Dec. 16, 1952 C. M. SLIEPCEVICH 2,621,976

ATOMIZING NOZZLE

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Fig. 1

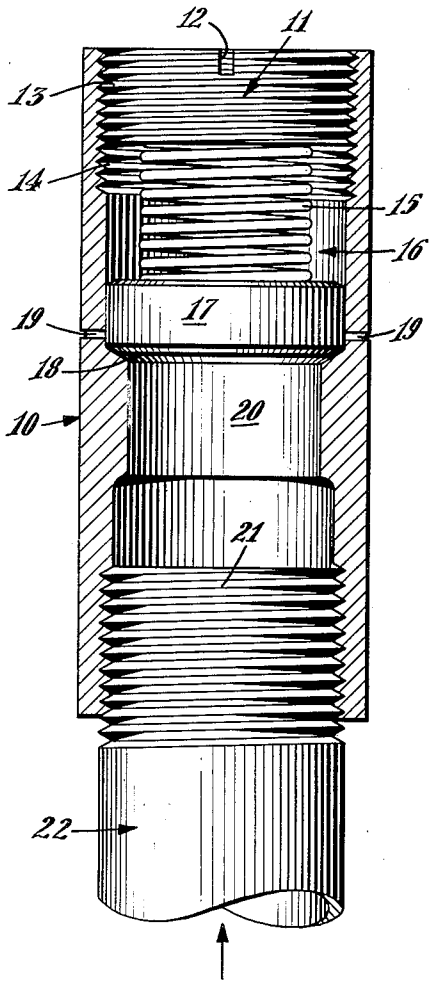
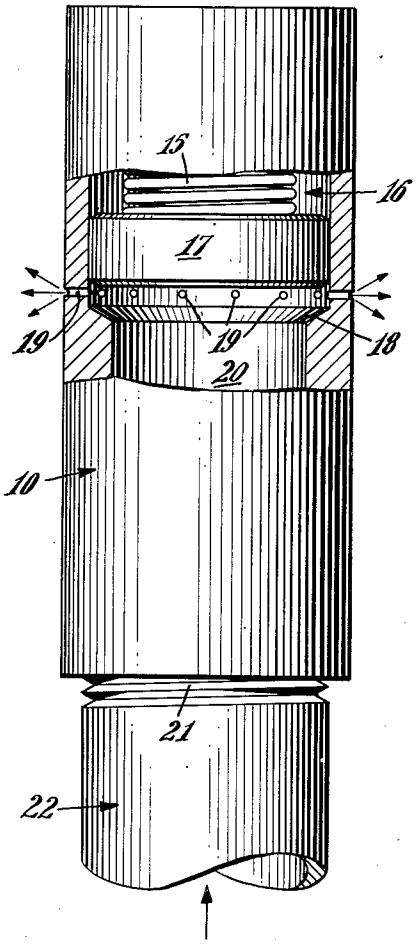



Fig. 2




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## ATOMIZING NOZZLE

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3 Claims. (Cl. 299—144)

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The present invention relates to nozzles for atomizing liquids. Particularly in one aspect this invention relates to such nozzles in which a vibrating member is employed to bring about the desired degree of atomization.

In the commercial atomizing nozzles on the market today in which pressure alone is employed as the atomizing force as contrasted with those in which a gas under pressure is used as the propelling and disruptive agency, the atomization of the liquid is produced by subjecting it to a whirling action before ejecting it from an orifice of the desired shape and size. The whirling motion is imparted to the liquid by passing it under pressure through a chamber of special construction. All of the nozzles of this type are inherently inefficient because of the pressure drop caused by the absorption of energy as fluid friction when the liquid traverses the nozzle chamber.

It is an object of the present invention to produce an atomizing nozzle of a design radically different from that discussed above in which energy losses due to fluid friction are in a large part eliminated.

It is a further object of this invention to produce an atomizing nozzle in which a much lower fluid pressure is required to obtain a certain degree of atomization than is the case with the presently-known types of atomizing nozzles.

It is still another object of the invention to provide an atomizing nozzle of relatively simple and compact construction having a substantially greater capacity than those presently in use.

Another and further object of the invention is to provide an atomizing nozzle which will operate efficiently and bring about a fine degree of atomization of a liquid by using only the force supplied by the liquid under pressure.

Other and further objects of the invention will be apparent from the detailed description thereof, taken in conjunction with the following drawing, in which:

Figure 1 of the drawing is a front elevational view, partly in cross-section, of the device of this invention in which atomization is effected through multiple orifices in a body portion by a vibrating valve member.

Figure 2 of the drawing is the same view as Figure 1 with the vibrating member in a different position to more clearly show the orifices. Only a small portion of the body portion of the device in Figure 2 is in cross-section.

Referring to the drawing, numeral 10 designates a cylindrical body portion having an upper chamber 16 and a lower chamber 20 therein. A

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solid plug 11 having a slot 12 in the top thereof and threaded at 13 is inserted in a threaded upper portion 14 of chamber 16. Plug 11 is screwed into the desired position by means of a screw driver or the like inserted in slot 12. A cylindrical helical spring 15 is positioned within chamber 16 with one end pressing against the bottom of plug 11 and the other end pressing against a valve member 17 comprising a circular beveled disk. The beveled bottom edge of valve member 17 rests on shoulder 18 between chambers 16 and 20.

In the lower portion of chamber 16 adjacent valve member 17, a plurality of orifices 19 are spaced circumferentially around body portion 10 in a plane perpendicular to the axis thereof. In Figure 2, valve member 17 is moved upward thereby more clearly showing orifices 19. The adjacent sides of chamber 16 and valve member 17 are machine finished so that valve member 17 will move freely longitudinally in chamber 16 without the leakage of liquid from chamber 20 to chamber 16.

The lower position of chamber 20 of body portion 10 is threaded to receive threaded end 21 of a conduit 22 transmitting liquid under pressure to chamber 20.

Although the cross-section of body portion 10, chambers 16 and 20, plug 11 and valve member 17 are shown as circular, they may be other shapes such as oval, polygonal, etc., without departing from the scope of this invention. A conical helical spring or other conventional spring may be used in place of the spring 15 shown, if desired. The dimensions of the various parts of the nozzle will depend on such factors as the capacity and the liquid pressure employed. The diameter of orifices 19 usually ranges from about 0.005 to about $\frac{1}{16}$ of an inch, but larger or smaller diameter orifices may be used without departing from the scope of this invention. The number of orifices may range from several to as many as 50 or 100, preferably at least 12 orifices are employed. For example, a nozzle having a one inch diameter chamber, a $\frac{3}{8}$ inch thick valve member and 16 orifices of about $\frac{1}{64}$ inch diameter has shown satisfactory results and relatively large capacities.

In operation, liquid under pressure, usually 25 to 1000 pounds per square inch gage, is supplied to chamber 20 through conduit 22. The force of spring 15 is adjusted by means of plug 11 such that at the constant pressure of liquid supplied to chamber 20 valve member 17 is forced upward slightly in chamber 16 to open orifices 19, as shown in Figure 2. As orifices 19 are opened and

liquid sprays therethrough, the pressure is decreased slightly allowing valve member 17 to seat on shoulder 18, as shown in Figure 1, thus closing orifices 19 and stopping the flow of liquid therethrough. The vibration of valve member 17 causes the liquid to issue from orifices 19 as a fine spray. In order for valve member 17 to vibrate, the liquid pressure, the size and number of orifices, the size of the valve member and the strength of the spring are adjusted to obtain a balanced system.

The orifices may be positioned in only one half of the periphery of the body portion thus directing the spray. The orifices may be grouped so as to spray in two or more directions at once. Two or more rows of orifices may also be spaced around the circumference of body portion 10 without departing from the scope of this invention. The orifices may be angularly drilled through body portion thus giving the spray issuing from the nozzle an upward or downward direction as desired. Any desired angle or spacing of the orifice may be employed to give the desired configuration to the resulting spray. In one modification, the orifices may be drilled in converging angles so that the spray issuing from several orifices impinge upon each other.

Spring 15 may be replaced by any resilient material, but a metal spring is preferred. For example, chamber 16 may contain a gas under pressure which gas has the desired degree of compressibility in order to maintain valve member 17 in vibration.

Valve member 17 may also be vibrated by either mechanical or electrical means without departing from the scope of this invention. In still another modification, a liquid or gas medium may be maintained in chamber 16 at a pressure sufficient to balance the force of liquid in chamber 20 and valve member 17 vibrated by pulsating the fluid pressure of the fluid in chamber 16. In this modification, a conduit is used leading to a liquid or gas pulsating mechanism such as a pump or like means.

Both a compressible fluid and a spring may be used together to vibrate valve member 17. Also mechanical means may be used to augment the natural vibrations of the system as shown.

The mechanical spring may be positioned within chamber 20 upstream of orifices 19, if desired. In this manner of operation, the force urging valve member 17 toward orifices 19 and seating it in shoulder 18 is obtained by the tension of a spring having one end attached to valve member 17 and the other end attached to body portion 19 or other suitable support in chamber 20.

From a structural standpoint, the cross-section of orifices 19 are circular, but the shape may be other than circular without departing from the scope of this invention. In place of shoulder 18, spikes or pegs may be employed, upon which valve member 17 may seat. Shoulder 18 acts primarily as a stop to prevent valve member 17 from being pushed too far into chamber 20 by decreases in pressure in chamber 20. In operation and when the system is in balance valve member 17 may not rest on shoulder 18 at all.

Various alterations and modifications of the nozzle illustrated, such as the size and shape of the orifices and the valve member, may become apparent to those skilled in the art without departing from the scope of this invention. Various uses of the nozzle and its principle of operation are contemplated such as for the use in humidification, emulsification, milk spraying, spray drying, fuel injection, spray painting, powder metallurgy, surface cooling, fire extinguishing, distillation, etc. The vibrating principle of the nozzle in atomizing liquids has its obvious application as an integral part of equipment and appliances, such as, oil burners, internal combustion engines, fire extinguishers, etc. In any of these instances the nozzle portion of the apparatus is defined by the various associated parts necessary to produce a vibrating action of the valve member, the result of which vibrating action liquid is atomized in passing through the multiple set of orifices.

It is understood that the essence of the present invention is the employment of a vibrating valve member and multiple orifices spaced circumferentially in the body portion of the nozzle for atomizing a liquid, and it is realized that there are many available ways other than those specifically disclosed herein for bringing about the desired results.

Having described my invention, I claim:

1. An atomizing nozzle comprising a body portion having a chamber approximately one inch in diameter therein and 16 orifices of about 1/64 inch in diameter spaced circumferentially around said cylindrical chamber of said body portion in a plane perpendicular to the axis thereof, a valve member comprising a circular disk about 3/8 inch in thickness closing said orifices and seated on a shoulder in said chamber of said body portion, said shoulder being positioned below and adjacent said orifices, and a helical spring positioned in said chamber urging said valve member towards said shoulder.

2. An atomizing nozzle comprising a body portion having a cylindrical chamber therein and at least 12 orifices of from about 0.005 to about 1/8th of an inch in diameter spaced circumferentially around said cylindrical chamber of said body portion in a plane perpendicular to the axis thereof, a valve member comprising a circular disk machine fit to the inside diameter of said cylindrical chamber and closing said orifices and seated on a shoulder in said chamber of said body portion, said shoulder being positioned below and adjacent said orifices, and a spring positioned in said chamber urging said valve member towards said shoulder.

3. An atomizing nozzle comprising a body portion having a cylindrical chamber therein and at least several orifices spaced circumferentially around said cylindrical chamber of said body portion in a plane substantially perpendicular to the axis thereof, a valve member comprising a circular disk machine fit to the inside diameter of said cylindrical chamber and seated on a shoulder in said chamber of said body portion, said shoulder being positioned below and adjacent said orifices, the position of said valve member when seated on said shoulder being such that said valve member closes said orifices, and a spring positioned in said chamber urging said valve member towards said shoulder.

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