United States Patent [19]

Doering

[11] **3,825,188**

[45] **July 23, 1974**

[54] **LIQUID SPRAY HEAD**

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[73] Assignee: **Par-Wey Mfg. Co.,** Los Angeles, Calif.

[22] Filed: **Mar. 23, 1973**

[21] Appl. No.: **344,075**

[52] **U.S. Cl.**..... **239/498,** 239/DIG. 1, 239/499, 239/520, 239/524, 239/601

[51] **Int. Cl.**..... **B05b 1/02,** B05b 7/06, B05b 15/04

[58] **Field of Search** 239/DIG. 1, 518, 520, 524, 239/601, 548, 498, 499, 552

[56] **References Cited**

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Primary Examiner—Robert S. Ward, Jr.

Attorney, Agent, or Firm—Forrest J. Lilly

[57] **ABSTRACT**

A nozzle for spraying liquids is provided. In a useful example, cooking oil is sprayed into baking pans using a conduit which discharges the oil at a center point between two concentric closely-spaced circular discs, in parallel horizontal planes, the lower disc being smaller than the upper disc, there being a large number of small air passages in a circular pattern extending downwardly through the upper disc, all around the border of the lower disc. The oil flows radially out from between the discs, and is impinged upon by air under pressure issuing downward from the air passages. Thereby the oil film is largely atomized and sprayed downwardly. Oil from between the discs not so atomized reaches the internal surface of a conical skirt, and is guided thereby down the skirt and off the lower edge thereof in an atomized condition. A solid cone of atomized oil particles is thereby delivered downwardly in a burst of only a few hundredths of a second. The skirt may be shaped to produce a round or square pattern of atomized oil.

8 Claims, 6 Drawing Figures

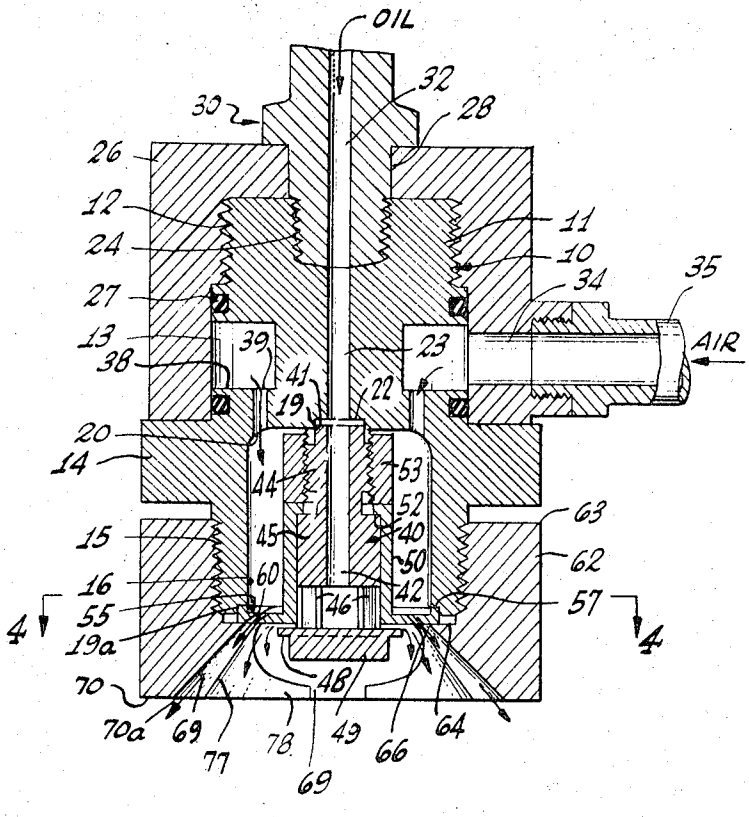


Fig. 1

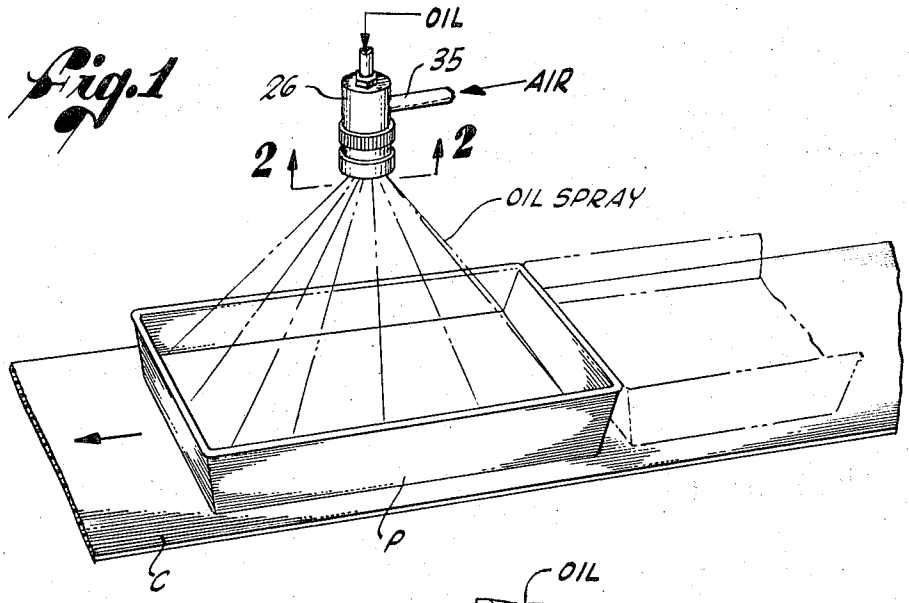


Fig. 2

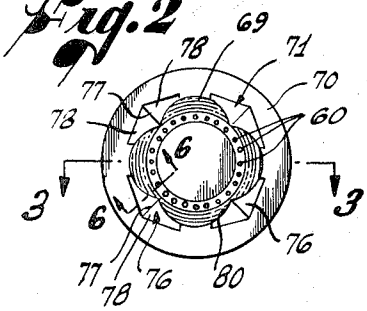


Fig. 6

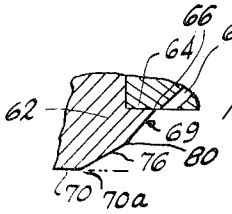


Fig. 3

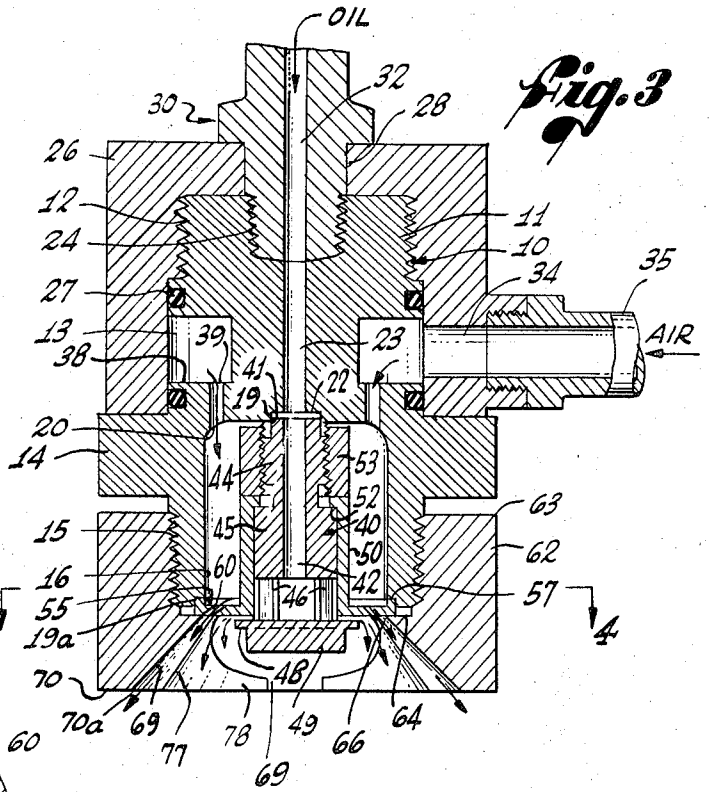


Fig. 4

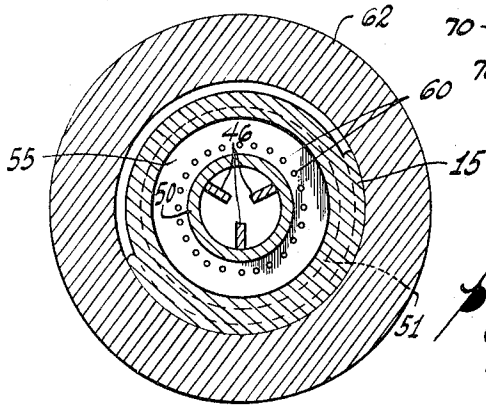
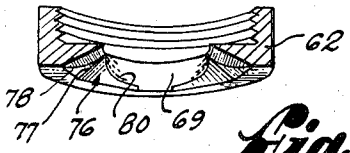


Fig. 5



LIQUID SPRAY HEAD

RELATED APPLICATION

This application is filed coincidently with an application filed by Harold W. Hanson, Jr., Ser. No. 344,074, and covers and claims subject matter other than that claimed in Ser. No. 344,074.

FIELD OF THE INVENTION

This invention relates to a liquid nozzle, and in an illustrative example, a nozzle adapted to spray a charge of atomized cooking oil or grease into a baking pan in an almost instantaneous burst. The field of the invention, however, includes the spraying of liquids generally.

BACKGROUND OF THE INVENTION

Confining attention, for illustrative purposes, largely to the cooking oil or grease application, it is common practice in bakeries to spray baking pans with a cooking oil or grease to prevent sticking. Generally, the baking pan, often on a traveling conveyor, is stopped, the spray then turned on for a short time, and the conveyor then moved on. A purpose of the present invention is to provide for spraying the pan for a time duration of the order of only a few hundredths of a second, so that it is unnecessary to stop the conveyor, and it can be in continuous motion, to obvious advantage. A further objective of the invention, following from the first, is to provide a liquid spray head which starts its spray substantially instantly when air under pressure and the liquid, even oil or grease, is supplied, and which has a substantially instantaneous cutoff when the charge of admitted liquid is exhausted. A further purpose is to provide a spray head which can provide a solid cone of substantially uniformly distributed spray particles or, using a modified spray control skirt, a modified cone, or cone merging into a pyramid; and also one which does not dribble or leak between bursts. A further purpose is to provide for a very finely atomized "fog" or oil or other liquid particles.

A further purpose is to provide a spray head as described which is uniquely constructed for quick disassembly for cleaning purposes.

BRIEF DESCRIPTION OF THE INVENTION

In accordance with the invention, broadly described, a spray head is provided to which air is delivered under considerable pressure, as 30 to 80 psi, and is valved on just before the burst of spray is required. A measured charge of oil, or other liquid, or grease, is then forced through the spray head, and formed into peripherally expanding layer of radially outward flow. The air under pressure impinges on this layer, and breaks it up into finely divided downwardly directed particles. The liquid which is not thus broken up continues radially outward until it is deflected downward into a spray cone by encountering the inside surfaces of a spray control skirt, whose angle and contour define the central angle, or angles, of; the sparay "cone" and also the exterior contour or permeter thereof.

At this point, it should be noted that the spray device handles liquid, oil, or grease, and in fact is applicable to non-gaseous fluids generally. For a generic expression, the words non-gaseous fluid will be used.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a spray head in accordance with the invention, spraying atomized cooking oil into a rectangular pan on a conveyor;

FIG. 2 is a section taken in accordance with the line 2—2 of FIG. 1;

FIG. 3 is a transverse section, to an enlarged scale, taken on line 3—3 of FIG. 2;

FIG. 4 is a transverse section taken on line 4—4 of FIG. 3;

FIG. 5 is a perspective view of the spray control ring; and

FIG. 6 is a detail section taken in accordance with the line 6—6 of FIG. 2.

DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

The drawings show, to approximately 1–to–1 scale in FIG. 2 of the original bristol board, a spray device in accordance with the invention capable of delivering a sufficiently uniform spray, of proper density, to cover a baking pan of five inches across. This spray can be of circular outline, or, using improvements of another inventor, can be five inches square in outline. For larger sized pans, the spray head can be enlarged accordingly; and for rectangular pans, modifications are available.

The spray device has a main body **10** comprising a generally cylindrical upper part **11**, screw-threaded at the top, as at **12**, and formed therebelow with an annular peripheral air port **13**, below that with a peripherally milled external annular flange **14**, and it terminates at the bottom in a tubular, externally-threaded end **15**. The parts **11, 13, 14** and **15** are all coaxial. The tubular formation results from a bore **16** extending coaxially up into the end part **15**; and the end part **15** is formed with a shallow counterbore **19**.

Bore **16** is formed with a fillet **20** at the bottom, and meets a shallow coaxial reduced bore **22**. An oil, grease, or other liquid passage **23** extends through the body **10** from the bottom of bore **22** to the bottom of a tapper counterbore **24** in said upper body part **11**.

A connector fitting **26** in the nature of cap screws onto the upper part **11** of the body and extends down past annular port **13** into engagement with body flange **14**. Packing rings **27** seal the air port **13**. The fitting **26** has a bore **28** receiving a threaded pipe fitting **30** adapted to be screwed into bore **24**, and provided with an oil, liquid or grease passage **32** meeting the aforementioned passage **23**. The fitting **30** is somewhat diagrammatically illustrated, but will be understood to comprise in practice any hydraulic fitting adapted to couple an oil, grease or liquid supply pipe or hose to the passage **23** in the body **10**. The fitting **26** can be a cap on the end of a support arm, not shown; and also, the upper part of the cap, above the lower end of threads **12** omitted. A large nut, not shown, screwed onto part **11** and down against the remaining ring-shaped part of the originally assumed cap then holds the parts in assembly with the support arm (not shown) jointed with said ring part.

Fitting **26** also has an air passage **34** communicating with annular port **13** and with conduit **35** which supplies air under pressure, which may be in the range of 35–80 psi, depending upon the scale of the head, or the degree of atomization required. The air port **13** is in the form of an annular groove encircling the body

port **11.** A circular series of vertical air holes **39** are drilled between the inner end of bore **16** and the annular groove **13.** These holds may be, for example, **12** in number and of adequate bore to assure unrestricted flow. They supply a uniform flow of air down the bore **16,** in the cross-sectional form of an annulus.

A plug **40** mounted coaxially in body **11** has a coaxial duct or passage **42** for oil, grease, or liquids which is aligned with and communicated with the duct or passage **23** and **32.** The pin-like upper end extremity **41** of the plug is closely received in and aligned by the counterbore **22.** Just below the pin **41** the plug has an enlarged threaded section **44,** and below that a further enlarged cylindrical body **45.**

Three very thin, flat, radially-disposed struts **46** at 120° spacing extend vertically downward from the lower end of body **45,** outside the projected area of the duct **42,** and carry at their lower ends a flat imperforate oil deflection plate **48,** preferably an annular disc, whose center is aligned with the duct **42.** The lower side of this disc may have a cross bar **49** by which the plug may be conveniently grasped during assembly or disassembly.

The plug body **45** fits slideably into a sleeve **50,** and engages at its upper end an internal shoulder **52** at the upper end of the sleeve. A milled nut **53** screws onto the upper end part **44** of the plug, and seats downwardly against the upper end of the sleeve **50.** The lower end of sleeve **50** carries a head plate **55** in the form of a flat annular flange, and the periphery of this member **55** has an upwardly-turned cylindric flange **57** which is very closely, but slideably, received inside the counterbore **19.** The bottom of this counterbore may serve as a positioning stop. The flange **55** is positioned a short distance, in this instance about 0.010 to 0.030 inch, above the disc **48,** to allow oil to flow radially at all points as it emerges from under the flange **55** and above the disc **48,** over the disc edge **49.** The flange **55** is provided, just outside the circle of the disc **48,** with an annular pattern of very small, closely-spaced, outwardly angled, air discharge ports **60.** Typically, these ports may be about **48** in number, have a diameter of 0.017 inch, and be at an angle of typically 45° to the longitudinal axis of the body **10.** Angles within a range of 30°–60° have been used successfully, however.

An annular spray head **62** is screwed onto the threaded tubular member **15** at the lower end of body **10,** and holds sleeve **50** and plug **40** in place. This head **62** thus has a threaded bore **63** to receive member **15,** and has an annular ledge **64** at the bottom thereof which is abutted by a narrow outer edge portion of the underside of flange **55.** The ledge **64** has a sharp circular edge **66,** below which is a downwardly divergent or flared flow control skirt or surface **69** that leads from the edge **66** to a terminal bounding edge **70***a* at the intersection of surface **69** with the horizontal bottom **70.** The flared surface **69** may be substantially conical, or may be substantially conical but with local modifications, as at **71** in FIG. **2,** to achieve desired spray patterns.

A specific modification to achieve a square spray pattern is shown, but is the invention of Harold W. Hanson, Jr. and is claimed in an application filed on even date herewith, U.S. Patent application Ser. No. 344,074, and also assigned to the assignee of the present invention.

The operation of the spray head will be described first with the assumption of a substantially conical skirt or control surface **69,** at 45° to the longitudinal axis of the spray head, and without modification as at **71,** so that a 90° atomized spray cone will result. This angle may range between about 60° and 110°, or thereabouts. After that will be described improvements, not a part of the present invention, which will produce a spray cone with, say, a basic 90° central angle, but with modifications which square the corner portions of the 90° cone.

In its basic operation, then, air under pressure is turned on an instant before the start of the pumping of a predetermined charge of liquid, cooking oil, or grease, into the duct of the spray head. The total charge of this liquid goes through the spray head in one almost instantaneous burst, consuming perhaps a few hundredths of a second of time; and the liquid charge being emitted, the pressurized air is then cut off. Proper valving and timing to accomplish this sequence cycle is within the skill of the art and need not be disclosed herein for an understanding of the present invention. However, a suitable pumping system is disclosed in an application of Harold W. Hanson, Jr., U.S. Patent application Ser. No. 344,074.

It will thus be seen that charges are discharged in short intermittent bursts. The pan P may be stationary, or moving on a conveyor C, at the time it is coated with the oil, because of the very short duration of the burst of spray.

Considering the operation in more particular, as the oil, other liquid, or grease exits from the lower end of the duct **42,** it strikes the face of the deflecting plate or disc **48** and is turned radially outward in all directions through the annular port between disc **48** and flange **55,** flowing off and past the edge of disc **48,** and in contact with the flange **55.** The radially outwardly flowing "disc" of liquid will be seen to decrease in velocity proportionally with the increase in radius, because of increasing cross-sectional area. The air ports **60** discharge fine streams of air at high pressure and velocity against and through this thin disc or layer of liquid. A large proportion of this liquid oil, thus impinged upon by the fine, high velocity air streams resulting from the high pressure of the air fed to the device, is broken up, atomized into fine spray particles, and thus blown downwardly in an expanding pattern. Some liquid particles are emitted in generally downward direction off the edge of the disc **48** as the radially flowing liquid passes thereover. Finally, and most importantly, another part of the expanding liquid layer, clinging to the underside of the flange even after passage over the air ports **60,** impinges upon the conical control surface **69,** and thence changes direction to run down this surface, and go off the lower bounding edge **71***a* of this surface at its intersection with the horizontal face **70.**

The liquid thus flowing down the substantially conical face **69** goes off the lower edge **71***a* thereon in a finely atomized spray with a relatively well-defined conical outline. The spray provided is thus in the form of an expanding cone, or modified cone, filled with particles of atomized liquid which are directed down the cone to fill the pan with adequate uniformity. The particles run together on the surface of the pan, affording an oil or other coating of the requisite uniformity and thickness.

It will be seen that the invention supplies the atomized particles which make up the total spray cone from several sources within the spray head. This results in pressure gradients across the spray cone, but these gradients reduce in successive sections across the cone, with the result that towards the large end of the cone, the liquid particles have a uniformity of distribution that results in a deposit of liquid particles on the pan with the right density to assure the desired coating.

To achieve a substantially square spray outline, in accordance with the invention of Harold W. Hanson, Jr., Ser. No. 344,074, referred to hereinabove, the conical flow surface **69** is modified at four locations, 90° apart, by forming the conical surface with obtuse dihedral angled indentations **76.** Thus at each of such four 90°-shaped locations, a radial cut is made along a straight bottom line **77** which is at substantially 60° to the longitudinal axis of the device and which intersects, or nearly or substantially intersects, the upper circular edge **66** at the top of the conical flow surface **69.** This bottom line **77** intersects the horizontal bottom surface **70,** and the indentations **76** thus have flat plane faces **78** which intersect one another, as dihedral angle planes, at the bottom edge line **77.** In the present embodiment, which has given the desired result, this dihedral angle is substantially 130°. Thus, I have a substantially conical, or frusto conical, flow surface **69,** at a preferred angle of 45°, interrupted at 90° intervals by an indentation or valley defined at the bottom by a straight edge line **77** at an angle of substantially 60° in a radial plane, and provided with plane faces **78** meeting at the edge line **77** and thus forming an obtuse dihedral angle, which in the illustrative embodiment is substantially 130°. The conical surface **69** and the plane faces **78** intersect one another along curved boundary lines **80.** It will be noted that in a radial plane, the conical surface **69** makes an angle of substantially 45° with the longitudinal axis, and that in any radial plane intersecting a plane face **76,** the angle with the axis is substantially 60°, a difference of 15°. In regions in which a radial plane intersects both a conical surface area **9** (at 45°) and then a plane face area **78** at 60° (FIG. 7), the radial liquid flow along the flow surface continues to remain attached to the flow surface over and beyond the 15° deflection angle at the curved boundary lines **78.** Thus, in these regions, the spray is emitted at progressively increasing angles in directions toward the valley lines **77,** so as to "square" out the conical spray at four points spaced 90° apart. Thus, with the shapes and angles described and illustrated, the emitted spray cone is modified to substantially the shape of a four-sided pyramid, such as conforms relatively closely to the outline of a square pan. Substantially rectangular spray patterns are accomplished by spacing the indentations as though they were at the four corners of a rectangle which is similar to the rectangular pan to be used.

The nozzle of the invention has a novel construction facilitating cleaning. The spaces cut in the plug **40** between the lower end of the plug and the disc **48,** and between the fins **46,** are amply large for easy clean-out. To reach these spaces, nut **53** can be removed or loosened. The parts can be disassembled or opened up to clean the space between parts **48** and **55.** The nozzle could be constructed to accomplish this while the nozzle is in operation by using spring-loading or a locking-part accessible from the outside.

I claim:

1. In a spray head for discharging a short burst of atomized spray of a non-gaseous fluid, the combination of:

means containing a conduit for said fluid, such conduit having an open discharge end;

a fluid distribution plate having a center aligned with said discharge end of said conduit, and having a flow surface substantially perpendicularly facing said discharge end of said conduit;

a flange of larger diameter than said distribution plate having a surface circumscribing, confronting and shortly spaced from said flow surface of said plate, said plate and flange forming therebetween a thin flow space through which a layer of fluid from said conduit flows radially outward in all directions;

means including said flange forming a chamber for pressurized air;

an air passage means for conveying air under pressure to said chamber;

an endless row of fine, close-spaced air ports extending through said flange in a substantially ring pattern circumscribing said distribution plate and spaced radially outwardly therefrom, such that high pressure air within said chamber discharges from said ports into and through said fluid layer to form an atomized spray; and

an outwardly angled skirt joining said flange outside said row of air ports to receive and deflect angularly downward the remainder of said radially flowing fluid layer to flow down the inside surface of said skirt and discharge as a spray off the lower edge portion thereof.

2. The spray head according to claim **1,** wherein:

said air ports extend through said flange on an outward angle.

3. The spray head of claim **1,** wherein:

said fluid distribution plate and said ported flange are annular in form and are coaxial with said discharge end of said conduit, the annular disc being of larger diameter than said plate, and wherein said air ports are in a circular row just outside the periphery of the annular plate.

4. The spray head of claim **3,** wherein said annular distribution plate and said ported disc have substantially flat confronting faces.

5. The spray head according to claim **3,** wherein:

said conduit-containing means is a generally cylindric body, into one end portion of which is sunk an axial bore terminating in an annular shoulder, said one end portion of said body being screw-threaded;

said conduit terminating in said body in an axial opening through said annular shoulder,

said flange closing the outer end of said axial bore to provide said air chamber,

a concentric hub extending inwardly of said axial bore from said flange, radially inside said ports in said flange, the bore of said hub continuing axially through said flange,

a hollow plug having means mounting it coaxially on said deflection plate, the inner extremity of said hollow plug having a fluid tight joint with the extremity of said conduit, said plug being received with a close-sliding fit through the bore in said hub, said mounting means for said plug on said disc affording openings between said plug and said deflec-

tion plate for fluid passage and for cleanout therebetween;

means limiting the spacing distance between the deflection plate and the ported flange to a determined spacing distance, and means releasably securing said plug and said hub to one another with said deflection plate and ported disc at said determined spacing distance, and

said skirt embodying a cap screwed into said screw-threaded end portion of said body, said cap having an internal flange at its outer end terminating in an annular internal circular edge engaging said ported plate shortly outside the circular array of air ports opening through said plate; and

a divergent nozzle throat formed in said flange extending angularly outward from said internal edge of said internal flange.

6. The nozzle according to claim **5** wherein said throat is in the form of a frustum of a cone.

7. The nozzle according to claim **5** wherein said hub has an internal annular flange at its inner end abutted by an annular shoulder on said plug to pre-determine the distance between said deflection plate and said ported disc,

said means for releasably screwing said plug and hub to one another comprising a screw-threaded section on said plug inwardly of said internal annular flange, and

a nut on said screw-threaded section of said plug engaging said internal annular flange on said hub.

8. The nozzle according to claim **6** wherein said air passage means includes a channel encircling said body adjacent to said annular shoulder, and a plurality of air ports extending through said shoulder between said channel and said chamber.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,825,188 Dated July 23, 1974

Inventor(s) BEAUFORD C. DOERING

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Name of the Assignee is mispelled; change

PAR-WEY MFG. CO. to PAR-WAY MFG. CO.

Signed and sealed this 8th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents