemblage between the head and atomizing cap, means is provided adjacent the rear end of the cap to provide a fluid tight seal, in the present instance comprising a rabbet groove 32 within which is tightly fitted packing 33 that sealingly engages the periphery of the head. As the atomizing cap 27 is moved rotatably and longitudinally of the head, the packing moves therewith to maintain a fluid sealing relationship in any relative position of the parts.

Improved means is provided for connecting the nozzle assembly to the fluid delivery duct 14. Accordingly, the forward end 17 of the duct and the rear end of the head 19 are arranged in coaxial abutting relationship, and a tubular metallic connecting band 34 is permanently secured about the joint to hold the parts in rigid alinement. This union is such, moreover, that the pressure for operating the device may be applied directly over the joint, a finger piece or disk 35 being secured over the band 34 by means of solder or the like 36. Thus, the device may be operated easily and efficiently to produce the character of spray desired upon the application of pressure upon the disk 35 by a finger of the hand in which the container 10 is held.

In the modified form of spray nozzle shown in Figs. 5 to 8, inclusive, a tubular head 37 is provided having a removable strainer 38 at its inlet end and being externally threaded at the latter end for connection with a fluid delivery duct. At its forward or outlet end, the head is provided with means for imparting a whirling motion to the fluid passing therethrough, in the present instance comprising a disk 39 fixedly secured in closing relation to the outlet end of the head and having a plurality, herein three, equally spaced straight slots 40. As may be seen in Fig. 5, the walls of the slots are parallel and extend diagonally to the axis of the head. The slots may be formed by saw-cutting the disk on straight lines inwardly from the periphery close to the center thereof and eccentrically relative to the radius of the disk. Through this arrangement, the fluid will be directed at high velocity in thin fan-shaped sheet-like streams angularly relative to the disk and to the axis of the head as indicated in broken outline in Fig. 7.

Extending axially from the disk 39 is a pointed metering tip 42 which projects toward a port 43 in a tapered atomizing cap 44 surrounding the forward end of the head. The atomizing cap 44 is in threaded engagement with the head and may be locked in any adjusted position by lock nut 45, a gasket 46 being interposed between the lock nut and the base of the cap to prevent fluid leakage. This modified form of nozzle may be used effectively with a device of the type shown in Fig. 1, or it may be employed in other types of spraying equipment such as for delivering atomized oil spray in an oil burner construction.

From the foregoing it will be evident that the invention simplifies the construction and the assembly operations in fluid spraying apparatus of the character described, and that the apparatus is simple, efficient and convenient in operation. The improved spray nozzle construction enables the device to be conditioned against the discharge of liquid when the spraying apparatus is not in use and permits the creation of a wide range of spray from fine mist to one of coarse character. When relatively inaccessible locations must be

reached by the fluid, the nozzle may be easily adjusted to create a fine solid whirling stream which may be easily projected to the desired point. When not in operation accumulation of fluid and gumming are avoided, and dripping or spattering at the beginning of a spraying operation are eliminated.

I claim as my invention:

1. In combination in a spraying apparatus including an elongated tubular fluid duct providing a passage of fixed flow area and means for forcing fluid through the duct, a tubular spray head of annular section forming a fixed part in communication with one end of said duct and having a front enclosing portion, said portion having a plurality of narrow slots disposed in angularly related flat planes diagonally intersecting the axis of the head and extending inwardly from its periphery toward the center thereof for deflecting liquid forced therethrough from said duct laterally in the form of flat sheet-like streams in the planes of the slots, an atomizing cap formed in one integral piece and having a chamber open at its rear end to receive said head, a wall at the front of said chamber converging toward the axis thereof to receive the sheets of fluid from said head to impart a whirling motion to the fluid and having a small axial port flaring outwardly at an acute angle to said axis, screw threads on said head rearwardly of said slots and interengaging threads on the inner wall of said chamber enabling movement of said cap for effecting longitudinal adjustment thereof relative to said head, and a tip on said head arranged to seal said port against fluid discharge when said cap is in its rearmost position on the head, said head and said tip being dimensioned to restrict the passage of fluid from said slots to said port to cause a finely divided whirling spray mist to be emitted therefrom when the cap is moved to carry the tip only slightly from sealing position relative to the port and to permit unrestricted passage of fluid so as to cause a whirling solid column of fluid to be emitted from the port when the cap is further removed from the port-sealing position.

2. In combination in a spraying apparatus including an elongated tubular fluid duct providing a passage of fixed flow area and means for forcing fluid through the duct, a spray head forming a fixed part of one end of said duct and having a plurality of narrow slots disposed in angularly related flat planes diagonally intersecting the axis of the head and extending inwardly from its periphery toward the center thereof for deflecting liquid forced therethrough from said duct laterally in the form of flat sheet-like streams in the planes of the slots, an atomizing cap formed in one integral piece and having a chamber open at its rear end to receive said head, the forward part of said chamber being dimensioned complementary to the forward end of said head so as to be substantially completely filled in one relative position of the parts and having an axial discharge port therein, and a tip on said head arranged to coact in fluid sealing relation with said port in said one relative position.

3. A spraying apparatus comprising, in combination, a spray nozzle construction including an elongated tubular head having a tapered closure at one end providing a peripheral ridge on the head, an atomizing cap providing a chamber surrounding said head, and a plurality of straight angularly related slots in said head in intersecting relation to said peripheral ridge and

arranged to project fluid passing through said head angularly against the wall of said chamber.

4. In combination in a spray device of the character described including a fluid container having a piston operated fluid projecting plunger device therein and a reciprocable fluid duct communicating with said plunger device to conduct fluid exteriorly of the container, a spray nozzle including an elongated element having a fluid passage therethrough and adjoining the outer end of said duct, means encircling the adjoining ends of said duct and said element to secure the same permanently together, and a disk secured over said means and providing a finger rest for manipulation of said duct to reciprocate said duct for operating said plunger.

5. In combination in a spraying device of the character described, means providing a passage for fluid under pressure and having a discharge end, a multi-apertured head portion closing said end and arranged to divide the flow from said passage into a plurality of small streams of increased velocity directed in different directions angularly of the flow axis of said passage, a cap secured to project forwardly of said head portion and including a forwardly tapered chamber to receive said streams for imparting a whirling motion thereto, said cap having an axial spray port of restricted diameter at its front end and communicating with said chamber, and a fixed forwardly tapered axial part on said head portion projecting substantially beyond the points of emission of said streams, said tapered chamber being dimensioned in its rear part relative to said tapered axial part to afford a clearance for the passage of said whirling streams entirely around said tapered axial part from the point of emission of said streams toward said port and said tapered part being coactive with said port to control the passage of said whirling streams therethrough, and said cap and said tapered part being relatively movable axially to adjust the position of said part relative to the port.

6. In spraying means of the character described, in combination, a tubular fluid receiving head closed at its forward end and having a tapered axial tip projecting therefrom, a plurality of narrow slots forming passages from the interior of said head near the base of said tip, said slots having straight parallel walls and being sharply inclined relative to the axis of said head to produce flattened angularly related streams of the fluid which is delivered into said head under pressure, and an atomizing cap threaded upon said head to be axially adjustable and having a forwardly tapered chamber to receive said streams for imparting thereto a whirling motion and for directing the same around said tip toward the forward end of said chamber, said cap having an atomizing port communicating in fluid discharge relation with the forward end of said chamber and being arranged to receive said tip in fluid sealing relation in one adjusted position.

7. In combination in spraying means of the character described, a hollow whirler head having a forwardly tapered closed chamber to be placed in communication with fluid under pressure, a plurality of elongated slots formed angularly across the axis of said head and communicating with said chamber to project flattened streams of fluid laterally of the head, and an atomizing cap having a chamber dimensioned substantially complementary to said head and

with sufficient clearance to receive said streams to impart a whirling motion thereto.

8. In combination in a spraying device of the character described, means providing a passage
5 for fluid under pressure, a hollow spraying head closing the discharge end of said passage, said head including a rear part and a tapered forward part, an axially ported spray cap having a chamber for receiving said head and being
10 mounted for axial adjustment relative to said head, said chamber including a rear wall section and a forward wall section tapered toward the axial spray port, said rear wall section being dimensioned to have slight fluid clearance from
15 said rear part of the head and said forward wall section having a slightly shallower taper than said tapered part of the head so that in one adjusted position of the cap the forward end of said tapered part will seal the axial spray port of
20 the cap, and restricted discharge openings communicating through said rear part of said head with said passage and being directed to project fluid streams generally laterally and forward-

ly against the surrounding wall of the spray cap chamber to whirl around said rear and forward parts of said head toward said spray port.

9. A spraying apparatus comprising, in combination, a nozzle including a tubular head originally constructed with an open discharge end,
5 an axially adjustable chambered atomizing cap surrounding the discharge end of the head and having an axial discharge port, a disk secured in closing relation to said discharge end and having a plurality of slots extending from the periphery thereof close to the center and disposed
10 in planes eccentric to the radius of the disk for directing fluid passing therethrough under pressure from said head into said cap with a whirling
15 action around the chamber wall of the cap toward said discharge port, and an elongated pointed metering pin projecting axially from said disk into cooperative relation with said discharge port for controlling the character of spray
20 from said discharge port as determined by the axial adjustment of said cap.

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