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NOZZLE

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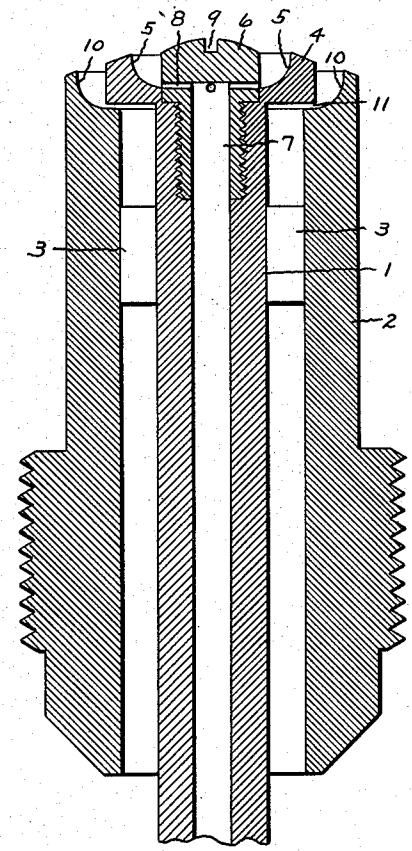

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NOZZLE

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5 Claims. (Cl. 299—141)

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This invention relates to nozzles. More particularly, it relates to a nozzle of improved design and characteristics.

Nozzles for feeding various fluids are found in a number of forms and types. In those cases in which a circular or conical solid sheet spray is desired, the so-called vortex nozzle has been widely used. In the vortex nozzle a circular or swirling motion is imparted to the fluid in a spin chamber. It is then discharged through an orifice in a solid sheet spray. A characteristic of the vortex nozzle and a limitation thereof is that a solid, steady, sheet spray of fluid is maintained only at a particular fluid feed pressure or very narrow range of pressures. Thus a narrow range of specific optimum pressures must be adhered to if best results are to be attained as regards the shape and density of the spray.

The specific or narrow range of optimum pressure of the vortex nozzle also places a definite limit upon the amount of fluid which may be discharged from a particular nozzle. If a greater flow of fluid is desired additional nozzles, each with its own operating characteristics, must be used.

It is an object of the present invention to provide an improved nozzle which may be used to discharge fluids in a continuous or solid sheet of spray.

A further object of the present invention is to provide a nozzle which will operate at a very low pressure over a wide range of pressure drops without substantial change in the shape of the spray.

Another object of this invention is to provide a nozzle which has a wide range of flow rates.

Still another object of the invention is to provide a nozzle which is capable of discharging one or more liquids in a plurality of solid, discrete and concentric sheet sprays.

A further object of the invention is to provide means for concentrically mixing sprays of different fluids.

Other objects will become apparent from a consideration of the following description and the drawing in which the single figure shows a particular embodiment of the present nozzle.

It has been found that a nozzle which will discharge one or more liquids in a plurality of solid, discrete, concentric, sheet sprays may be very readily provided.

More particularly, it has been found that such a nozzle may be made by providing a plurality of concentrically arranged conduits having means at their discharge ends for feeding the liquid onto arcuate shaped liquid-deflecting surfaces which are so disposed as to deflect the liquid forward in a plurality of discrete, concentric, solid, sheet sprays.

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Reference is made to the single figure of the drawing for a more complete description of the present nozzle. The nozzle is constructed of two concentric tubes 1 and 2 through which may be fed like or different liquids, the spacing of the tubes being maintained by means of ribs 3. The discharge end of inner tube 1 has an enlarged section 4, the hole in the tube being flared outwardly and upwardly in an arcuate manner as at 5. Mounted in the discharge end of tube 1 is a member 6 which is threaded into the tube itself. Member 6 is generally in the shape of a headed screw having a hollow shaft providing a conduit 7 for the flow of liquid and a slot 9 for easy adjustment. A plurality of radially disposed conduits or holes 8 are provided in the head of the member 6 perpendicular to and radiating outwardly from conduit 7 to feed the liquid to arcuate surface 5. The discharge end of tube 2 is provided with an outwardly and upwardly deposited arcuate surface 10 similar in shape to 5. The enlarged section 4 at the discharge end of tube 1 lies adjacent an arcuate surface 10 at the end of tube 2, being spaced therefrom by a passage 11.

In operation, the liquid being fed through tube 1 passes through radial passages 8 and impinges upon arcuate surface 5 disposed radially outward from tube 1, being then discharged from the arcuate deflecting surface in a solid circular sheet. Liquid fed through the space between tubes 1 and 2 passes through passage 11 and strikes arcuate surface 10 leaving the latter in the form of a solid circular sheet which is concentric to that projected from surface 5. By changing the angle of the arcuate surface 10, the angle of the spray may be altered as desired.

The present nozzle may be used to discharge only one liquid by simply feeding the same material through tubes 1 and 2 or by combining the conduits. The flow capacity of the nozzle may be increased readily by merely adding more concentric liquid tubes and discharge surfaces to the extent required.

The present nozzle has the advantage that it may be operated at very low fluid feed pressures and over a wide range of fluid feed pressures without substantial change in the shape of the spray. This is in contrast to the operation of vortex nozzles. For example, if the combustion chamber pressure in a rocket is about 350 pounds per square inch, the present nozzle will

begin to operate efficiently at a pressure of about 355 pounds per square inch, and the performance and shape of the spray is not substantially affected by changes in the chamber pressure. The angle of the spray is practically independent of pressures used. On the other hand, using a vortex nozzle with a chamber pressure of 350 pounds per square inch, efficient operation would begin only at a much higher liquid feed pressure, say about 400 pounds per square inch. In addition, since vortex nozzles operate at maximum efficiency only at a particular pressure or over a very narrow range of pressures, any rise in liquid feed pressure changes the shape of the spray and delivery of liquid.

While the above desirable characteristics of the present nozzle are of general benefit, they are particularly so when it is desired to contain a spray of one liquid within that of another liquid until they are thoroughly mixed some distance from the nozzle. It is well known, for example, that in rocket motors it is important to keep an unmixed spray or jet of an oxidizer from impinging upon or contacting the walls of the motor in order to prevent the latter from burning out. Using the present nozzle, the oxidizer may be fed from the inner orifice or orifices and the other reactant from the outer orifices so that no pure oxidizer jet or spray contacts the motor walls.

Better mixing of different liquids is likewise possible by the presence of sheets of different liquids adjacent one another as the spray diffuses some distance from the nozzle. This is in contrast to the situation which exists where sprays of different fluids are directed at one another.

As pointed out above, the present nozzle maintains sprays of substantially the same shape over a wide range of fluid feed pressures. Where a greater quantity of liquid is desired to be fed, additional annular feed conduits and deflecting members may be provided up to any number desired to meet any particular requirement. Thus, instead of being obliged to use a number of nozzles where high flow rates are required, a single nozzle of the present simple design may be used.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A nozzle for feeding liquids in a plurality of solid, discrete, concentric sheet sprays, said nozzle comprising a plurality of concentric conduits and means at the outlet end of each conduit to discharge liquid flowing therein in the form of a circular spray, said means comprising a conduit-surrounding arcuate shaped liquid-deflecting surface.

2. A nozzle for spraying liquid in a plurality of solid, discrete, concentric sheets, said nozzle comprising a plurality of concentric conduits and an outwardly flared conduit-surrounding arcuate shaped liquid-deflecting surface at the outlet end of each conduit.

3. A nozzle for spraying liquids comprising a plurality of concentrically arranged conduits, means at the end of each conduit for directing the liquid radially outward, and arcuate shaped liquid-deflecting surfaces so located as to direct the radially fed liquid forward in a plurality of solid, discrete, concentric sheet sprays.

4. A nozzle for spraying liquid, said nozzle comprising a plurality of concentric conduits and an arcuate shaped liquid-deflecting surface surrounding the outlet end of each conduit, said surfaces being so disposed as to deflect the liquid forward in a plurality of concentric, solid, circular, sheet sprays.

5. A nozzle for spraying liquid which is characterized by efficient operation at low pressures and stability of spray shape over a wide range of pressures, said nozzle comprising a plurality of concentrically arranged conduits, means for feeding the liquid radially outward from the discharge end of each conduit, and arcuate shaped deflecting means located radially outward from each conduit to deflect the liquid in a plurality of concentric, solid, circular sheet sprays.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
422,222	Jennings	Feb. 25, 1890
451,784	Upson	May 5, 1891
1,285,952	De Ros	Nov. 26, 1918
1,523,382	Rew	Jan. 13, 1925
1,688,827	Nelson	Oct. 23, 1928
1,878,105	Brown	Sept. 20, 1932
2,297,497	Popoff	Sept. 29, 1942
2,533,953	Peeps	Dec. 12, 1950