United States Patent

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[72] Inventor **William H. Johnson**
Raleigh, N.C.

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[73] Assignee **Patent and Development of North Carolina, Inc.**
Raleigh, N.C.

[54] **FLUID DISPERSION NOZZLE**
7 Claims, 17 Drawing Figs.

[52] **U.S. Cl.** **239/568,** 239/597, 239/601
[51] **Int. Cl.** **B05b 1/14**
[50] **Field of Search** 239/601, 568, 597, 567

[56] **References Cited**

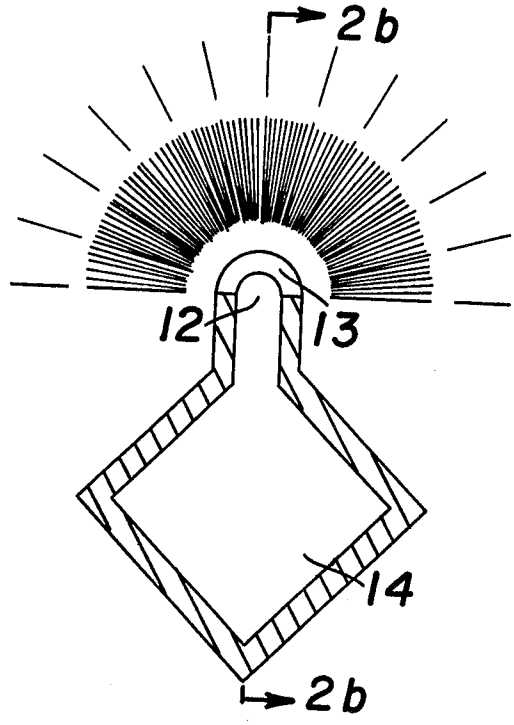
UNITED STATES PATENTS

1,005,431	10/1911	Huber	239/568 X
2,718,712	9/1955	Bruker et al.	239/568 X
2,780,492	2/1957	Stine	239/568 X
2,976,794	3/1961	Allander et al.	239/568 X
3,262,460	7/1966	Huddle et al.	239/601 X
3,401,888	9/1968	Sutter	239/568
3,447,756	6/1969	Lawrence, Jr.	239/568 X

Primary Examiner – Lloyd L. King
Attorneys—Munson H. Lane and Munson H. Lane, Jr.

ABSTRACT: A single element fluid dispersion nozzle for achieving unusually fine atomization of liquids and a wide angle flat-fan dispersion of both liquids and gases uniformly and over a wide range of capacity and pressure. These features, heretofore unavailable commercially in a single element, have been achieved in practice by a unique design that: (1) minimizes the diameter of the orifice aperture down to about 0.001 inch, (2) maximizes the dispersion angle up to at least 180°, (3) assures a uniformly curved corona orifice cavity at its outer extremity, (4) allows extensible lengths with multiple apertures therein and, (5) provides equipressure among apertures.

The long tubelike structure has a main feed cavity with at least one fluidly connected corona orifice cavity extending outwardly therefrom. The inner edge of a section thru the corona orifice cavity would be an arc, approximating a circle, having a diameter as minute as 0.001 inch. The simplicity of this structure and the unique and easily varied relationship of the cavities, in combination with the technique of intersection to produce minimum orifice areas and maximum dispersion angles results in outstanding improvements in performance, manufacturing and economy.



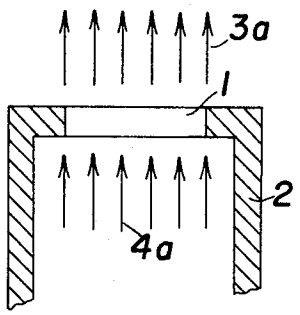


FIG. 1.a

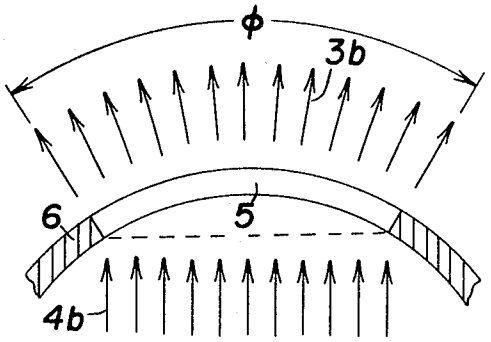


FIG. 1.b

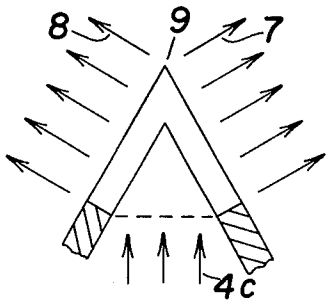


FIG. 1.C

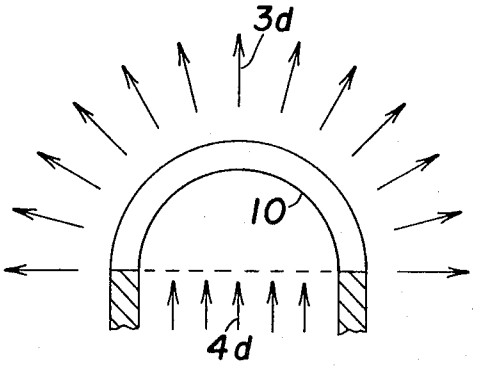


FIG. 1.d

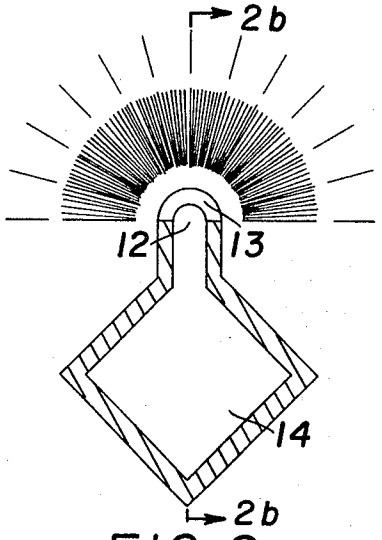


FIG. 2.a

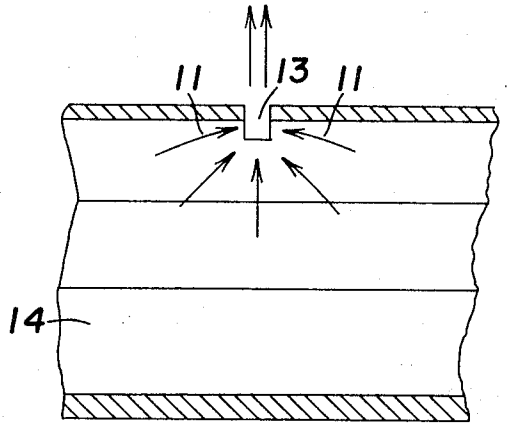


FIG. 2.b

INVENTOR
WILLIAM H. JOHNSON
BY Munson H. Lane
ATTORNEY

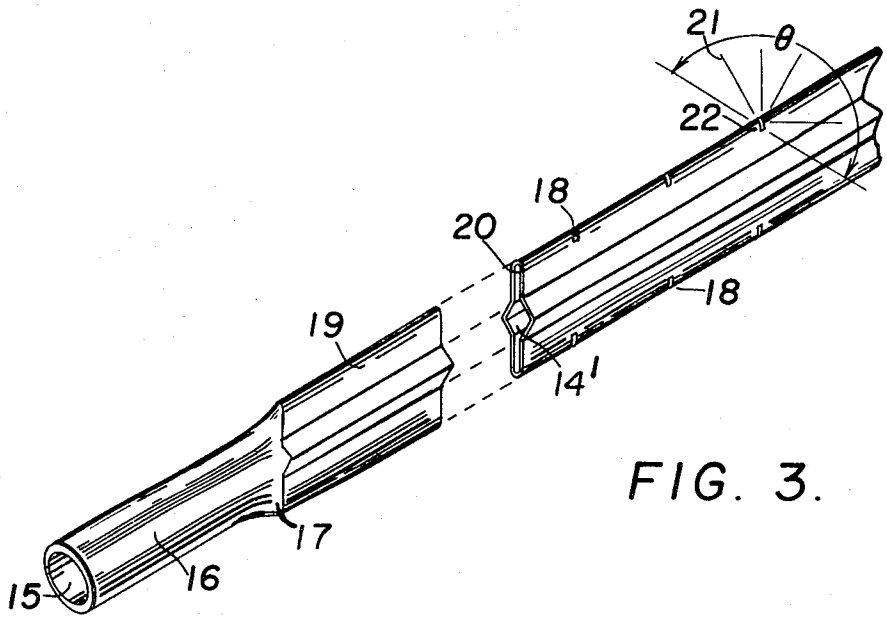


FIG. 3.

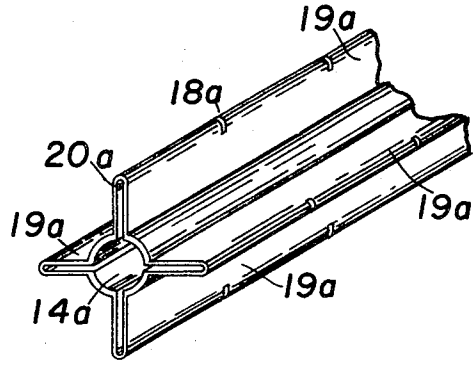


FIG. 4.a

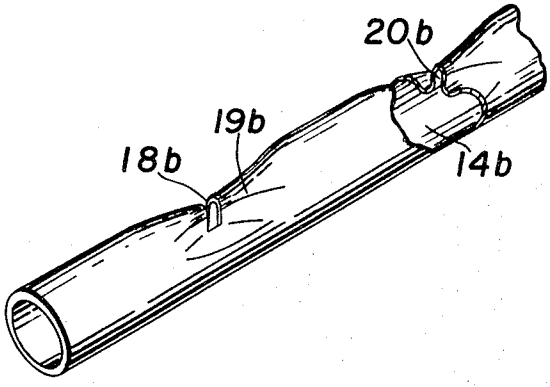


FIG. 4.b

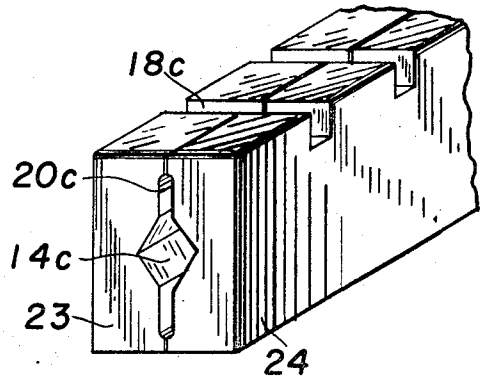


FIG. 4.c

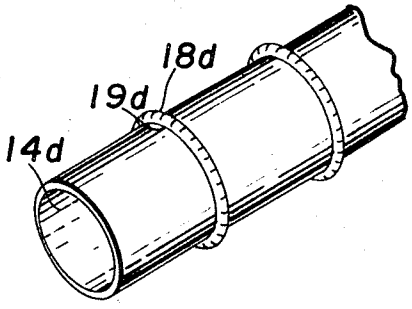


FIG. 4.d

INVENTOR
WILLIAM H. JOHNSON

BY Manson H Lane
ATTORNEY

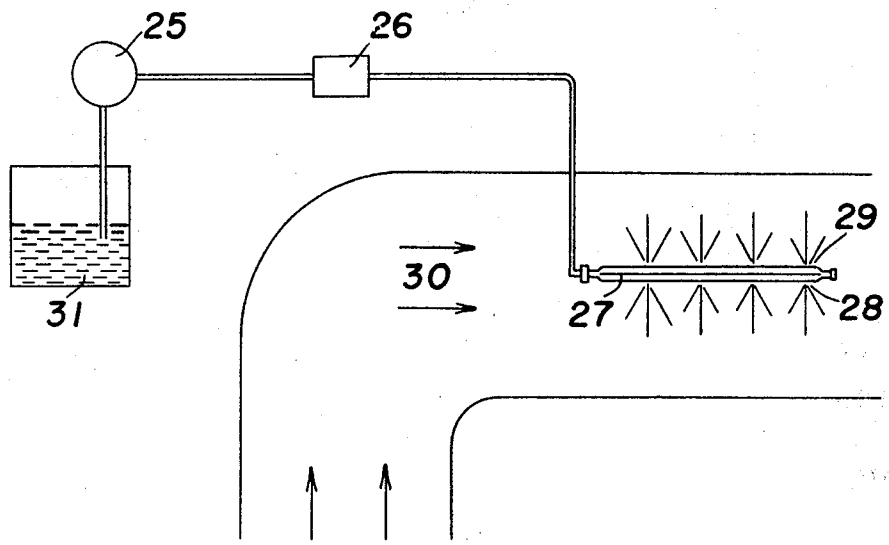


FIG. 5

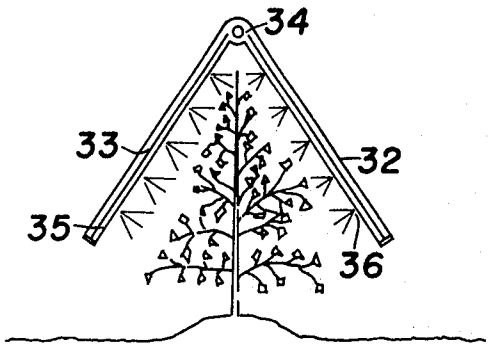


FIG. 6

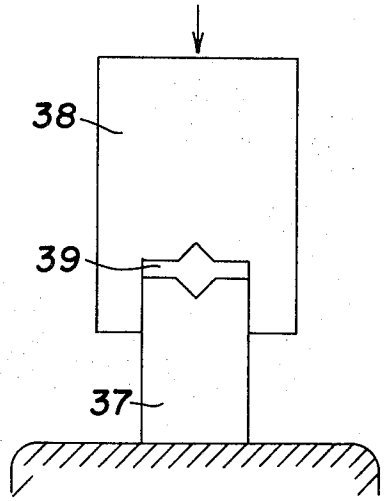


FIG. 7.a

INITIALLY - 

FIG. 7.b

FIRST PRESS - 

FIG. 7.c

SECOND PRESS - 

FIG. 7.d

INVENTOR
WILLIAM H. JOHNSON
BY Munson H. Lane
ATTORNEY

FLUID DISPERSION NOZZLE

This invention relates to a nozzle and method of making the same to achieve, simply and at low cost, a wide range of degree of atomization, including extremely fine atomization of liquids and wide angle, flat-fan uniform dispersion of both liquids and gases. Further, the invention achieves these two features, fine atomization and wide angle flat-fan dispersion, uniformly for a wide range of volumetric capacity in a single element. These features and advantages, heretofore unachieved commercially in a single element, along with the simplicity and low cost of manufacture make this invention particularly useful for general application where a flat-fan dispersion of highly atomized liquids is required, such as farm spraying of herbicides, insecticides, etc., humidification, spray washing and cleaning, and numerous industrial processes. The invention is equally useful in gaseous dispersion applications where it is desirable to achieve uniform dispersion and mixing of one gas in a second gaseous medium. Examples are numerous including liquid propane and natural gas burners, steam injectors, and gas mixing units of various types.

A noteworthy application, in the case of liquid dispersion, is the ordering (moisture conditioning) of flue-cured tobacco immediately following the curing process. The moisture content of the leaves, following the curing in a barn, must be raised so that they can be removed from the barn and handled without shattering. To do this 20 to 50 gallons of water must be absorbed by the leaves in a conventional barn having a volume of about 4000 cu. ft. and containing about 1200 pounds of cured tobacco leaves. This ordering of tobacco has been achieved in practice, with a nozzle as described herein and costing around $1.00, in less than 3 hours. Fifty nozzles of conventional types, costing about $60.00 will require perhaps as much or more than 6 hours to do the same job.

A fluid dispersion nozzle may have as many as three main functions: (1) to meter, (2) to atomize or to break into droplets (applies only to liquids, not gases) and, (3) to disperse uniformly into a specific pattern. The new invention relates to accomplishing function No. 2 and No. 3 better, more simply and at a lower cost than has been done heretofore for a very wide range of volume rate of flow.

A nozzle for flat-fan dispersion must have two features to accomplish function (2) and (3) well for a given pressure. First the nozzle should have an inner curved surface that forms a near perfect circular arc of about 150° to about 190° and that has a diameter as small as 0.001 inch. Secondly, the orifice should be a very narrow slot cut into that inner surface of the nozzle and varied in depth to produce the desired arc. These two features will produce an unusually small orifice area and flat-fan dispersion uniformly up to at least 180°. By minimizing the orifice area while at the same time maximizing the dispersion angle, both atomization and dispersion can be optimally achieved. While manufacturers have exploited all of these principles, practical limitations have existed heretofore in achieving an extremely small orifice and large dispersion angle (up to at least 180°).

Existing production methods generally require several precise machine operations to produce the desired orifice size and configuration. The orifice inner cavity is machined or drilled in the nozzle or nozzle tip; this is then intersected by surface machining of a slit to produce the orifice. Four difficulties or objections are apparent: drilling down to a diameter as small as 0.001 inch, achieving a dome shape to the inner extremity of the drilled hole, intersecting with a surface slit the end of the extremely small drilled orifice inner cavity, and producing only one nozzle at a time with the aforementioned operations. Orifices with the design of the invention described herein have now been produced having an effective diameter of 0.001 inch along with a dispersion angle of 180°, whereas manufacturers now list commercial flat-fan spray nozzles down to a minimum diameter of 0.10—0.012 inch and having maximum dispersion angles of 75° and 80°.

The first object therefore of the new nozzle device is to provide a structure of such design that the orifice size expressed by the area of the inner surface of the orifice may be minimized while providing the possibility for maximizing the dispersion angle, consistent with a single element design. The orifice size may also be expressed, as is frequently done in commercial practice, as a single dimension by using the diameter of a circular orifice having an equivalent discharge rate.

A second objective is to provide a nozzle of simple design such that the problem of intersecting the orifice inner cavity to effect a precision aperture is simplified. Not only once but, unlike conventional nozzles, a number of parallel intersections can be made simultaneously into the inner cavity to produce the desired number of orifices.

A third objective of the new nozzle is to provide a structure capable of delivering full pressure to multiple orifices integral therein wherein the output from one orifice does not appreciably affect the pressure and operating characteristics of other orifices, thereby achieving a wide range of output capacity.

A fourth objective of this invention is to provide a structure of such design that maximum uniformity of dispersion of a fluid in the region surrounding the nozzle can be achieved. This is important in applications where it is desired to minimize the volume of any one nozzle, such as in certain combustion chambers or humidification chambers.

A fifth objective is to provide a nozzle of simple design such that the orifice inner cavity, and a large cavity to feed it without a pressure drop among orifices, can be brought to the desired size and shape by means of a metal-shaping process rather than by conventional expensive and precision machining processes. The design of this invention simplifies greatly the construction of a nozzle by permitting a rapid technique for shaping the orifice inner cavity and main feed cavity in seconds and eliminating costly machining of the orifice inner cavity.

A sixth objective is to provide a structure that is suitable for flat-fan dispersion of either liquids or gases. A number of conventional designs for gaseous dispersion are not applicable for liquid dispersion, and vice versa, because of the lack of proper design to achieve controlled dispersion at desired flow rates into the surrounding space.

These and other objects and advantages of the invention will become apparent in the following description of the nozzle, its mode of operation, and method of manufacture.

In the drawings:

FIG 1*a* through 1*a* serve to illustrate how a wide dispersion angle is achievable in a single nozzle design.

FIG. 1*a* is a longitudinal sectional view largely diagrammatic in character showing a single nozzle orifice having a flat face with a slot cut in the flat face thereof and illustrates that no dispersion will take place if a slot is cut into the face of a flat plate such as the end of a tube.

FIG. 1*b* is a diagrammatic section of a curved nozzle end portion having a slot formed therein and illustrates how dispersion is achieved by having the slot intersect a curved surface having no discontinuities.

FIG. 1*c* is a diagrammatic sectional view of a nozzle end portion formed in two angularly disposed planes with a slot intersecting the two planes and illustrates how a uniform dispersion pattern cannot be achieved by having the slot intersect two intersecting planes, and the limitation of the dispersion angle. In this instance a dispersion angle of 180° cannot be achieved.

FIG. 1*d* is a diagrammatic sectional view of a suitably curved nozzle end portion having a slot therein and illustrates how to maximize the dispersion angle, that is achieve at least 180°.

FIG. 2*a* is a longitudinal nozzle section largely diagrammatic in character and illustrates how the orifice size can be minimized while maintaining a wide dispersion angle.

FIG. 2*b* is a vertical cross-sectional view taken along the line 2*b*–2*b* of FIG. 2*a* and illustrates the convergence of fluid from the sides, which is necessary to achieve uniform dispersion.

FIG. 3 is a diagrammatic view partially in longitudinal section of a multiple orifice nozzle and illustrates how to achieve a multiple of orifices to produce high volumetric capacity in a single element without an appreciable line pressure drop due to any one orifice.

FIGS. 4*a*, 4*b*, 4*c* and 4*d* are perspective views of four different forms of nozzles having multiple orifices therein and illustrate various designs for the spray nozzle section.

FIG. 5 is a diagrammatic view of a humidifier system and illustrates the application of the spray nozzle to a humidification process.

FIG. 6 is a diagrammatic sectional view which illustrates the use of the spray nozzle in applying pesticides to row crops such as cotton.

FIG. 7*a* is a schematic view of a press assembly for shaping the spray nozzle from a circular metallic tube.

FIGS. 7*b*, 7*c* and 7*d* are diagrammatic views illustrating the initial shape of the tubing and shapes after the first and second pressing operations, respectively, have been performed.

The full nature of this invention will be more clearly understood by the following description: If a slot **1** as illustrated in FIG. 1*a* is cut in a flat plane as for example in the end plate of a conduit **2**, no angular dispersion takes place, since the flow of liquid 3*a* leaving the conduit by way of the slot **1** is parallel to the flow of liquid 4*a* moving into the slot **1**. Actually the liquid 3*a* may contract slightly. If on the other hand, as is illustrated in FIG. 1*b*, a slot **5** is cut in a curved surface **6**, the emerging liquid 3*b* undergoes angular dispersion. The dispersion angle Φ is determined by lines essentially normal to the curved surface. The direction of the liquid 4*b* moving into the slot is the same as 4*a* in FIG. 1*a*.

Uniform angular dispersion cannot be achieved by anything other than a slot in a section that has an inner surface that is curved uniformly. The outer surface of the curved section is of lesser importance. A contrast is illustrated in FIG. 1*c* by a cavity formed by two intersecting planes. For large flow rates the fluid exits from a slot intersecting the cavity in essentially two flat sheets **7** and **8**, each sheet being essentially the same as 3*a* illustrated in FIG. 1*a*. The fluid moving into this cavity is identified as 4*c*. The area at the vertex **9** or intersection of the two planes is not covered by the fluid. For low rates however, where the surface tension may be large in comparison with momentum changes, the film will be more or less connected at the vertex **9** but the dispersion will not be uniform. For gases, where surface tension is obviously not present, the result is no dispersion whatsoever for an orifice formed by a slot intersecting a cavity as shown in FIG. 1*c*.

In order to maximize the dispersion angle, it is thus necessary to intersect an inner cavity of such shape and curvature that Φ is at least 180°. This is illustrated in FIG. 1*d* in which the emerging liquid 3*d* is dispersed through 180°. The entering fluid is identified as 4*d*. In order to produce a uniform flow throughout the angle of dispersion, the inner cavity surface **10** particularly must be of a uniform and constant curvature (circular). Also the fluid must converge from the sides, that is 90° from the view shown in FIG. 1*d*. The fluid converging from the sides of the orifice produces a pressure at the orifice center, which is quite necessary for uniform dispersion. The converging liquid is illustrated by **11** in FIG. 2*b*.

There are two requirements for improved atomization of liquids: (1) minimize the orifice size and (2) maintain a wide dispersion angle. FIG. 2*a* illustrates the concept of intersecting a curved inner cavity in which the diameter **12** is made arbitrarily small, as minute as 0.001 inch. Intersection to the point at which the curvature becomes zero provides a dispersion of 180°. FIG. 2*b* shows the manner by which fluid **11** under pressure converges at the exit orifice **13**. The cavity **14** provides an abundant supply of liquid at the desired pressure without loss due to friction. It also makes possible a multiple of orifices feeding off of one cavity **14** as illustrated in FIG. 3.

Fine atomization having a uniformly wide flat-fan dispersion angle, is achieved by four basic principles: First a uniform approximately circular inner surface nozzle cavity **10** in FIG. 1*d*, second a small diameter of cavity **12** in FIG. 2*a* (as minute as 0.001 inch), third the intersection of this cavity by a slot to form a near perfect semicircle **13** in FIG. 2*a* and, fourth a central feed cavity **14** in FIG. 2*a*. These are all incorporated in the nozzle illustrated in FIG. 3. The nozzle was originally a straight length of circular tubing and has been brought to the desired shape by pressure operations which form a central feed cavity and at least one corona discharge wing. Each wing contains within its surface a corona orifice cavity, fluidly connected to said feed cavity. The wing and its cavity are referred to as corona in that they are crownlike and protrude outwardly. The fluid enters the nozzle **15** and travels through the tube section **16** into the main nozzle section beginning at **17**. The design of the main nozzle section is such that fluid moves in a continuous path through the main feed cavity **14** which supplies fluid to one or more orifices **18** located along the corona discharge wings **19** of the nozzle device. Fluid moves unrestrictedly along the main feed cavity **14** until finally terminating at a closed end. From the main feed cavity, the fluid moves within the corona discharge wing **19** at any point by nature of its corona orifice cavity **20**. This cavity supplies fluid directly or orifices **18** formed by intersection of a surface slit with the corona orifice cavity as previously described. The shape of the corona orifice cavity at its outer extremity as revealed by a cutting plane at right angles to the longitudinal axis of the structure at any point, would be preferably an approximate arc of a circle of about 150° to about 190°. Convergence of fluid flow at the orifices establishes a flat-fan dispersion pattern **21** as shown at orifice **22**. The angle of dispersion Φ is determined by the degree of intersection of the curved portion of the inner cavity **20** by the surface slit. For liquids, the dispersion angle several inches outside the orifice and in the plane of the atomized fluid is also influenced by the discharge pressure, with larger angles achieved for higher pressures. The surface slit **18** may be of various shapes such as V, U, or rectangular. As shown for example in FIG. 3 a plurality of widely spaced slits **18** are provided, the slits being spaced apart a sufficient distance so that the orifice cavity is unslitted on either side of any orifice for a distance greater than the diameter of the orifice cavity, which is an important feature from the standpoint of ensuring the uniform flow previously referred to in the description of FIGS. 1*d* and 2*b*, particularly the latter.

FIG. 4*a*, 4*b*, 4*c* and 4*d* illustrates four designs which differ somewhat, yet embody the essential principles described heretofore. FIG. 4*a* shows the pressed nozzle having the essential design elements of a main feed cavity **14***a*, corona orifice cavity **20***a*, and surface slits **18***a* but along four corona discharge wings **19***a*. These elements have been previously described. Four wings will provide essentially complete dispersion of fluid in the region surrounding the nozzle provided a large dispersion angle is used. Each corona cavity is not restricted in the distance it extends outwardly. FIG. 4*b* shows also a pressed nozzle but having an interrupted or relatively short corona orifice cavity **19***b*. Note the features of main feed cavity **14***b*, orifice inner cavity **20***b* and surface slits **18***b* along the circular corona. In this case any number and location of corona orifice cavities may be formed on the circular tube by simple pinching operations. Actually the number of corona cavities and the direction and amount each is extended from the main feed cavity depends upon the specific application. FIG. 4*c* shows the achievement of the essential principles but with two elements **23** and **24** which are fabricated independently and welded or glued together as shown to achieve the basic design of main feeding cavity **14***c*, corona orifice inner cavity **20***c*, and surface slit **18***c* which intersects the inner cavity. It is to be understood that the aforementioned designs are illustrative and not restrictive. The dimensions and configuration of the relationship of the main feed cavity and corona orifice cavities are flexible. For example the corona

orifice structure may spiral about the main feed cavity without changing performance characteristics. Or, as illustrated in FIG. 4*d*, the corona cavity **19***d*, with surface slits **18***d* cut therein, may be a complete circle around the feed cavity **14***d*, formed by the common practice of upsetting tubing. In all of these examples there is no necessity for symmetry.

As an example of the application of the spray nozzle, consider the humidification system shown in FIG. **5**. A pump **25** of any conventional design is used to transfer a fluid (water) **31** under pressure to the single element nozzle **27**. A line strainer **26** is used to remove any solid particles larger than the nozzle orifices. A spray nozzle **27** of the general design of FIG. 3 having multiple orifices on two corona discharge wings **28** and **29** is installed centrally in an air stream **30**. The orifices are sized to provide wide angle dispersion with small exit areas in order to achieve fine atomization of the water spray. The water spray is injected as a fine mist at right angles to the airstream and effective entrainment and further dispersion of the water particles are obtained.

In operation, water is pumped to the nozzle **27**. Water enters the main feed cavity which is of sufficient size to supply ample water to the orifices with minimum pressure drop. From the feed cavity, the water converges to each orifice to produce wide angle dispersion and effective atomization for humidification. The capacity of the nozzle is determined by the number and size of orifices and the operating pressure.

Another example of the use of the type of nozzle described herein is with respect to the application of liquid pesticides on crops planted in rows. This is illustrated in FIG. **6**. Two spray nozzles **32** and **33** of the general design illustrated in FIG. **3** are attached to form a triangle whose apex **34** is centered over the row of plants. The two tubings have their center lines generally paralleling the outer surface of the plants. In this case only one corona discharge wing **35** having a multiple of openings **36** is sufficient.

The fluid dispersion nozzle described herein offers certain simplifications to construction. This is attributable to the shape of the corona orifice cavity **20** and main feed cavity **14** in FIG. **3** which may easily be produced by a metal-shaping process rather than a machining process. Various material shaping processes such as casting, extruding, forming, pressing and use of force fields may be used singly or in combination to effect the desirable nozzle characteristics, as described previously. Hot or cold working processes may be used as dictated by the type and size of material and final characteristics desired.

The design of FIG. 3 has been achieved using a cold working, pressure technique. FIG. 7*a* shows a schematic view of a press assembly used to shape the nozzle section from circular tubing shown in FIG. 7*b*. The portion of the tubing to be pressed is inserted between the dies **37** and **38**. Shim stops are also inserted on each side of the tubing at **39** to limit the die movement so as to achieve a specified corona cavity clearance. A two-press procedure has been found in this particular setup to be most effective: (1) first press to produce an oval shape as shown in FIG. 7*c* by using the dies shown in FIG. 7*a* then, (2) rotate the work 90° and press to form the desired clearance in the corona orifice cavity as shown in FIG. 7*d*. This design could also be produced by moving the material through a series of rollers or pressure forming devices.

After the general shape of the nozzle has been formed, the device is placed in a jig which holds the nozzle device in position for milling of the surface slits which intersect the corona orifice cavity.

For producing extremely small orifices, there definitely is an advantage in performing the following four steps in sequence: (1) pressing to form an intermediate-size corona cavity, (2) milling of slits, (3) deburring the inner surface using pumped chemical abrasive, (or any other deburring procedure), and (4) pressing to the final desired clearance in the corona cavity. The deburring process is much more successful by this procedure because of the larger clearance.

A means for connecting the nozzle to a fluid supply line is easily accomplished by threading or tapping the circular end portion of the device, by using a ferrule or a flared-end connection, or by clamping.

I have described and illustrated the basic principles necessary to maximize atomization and achieve uniformly wide flat-fan dispersion of liquids; and how these principles have been uniquely utilized in a design that is simple and is readily adapted to a wide range of volumetric capacities, coverage areas and spray patterns. It should be apparent however that modifications may be made from the designs shown herein without departing from the scope of the invention. For example the tubelike structure can have its main axis curved, rather than straight as shown in FIG. **3**, in fact it can form a complete circle with a corona discharge wing on any one or all of its sides. Several concentric circles could be used to maximize the saturation of a fluid economically within an airstream moving in a circular duct such as **30** in FIG. **5**. Alternate concentric circular fluid dispersion nozzles could be used to supply a separate combustion fluid such as liquid oxygen to achieve a more uniform dispersion and mixing with the primary combustion fluid in a rocket engine as used in today's air and space crafts.

Another example would be to shape the tubelike member of the spray nozzle so that it becomes one of the structural members supporting a suspended room ceiling, of say acoustical tile, at the same time providing fire protection for the room. Consider the nozzle as having four corona discharge wings, two in the vertical plane and two in the horizontal plane. The corona discharge wing extending downwardly form the center lower side would protrude slightly below and between adjacent tile and have a multitude of slots for providing a fine mist in case of fire. This corona discharge wing can be moulded to very narrow widths (depending upon the material thickness and inner cavity clearance). Two wings extending outwardly horizontally would not have orifice slots but would fit tightly into grooves cut in the tile. The vertical wing extending upwardly could be used to mechanically support the ceiling as well as provide fire protection in the space above the ceiling. In this latter case the wing would also have orifice slots.

Alternatively, the center feed cavity could be directly above the upper surface of the tile, in which case the tile may be supported by wings or clips appropriately attached to opposite sides of the lower corona discharge wing. Various designs to provide structural support, easy alignment of tile, pleasing appearance along with fire protection both above and below the ceiling is possible without detracting from the principles of this invention.

I claim:

1. A fluid dispersion nozzle comprising a relatively large elongated fluid feed conduit and a smaller elongated discharge orifice portion communicating with the interior of said conduit including an elongated wall portion having a uniform semicylindrical internal curvature substantially semicircular in cross section forming a corona orifice cavity slitted transversely to provide an orifice for fan-shaped fluid dispersion, said orifice cavity being unslitted on either side of said orifice for a distance greater than its diameter.

2. A single element fluid dispersion nozzle for achieving a wide range of degree of atomization including unusually fine atomization of liquids, uniform dispersion of both liquids and gases over a wide range of capacity and pressure, and a wide flat-fan dispersion angle; comprising a single tubelike structure in that its internal walls are generated by a line, moving about a fixed lengthwise central line on varying radii, whose longitudinal dimension is long in relation to the other dimensions, and in manufacture is extensible; said tubelike structure having a main feed cavity, longitudinally disposed, of large cross-sectional area in comparison with the total free cross-sectional area of the said tubelike member such that the major portion of fluid flows unrestrictedly through the said main feed cavity, the main feed cavity having at least one fluidly

connected corona discharge wing extending outwardly and forming a corona orifice cavity in section, the inner edge of the said corona orifice cavity being an arc approximating a semicircle having a small diameter to minimize area of the aperture and maximize atomization, said orifice cavity being slitted transversely to form an orifice, said orifice cavity being unslitted on either side of said orifice for a distance greater than the diameter of said semicircle.

3. A single element fluid dispersion nozzle for achieving a wide range of degree of atomization including unusually fine atomization of liquids, uniform dispersion of both liquids and gases over a wide range of capacity and pressure and a wide flat-fan dispersion angle; comprising a single tubelike structure in that its internal walls are generated by a line, moving about a fixed lengthwise central line on varying radii, whose longitudinal dimension is long in relation to the other dimensions, and in manufacture is extensible; said tubelike structure having a main feed cavity, of large cross-sectional area in comparison with the total free cross-sectional area of the said tubelike member such that the major portion of fluid flows unrestrictedly through the said main feed cavity, the main feed cavity having at least one fluidly connected corona discharge wing extending outwardly and forming a corona orifice cavity in section, the inner edge of the said corona orifice cavity being an arc approximating a semicircle having a small diameter to minimize area of the aperture and maximize atomization; said inner edge of the corona orifice cavity having an included angle of about 150° to about 190°, and said corona orifice cavity having at least one orifice formed by the transverse intersection of a surface slit; said orifice cavity being unslitted on either side of said orifice for a distance greater than the diameter of said semicircle.

4. A fluid dispensing nozzle comprising an elongated main fluid feed conduit having a relatively large cross-sectional area, a corona discharge wing member of less cross-sectional area than the main fluid conduit extending substantially parallel with the main fluid conduit and communicating with the interior thereof, said wing portion including at least one corona orifice cavity having a smooth inner wall surface of substantially semicircular cross section and having a narrow transverse slit formed therein providing a discharge orifice.

5. A fluid dispensing nozzle as set forth in claim 4, wherein the wing member is provided with a plurality of transverse slits.

6. A fluid dispensing nozzle as set forth in claim 4, wherein a plurality of wing members are provided each connecting with the main fluid conduit and each including a discharge orifice as defined in claim 4.

7. A fluid dispensing nozzle comprising an elongated main fluid conduit, a hollow discharge ring surrounding the main conduit and communicating with the interior thereof, said ring having a corona orifice cavity, the interior of said ring at said orifice cavity being semicircular in cross section, and a transverse slit at said corona orifice cavity to provide an orifice for discharge of fluid.