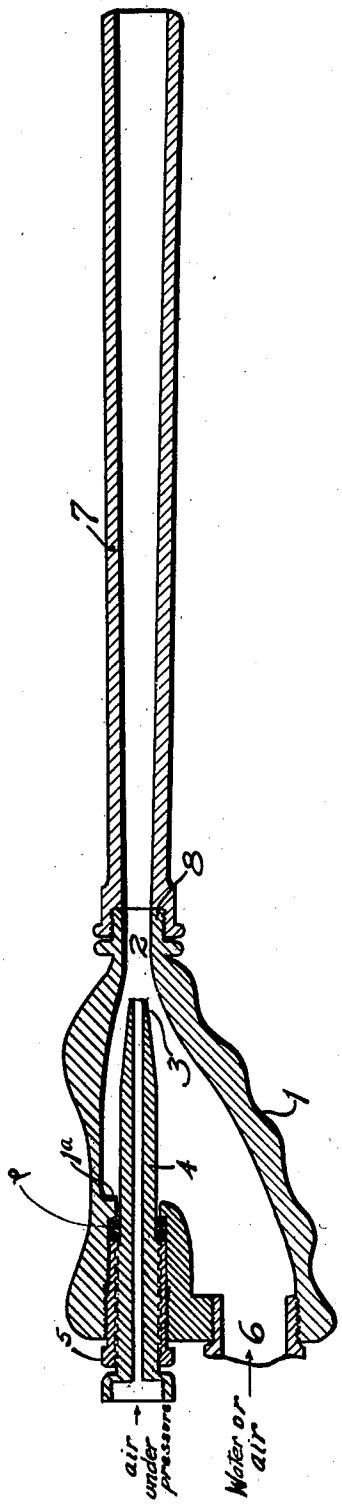
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NOZZLE

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UNITED STATES PATENT OFFICE

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NOZZLE

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My invention relates to discharge nozzles such as are adapted to be used for washing and drying articles by means of fluid streams under pressure. My invention also embodies the production of an especially efficient atomized dual stream of fluid from such a nozzle.

The objects of my invention are to provide an efficient nozzle adapted to combine a relatively small amount of fluid under high pressure with a larger amount of the same or another fluid under atmospheric or other low pressure so as to increase the flow through the nozzle of the fluid under the low pressure and to atomize the same. I also desire to eliminate back pressure and to provide a nozzle which may be adjusted and changed to suit different conditions. Another object is to provide a stream of atomized water having different degrees of density at different points in its cross section.

My invention consists broadly in the provision of a nozzle having an elongated expanding discharge tube and an inlet for a comparatively restricted stream of motive fluid under high pressure aligned with said orifice and in the provision of another larger inlet for fluid under low pressure adapted to be delivered from said orifice by the action of the high pressure fluid passing through the orifice. The use of my nozzle results in a novel method of producing an atomized stream which method is also an inherent part of my invention.

In the accompanying drawing illustrating my invention—

The figure is a vertical section through a preferred embodiment of the same.

In the drawing the body of the nozzle is indicated at 1 and the same is provided with an elongated discharge orifice 2 comprising a Venturi tube. Opposite orifice 2 the body 1 has an opening, the inner end of which is provided with a peripheral flange 1^a. A bushing 5 is threaded into the body opening and an inlet 4 of restricted diameter is threaded into bushing 5 and terminates adjacent the beginning of orifice 2. The inlet 4 is aligned with orifice 2 and is adjustable to and from the latter. Packing *p* is compressed between flange 1^a and the end of bushing 5 and the joint thus formed is not disturbed by adjustment of inlet 4.

A body of fluid under high pressure is connected to inlet 4. Another inlet 6 admits the same or another fluid under low pressure to the body receiving chamber C. The stream line shape of the chamber interior permits the fluid admitted at 6 to flow freely around inlet 4 and into the inner end of the Venturi tube discharge orifice 2.

In admitting a substantial volume of water around the restricted cylindrical air stream and in confining the joint stream for a substantial distance, gradually enlarging the diameter of the joint stream, a substantial quantity of the outer portion of the water stream is in contact with the interior wall of the discharge tube and continues to contact with the inner wall of the tube throughout the length of the latter and without being directly subjected to the air stream. This quantity of water serves as a lubricant and moving vehicle for an inner stream of air and water.

This condition produces a discharged stream of water atomized to a high degree and having an inner section, with a relatively high degree of velocity, surrounded by an annular section of less velocity. The atomization and velocity results largely because the inner stream passes through the discharge tube without being subjected to frictional contact with the tube nor to cross currents created by one or more streams rapidly expanding at the inlet end of the discharge tube and reflected from the inner wall of the tube. Since the entire discharged atomized stream is expanding in diameter its impact is distributed over a substantial area and the impact force per square inch is much less than the impact force of streams produced by nozzles previously used and supplied with air and water under pressures higher than I use or by nozzles discharging ordinary streams of restricted diameter. These are novel results which I believe have not been obtained by any nozzle previously used.

In various mixing nozzles which have been used heretofore, it has been the practice to

supply water to the same under substantial pressures in order to secure a proper operation of the nozzle. The higher the water pressure the greater the proportion of water which would be discharged by the nozzle. Attempts to operate such nozzles without substantial pressure on the water have usually resulted in the air shooting through the nozzle without drawing sufficient water through the nozzle to render the discharge stream effective. Usually no attempt is made to utilize nozzles of the type referred to unless water over thirty pound pressure can be supplied. The apparent reason for the necessity of having water under pressure is that the air pressure in the nozzle instead of drawing the water through the nozzle would prevent the water from being discharged from the nozzle. With the substantial pressures on the water supply it has been also customary to use high pressure on the air supply, eighty and ninety pounds pressure per square inch being frequently recommended by the manufacturers and provided by the users. These high water and air pressures always produce a back pressure on the hand and arm of the user.

With my nozzle, water or air may be supplied under atmospheric pressure or pressure slightly above atmospheric pressure and plenty of water will be drawn through the nozzle. Because of my arrangement, it is not necessary to use such high air pressures and I find that sixty pounds per square inch provides a very efficient operation of my nozzle.

With my nozzle operated under the conditions just described, there is no noticeable or objectionable back pressure on the hand or arm of the user.

In the preferred form, the outer portion 7 of the discharge orifice is detachably secured to the portion 8 and by means of this construction various lengths and different degrees of flare of the discharge orifice may be provided. It will be noted that the parting line between portions 7 and 8 is at the narrowest point of the Venturi tube. Hence changing portion 7 for a similar member having a greater, or smaller, degree of divergence will not produce an objectional angle in the wall of the orifice.

The combination of the two inlets and the Venturi tube orifice may be utilized in the creation of a vacuum for cleaning purposes. If an open tube be connected at 6, the passage of air under pressure through 4 and 2 will tend to create a vacuum in the nozzle and in the tube sufficient to clean dust from upholstery, etc. Modern automobile washing apparatus includes an air compressor for supplying air and water for washing purposes and air alone for drying purposes. By means of my device the same apparatus supplies a vacuum system for cleaning the cushions, tops, and other non-washable parts of the car and eliminates the necessity of an expensive separate vacuum system or the alternate necessity of foregoing the benefit of vacuum cleaning apparatus.

While I have referred to the passage of air under pressure through inlet 4 and water through inlet 6, in the nozzle, it is obvious that other fluids may be utilized in the device. For example, water under substantial pressure could be supplied to inlet 4 to draw water through inlet 6 and discharge through the orifice. A water pump of relatively small capacity could thus produce a substantially greater discharge than that obtainable by a larger water pump through the ordinary nozzle which almost invariably has a convergent orifice so made in an attempt to produce a more forceful stream. Oil and other liquids may be similarly atomized for various purposes.

Various other modifications in the details of my invention will be suggested to those familiar with the art and I contemplate the exclusive use of such as fall within the scope of the following claims.

I claim:

1. In a device of the class described, a tube of substantial length expanding in internal diameter throughout its length from its inner to its outer end, means for directing a comparatively small diameter cylindrical stream of motive fluid into said tube and spaced from the inner walls of said tube near its entrance, and means for admitting liquid to said tube and surrounding said stream of motive fluid.

2. In a nozzle for delivering a stream of atomized liquid, a motive fluid conduit having a restricted cylinder outlet, an expanding discharge tube axially aligned with said conduit and extending from a point adjacent to the discharge end of said inlet, the smallest diameter of said tube substantially exceeding the diameter of said conduit and the ratio between the length of said tube and its smallest diameter being not less than eighteen to one, and an inlet for delivering liquid to said tube.

3. In a portable nozzle adapted to be manually manipulated for delivering a stream of atomized liquid and varying the direction of said stream, a body chamber, a gradually expanding discharge tube of substantial length leading from one side of said chamber and terminating at the point of its greatest width, an inlet opening at the opposite side of said chamber for supplying water or the like to said chamber and tube, and a member forming a substantially smaller and restricted separated conduit through said chamber for a motive fluid and having an inlet at said latter-mentioned side of said chamber, said conduit terminating in a portion of constant cross section for a substantial distance and aligned with said discharge tube and surrounded by and spaced radially from the wall forming

the entrance to said tube and adapted to project a stream axially of said tube and spaced a substantial distance from the sides thereof.

4. The method of obtaining an atomized mixture which consists in forming a cylindrical air jet of restricted diameter, utilizing the entraining force of this jet to increase the velocity of a mass of liquid surrounding the jet and supplied thereto at a pressure lower than that of the air supplied for the jet, shaping the resulting mass of air and liquid into a stream the first diameter of which is substantially larger than that of the air jet whereby the liquid may form an envelope for the air jet, and controlling the diameter of the resulting stream so that it increases uniformly in the direction of flow, whereby mixing of the air and liquid may occur along the surface of contact of the two, the control being exercised over a length of the stream sufficient to permit substantial atomization of at least a part of the liquid by the air, then freeing the stream from the control.

5. The method of producing a stream of atomized liquid which is characterized by forming a cylindrical air jet of restricted diameter, utilizing the entraining force of said jet to increase the velocity of the inner portion of a mass of liquid, delivered and confined around said jet, in a stream of substantially larger diameter than the diameter of said jet and under initial pressure lower than the pressure on said jet, and controlling the joint stream for a substantial distance so that its diameter increases gradually, and then discharging said stream from control.

6. The method of obtaining an atomized mixture which consists in forming a cylindrical air jet of restricted diameter utilizing the entraining force of this jet to increase the velocity of a mass of liquid surrounding the jet, shaping the resulting mass of air and liquid into a stream the first diameter of which is substantially larger than that of the air jet whereby the liquid may form an envelope for the air jet, and controlling the diameter of the resulting stream so that it increases uniformly in the direction of flow, whereby mixing of the air and liquid may occur along the surface of contact of the two, the control being exercised over a length of the stream sufficient to permit substantial atomization of at least a part of the liquid by the air, then freeing the stream from the control.

In testimony whereof I hereunto affix my signature this 6th day of April, 1925.

WILLIAM C. UHRI, JR.