United States Patent [19]

Mocarski

[11] **3,806,039**

[45] **Apr. 23, 1974**

[54] **COANDA TYPE NOZZLE WITH DISCONTINUOUS SLOT**

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[22] Filed: **May 9, 1973**

[21] Appl. No.: **358,634**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 234,535, March 14, 1972, Pat. No. 3,743,186.

[52] **U.S. Cl.**..... **239/417.3,** 239/DIG. 7, 239/425.5, 239/433

[51] **Int. Cl.**..... **B05b 7/12**

[58] **Field of Search**..... 239/DIG. 7, 419.5, 498, 239/525, 417.3, 556, 288.3, 433, 434.5, 425.5, 425, 413

[56] **References Cited**

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Attorney, Agent, or Firm—Ernest M. Junkins

[57] **ABSTRACT**

A nozzle having a through passageway and an intermediate slot with pressurized fluid through the slot inducing flow of ambient fluid through the passageway with the nozzle being formed in two parts having opposing surfaces defining the slot and with a spoked washer positioned between the two surfaces to make the slot discontinuous with a width equal to the width of the washer.

7 Claims, 4 Drawing Figures

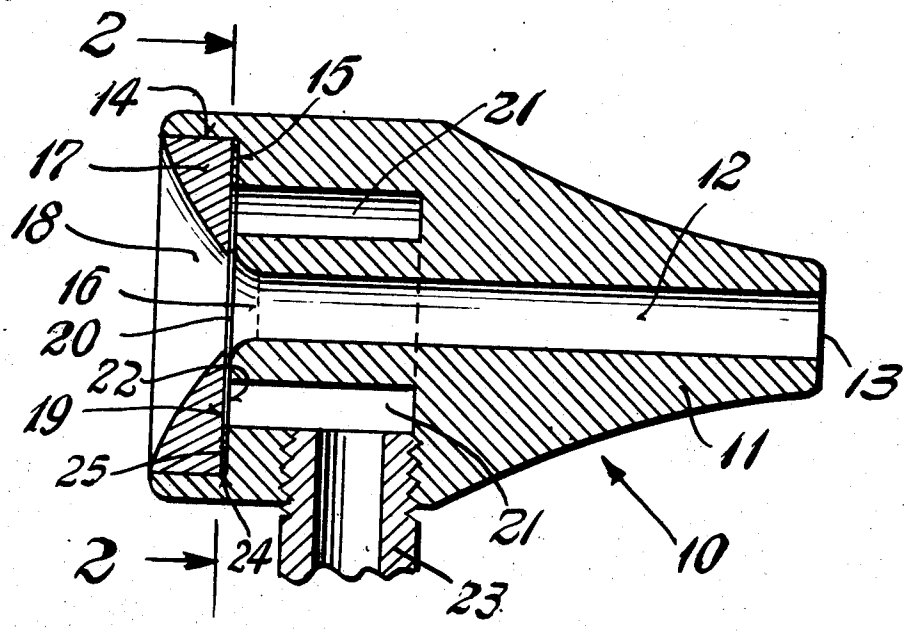


Fig. 1

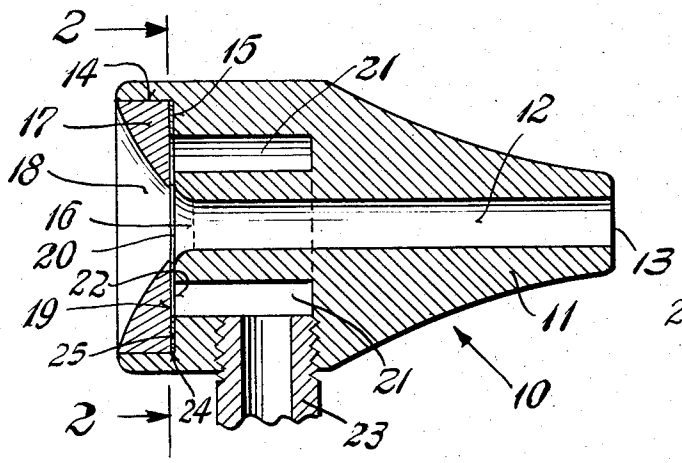


Fig. 2

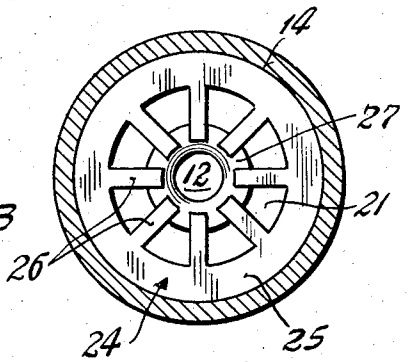


Fig. 3

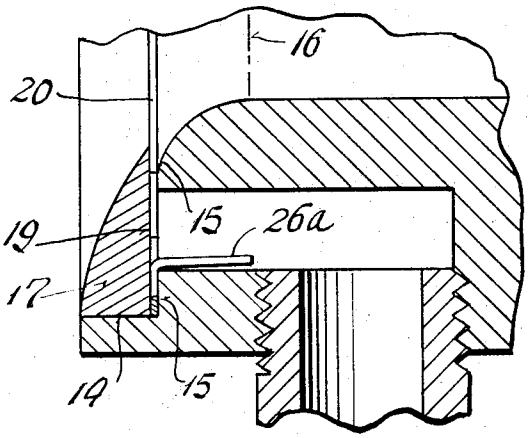
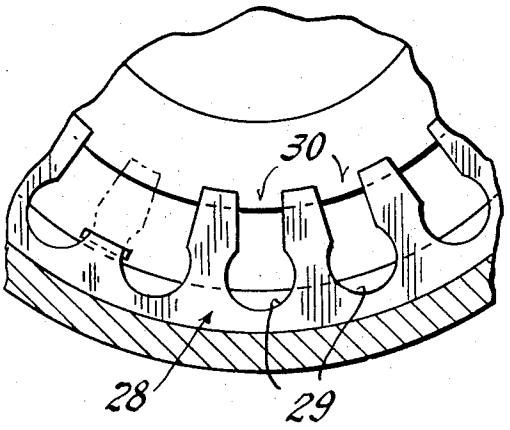


Fig. 4



COANDA TYPE NOZZLE WITH DISCONTINUOUS SLOT

The present application is a continuation-in-part of my co-pending application Ser. No. 234,535, filed Mar. 14, 1972, now U.S. Pat. No. 3,743,186 and entitled Air Gun.

The air gun disclosed therein includes a nozzle portion which is formed to have a through passageway and an intermediate slot communicating therewith. Pressurized air introduced into the slot flows through the passageway by reason of the Coanda effect and is discharged at the exit end of the passageway. This flow induces the flow of ambient air at the entrance end of the passageway so that the nozzle discharge is a combination of both the pressurized air and the ambient air.

It is an object of the present invention to provide a nozzle of the above type in which the volume of pressurized fluid flowing through the slot may be precisely controlled by accurately and easily controlling the area of the slot through which the pressurized fluid may flow.

Another object of the present invention is to provide a nozzle of the above type which is less apt to become malfunctioning by contaminants in the slot by forming the slot to be discontinuous with a width that is greater than a slot which is continuous.

A further object of the present invention is to achieve the above objects with a slot that may not only be easily, accurately and inexpensively formed but which also enables the area through which pressurized fluid flows to be easily altered.

In carrying out the present invention, the nozzle is formed as two parts with the first part having a through passageway and with one end thereof including a surface that is essentially perpendicular to the axis of the passageway. Adjacent the one end, the passageway is formed to have its narrowest cross-sectional area which constitutes the throat of the nozzle. A second part is also formed to have a through passageway and has one end formed to provide a first surface which is essentially perpendicular to its passageway axis. The two parts are assembled together with their passageways aligned and with the one surface and first surface spaced from each other to define the slot.

Positioned between the two surfaces is a spoked washer which has a width or thickness equal to the desired width of the slot and with the spokes terminating just slightly prior to the passageway. Thus the spoke washer forms a slot which is discontinuous, i.e., only has an opening where a spoke does not exist and also accurately sets the width of the slot by having it equal to the thickness of the washer.

In use, air or other fluid under pressure is introduced into an annular cavity formed in the first part and flows through the discontinuous slot into the passageway. For the same area of slot through which pressurized fluid may flow, the blocking of portions of the slot by the spokes enables the open portions to be much wider than if the slot was annular and not discontinuous. In this manner contaminants or small particles in the pressurized fluid which would block a thinner continuous slot, may flow through the open portions of the discontinuous slot without blocking. In one example where the width of the slot is 0.002 inch, an equivalent discontinuous slot made according to the present invention may have a thickness of its open portions equal to

0.006 inch which would enable particles which could block an annular slot to pass through the discontinuous slot. Moreover, by controlling the ratio between the blocked and open portions of the slot, the area of the slot through which the pressurized fluid flows may be altered to adjust the quantity of fluid that flows.

Other features and advantages will hereinafter appear.

Referring to the drawing:

FIG. 1 is an axial cross-section of a nozzle of the present invention.

FIG. 2 is a section taken on the line 2—2 of FIG. 1.

FIG. 3 is an enlarged radial section of the slot portion.

FIG. 4 is a view, somewhat enlarged, of a portion similar to FIG. 2, of a further embodiment of a spoked washer.

Referring to the drawing, the nozzle of the present invention is generally indicated by the reference numeral **10** and includes a first part **11** having the axial cross-sectional shape shown and formed to provide a through passageway **12.** One end **13** of the passageway constitutes the discharge end of the nozzle while the opposite end of the part **11** is formed with a cylindrical cavity **14** which includes a bottom surface **15** that is essentially perpendicular to the axis of the passageway **12.** The surface **15** curves into the passageway that includes a throat **16** that is the narrowest cross-sectional area of the passageway **12** adjacent to the surface **15.**

Positioned within the cavity **14** is an annular part **17** that also has a passageway **18** which rapidly decreases in cross-sectional area as it approaches the first part **11.** Moreover, the annular **17** includes a flat surface **19** that is essentially perpendicular to the axis of the passageway **18.**

The two parts are assembled as shown with the axes of the passageways **12** and **18** being aligned and with the surfaces **15** and **18** being slightly spaced from each other to define there between a slot **20.** Preferably the second part is fastened to the first part **11** by mechanical securement such as by staking, welding, cooperating threads, etc.

The first part **11** is formed with an annular chamber **21** which has an open end **22** which communicates with the slot **20.** A conduit **23** which may be a threaded pipe is in communication with the chamber **21** and is connectible to a source (not shown) of pressurized fluid. Accordingly, fluid may flow from the source through the chamber **21,** the slot **20** and by reason of the Coanda effect will be discharged through the opening **13** of the passageway **12.** In addition, ambient fluid at the large end of the passageway **18** will be induced to flow through both passageways and also be discharged through the discharge end **13.**

In accordance with the present invention, the width of the slot **20** is accurately and precisely set by the thickness of a spoked washer **24** that is positioned between and abutting the two surfaces **15** and **19.** The washer **24** includes an outer annular portion **25** that is positioned outwardly of the chamber open end **22** with integral spokes **26** extending inwardly therefrom. The inner end of the spokes are located between the surface **19** and the portion of the surface **15** that lies between the chamber **21** and the passageway **12.** The inner ends are thus positioned to block the slot and to permit pas-

sage of fluid through the slot only where an opening such as the opening **27** exists between the spokes. By regulating the thickness of the washer **24** and the ratio of blocked area to open areas, the area of the slot through which pressurized fluid may flow may be accurately, economically and precisely made.

With a substantial portion of the slot blocked, the width of the slot may be substantially increased as compared to a completely open annular slot but yet still have the same areas through which pressurized fluid may flow. However, by reason of the increased thickness of the opening, the nozzle of the present invention is less subject to having its slot blocked by small particles that may exist in the pressurized fluid. It will also be understood that the spokes **26** terminate at substantially the passageway so that they do not interfere with the flow of the ambient fluid into the passageway.

As shown in FIG. **3**, the pressurized fluid flow area of the slot may be easily increased by eliminating a spoke in the slot, by bending, as spoke **26***a* is bent into the annular chamber **21**.

Shown in FIG. **4** is a further embodiment of a spoked washer **28** which may be used in the present invention. In this embodiment, the spokes are formed by first drilling holes such as holes **29** at spaced locations about the washer and then forming the spokes by making annular slits such as slit **30** to communicate with the drilled holes **29**. Except for the different shape of the spokes, the washer shown in this embodiment will function in the same manner as the washer **24** previously disclosed.

It has been found that with the openings **27** evenly distributed about the slot, that there does not seem to be any noticeable difference in inducing ambient fluid flow as compared to a same area continuous slot.

The surfaces **15** and **19** are as shown, preferably perpendicular to the passageways' axes and, as such, may be formed to be accurately planar quite easily and economically.

It will accordingly be appreciated there has been disclosed a construction for a nozzle of the Coanda type in which the width of the slot may be accurately dimensioned. Moreover, portions of the slot are blocked so as to decrease the length through which pressurized fluid may flow but by increasing the open portions of the slot, the slot may be made to have the same area for the fluid flow as a thinner continuous annular slot. The wider slot openings enables, especially for small area slots, particles which are difficult to filter from the pressurized fluid to pass through the slot openings without their becoming lodged therein.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. A nozzle for inducing flow of ambient fluid therethrough by pressurized fluid flow through a slot comprising a first part formed to have a through passageway and a surface formed at one end transverse to the passageway, said passageway further having a minimum cross-sectional area throat located adjacent the one end with the passageway increasing in cross-sectional area from the throat to the surface; a second part having a through passageway and having a first surface transverse to its passage-way, said passageway increasing in cross-sectional area from its first end; means for positioning the two parts with the passageways aligned and with the one surface and the first surface facing each other but spaced therefrom to define the slot there-between and blocking means positioned between at least a portion of the two surfaces for closing the slot where the blocking means are positioned.

2. The invention as defined in claim **1** in which a blocking means includes a plurality of flat segments positioned between the two surfaces and in which the width of the slot between the segments essentially equals the thickness of the flat segments.

3. The invention as defined in claim **2** in which the segments terminate essentially at the passageway.

4. The invention as defined in claim **2** in which the both surfaces are perpendicular to the axes of the passageways.

5. The invention as defined in claim **1** in which the blocking means consists of a spoked annular washer with the inner end portions of the spoke forming the blocking means.

6. The invention as defined in claim **5** in which the first part is formed with an annular chamber having an open end at the one surface surrounding its passageway and in which the spokes of the washer extend across the open end of the chamber.

7. The invention as defined in claim **6** in which at least one of the spokes has been bent transversely to the other spokes to extend into the annular chamber.

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