Dec. 30, 1969 B. C. BRISTOW 3,486,700

NOZZLE

Filed Dec. 14, 1967

Fig. 1

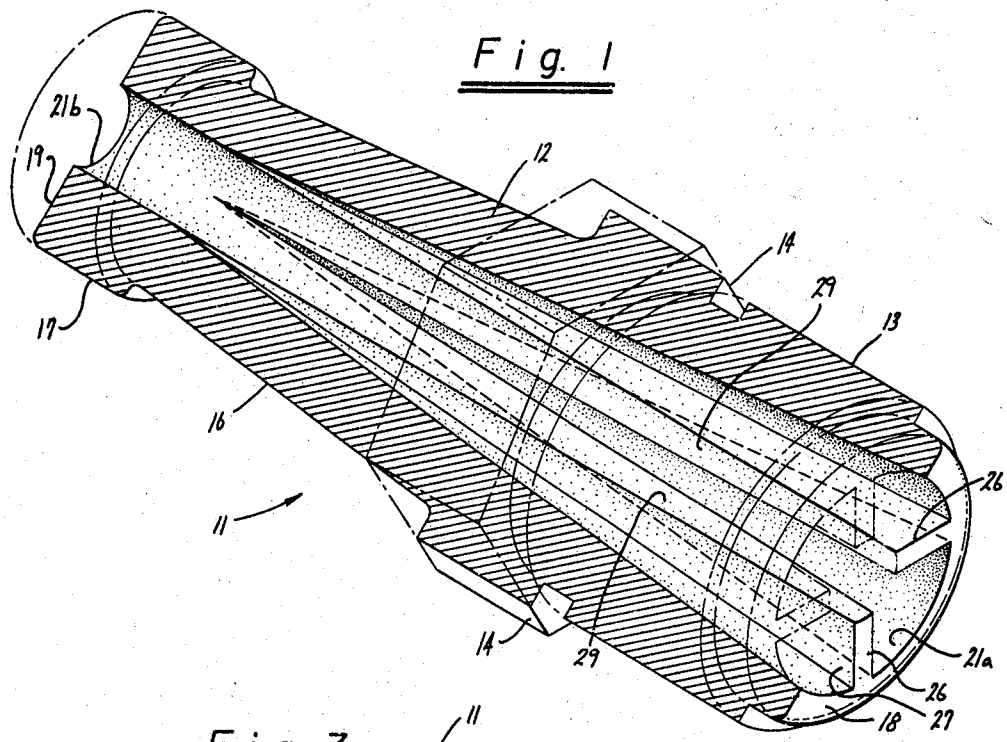



Fig. 3

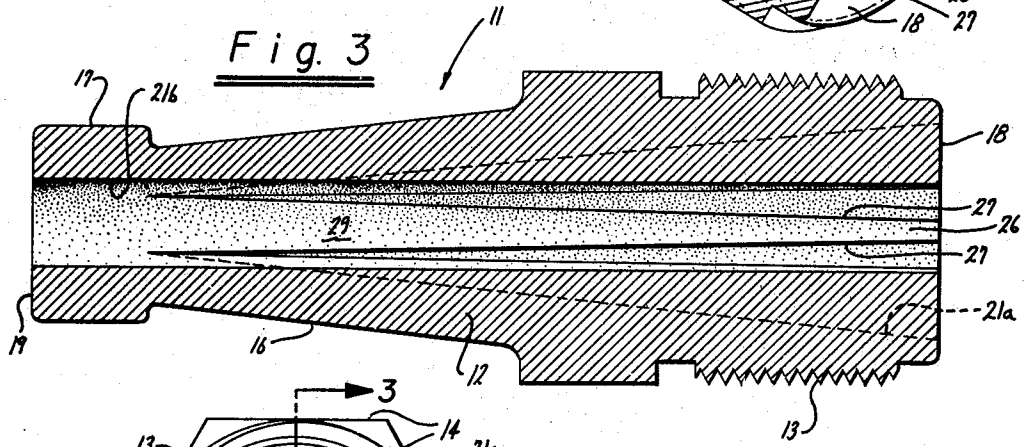
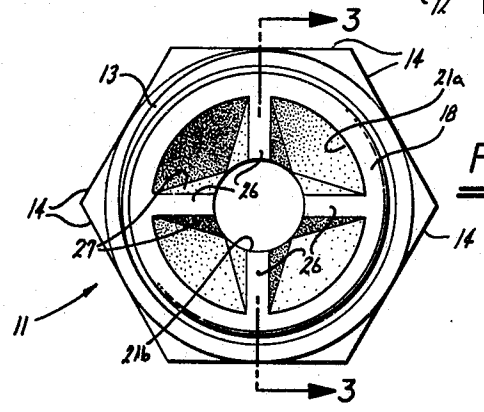



Fig. 2

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3,486,700

# NOZZLE

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U.S. Cl. 239—590.5 6 Claims

## ABSTRACT OF THE DISCLOSURE

Nozzle having a flow passage therethrough in which at least a portion of the flow passage is tapered in one direction and in which a rib extends into the flow passage and is tapered in the opposite direction whereby the nozzle serves as a combined stream straightener and choke to provide a solid jet without turbulence.

## BACKGROUND OF THE INVENTION

Nozzles have heretofore been provided in which it has been attempted to obtain stream straightening and choking features. However, in such nozzles, it has been found that there is still considerable turbulence in the stream which emerges from the nozzle and that there is a tendency for the stream passing from the nozzle to neck after it has passed into the air. There is therefore, a need for a new and improved nozzle.

## SUMMARY OF THE INVENTION AND OBJECTS

The nozzle comprises a body which is formed with a flow passage which extends therethrough. At least a portion of the flow passage is tapered so that its size decreases in a direction towards one end of the flow passage. At least one rib or fin is formed in the body and extends into the tapered portion of the flow passage and has a taper which increases in thickness in a direction towards said one end of the passage.

In general, it is an object of the present invention to provide a nozzle which has greatly improved flow characteristics in which the stream passing therefrom comes out as a solid jet without turbulence.

Another object of the invention is to provide a nozzle of the above character with which it is possible to provide a jet or stream which has a greater striking force than conventional nozzles utilizing the same pressure.

Another object of the invention is to provide a nozzle of the above character which does not have members which cross the main stream and, therefore, is substantially non-clogging.

Another object of the invention is to provide a nozzle of the above character which combines stream straightening and choking features within the nozzle.

Another object of the invention is to provide a nozzle of the above character which can be readily and economically fabricated.

Additional objects and features of the invention will appear from the following description in which the preferred embodiment is set forth in detail in conjunction with the accompanying drawing.

## BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is an isometric view in cross-section of a nozzle incorporating the present invention.

FIGURE 2 is an end elevational view of the inlet end of the nozzle shown in FIGURE 1.

FIGURE 3 is a cross-sectional view taken along the line 3—3 of FIGURE 2.



## DESCRIPTION OF THE PREFERRED EMBODIMENT

The nozzle **11** shown in the drawings is formed from a body **12** of a suitable material such as cast steel which is provided with threads **13** at one end. It is also provided with a plurality of flats **14** intermediate it ends adjacent the threads **13** which form a hexagonal surface permitting the same to be engaged by a wrench for threading the socket into the desired receptacle. The body **12** is also provided with an exterior conical tapered surface **16** which extends from the flats **14** to a cylindrical end portion **17**. The body is also provided with an inlet end surface **18** and an outlet end surface **19** which are substantially parallel.

The body **12** is provided with a flow passage **21** which extends from the inlet surface **18** through the outlet surface **19** longitudinally of the body **12**. At least a portion of the flow passage is tapered. Thus, as shown in the drawings, there is provided a tapered portion **21***a* which is conical and which decreases in size, i.e., width, as the flow passage approaches the exit end **19** of the nozzle. The tapered portion **21***a* joins a cylindrical portion **21***b*. The tapered portion **21***a* can be formed in any desired portion of the length of the flow passage **21**. However, it has been found that a tapered portion should represent a major portion of the passage and, as shown in the drawings, can represent as much as 85% of the total length of the flow passage.

The body **12** is provided with at least one rib or fin **26** extending into the tapered portion **21***a* of the flow passage **21** but which has a taper which is the reverse of that of the flow passage. Thus, as shown in the drawings, there are provided four radially extending fins or ribs **26** which are equally spaced circumferentially of the tapered portion of the flow passage. Thus, since four of the fins **26** are provided, they are spaced 90° apart and have a taper which increases the width of the fins toward the discharge end **19** of the nozzle. As can be seen from FIGURE 3, the taper of the flow passage **21** and the taper of the fins **26** are such that the fins, when they reach the cylindrical portion **21***b* of the flow passage **21**, in effect, join the surface which forms the cylindrical portion of the flow passage **21**.

The side walls **27** for each of the fins **26** form planes which extend into the flow passage generally perpendicular from the surface forming the flow passage but in a diverging fashion as can be seen particularly in FIGURE 3. Each of the fins is provided with an upper surface **29** which is arcuate and which also gradually increases in width towards the discharge end **19** of the nozzle and which forms a part of a circle which is the same diameter as the diameter of the portion **21***b* of the flow passage **21** so that, in effect, the curved surfaces **29** form a continuation of the portion **21***b*.

Looking at the construction of the nozzle in another way, it would be possible to say that nozzle is provided with a bore which extends therethrough which has the same diameter throughout the entire length of the same and that there are sector-shaped recesses formed in the body which open into this main bore with the sector-shaped recesses having a taper so that they gradually decrease in size towards the discharge end of the nozzle.

Use of the nozzle may be briefly described as follows. The nozzle can be utilized in a conventional manner. For example, the nozzle can be mounted on a tank cleaner of the type described in copending application Ser. No. 683,700, filed Nov. 16, 1967, for use in tank cleaning. In such an application, it has been found that the nozzle is very efficacious. It provides a stream which comes out in a solid jet that has a much greater striking force than that provided by a conventional nozzle. The present nozzle

provides a choking action since it gradually decreases the size of the stream passing through the nozzle. In addition, the nozzle provides a stream straightening function by means of the ribs or fins **26**. The nozzle is particularly outstanding in delivery of a stream without any substantial turbulence. The nozzle is also desirable in that it is less likely to clog than other types of nozzles. There is no member which extends completely across the stream to impede the flow of foreign materials through the nozzle.

As can be seen, the nozzle is relatively simple in construction and can be formed as a single integral unit. The tapers of the flow passage and of the fins within the flow passage are complementary so that they eventually join to provide a stream which has the same size as the exit portion **21***b* of the flow passage **21** extending through the nozzle.

I claim:

**1.** In a nozzle, a body having inlet and outlet ends and a flow passage extending therethrough, at least a portion of the flow passage being tapered so that its size decreases toward the outlet end of the body, and at least one tapered fin carried by the body and extending into the portion of the flow passage which is tapered, said fin increasing in width toward the outlet end of said body.

**2.** A nozzle as in claim **1** wherein said tapered fin decreases in height toward the outlet end of said body.

**3.** A nozzle as in claim **1** wherein said body carries a plurality of fins and wherein said fins are equally spaced circumferentially of the flow passage.



**4.** A nozzle as in claim **3** wherein each of said fins has diverging side walls which extend substantially radially into the passage and has a concavely curved top surface which forms a part of a circle having a diameter substantially the same as the diameter of the portion of the passage which is not tapered.

**5.** A nozzle as in claim **3** wherein the ribs extend to the inlet end of said body.

**6.** In a nozzle, a body having an inner wall forming a flow passage extending through said body, at least a portion of the flow passage being tapered so that its size decreases toward one end of the body, and at least one fin carried by the body and extending from the inner wall into the portion of the flow passage which is tapered, said fin having diverging side walls substantially perpendicular to the portion of the inner wall from which they extend and having a top surface joining the side walls, said top surface having a curvature such that it forms a part of a circle having substantially the same diameter as the diameter of the portion of the flow passage which is not tapered.

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