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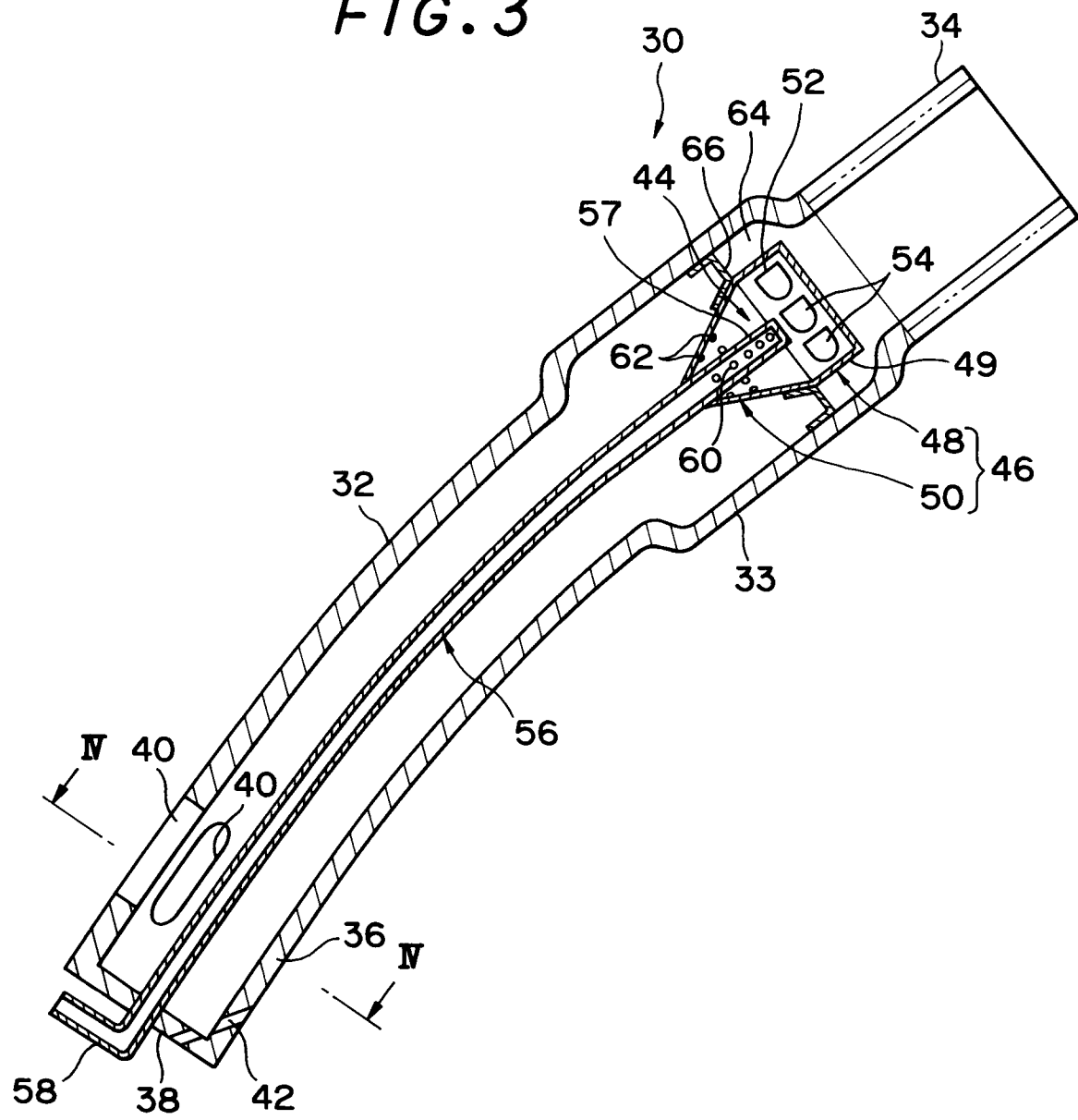
③① Priority : 16.07.90 JP 185325/90 ④③ Date of publication of application : 22.01.92 Bulletin 92/04 ⑧④ Designated Contracting States : DE FR GB ⑦① Applicant : Mitsubishi Oil Company, Limited no. 2-4, Toranomom 1-chome Minato-ku Tokyo (JP)	⑦② Inventor : Yano, Hisashi 1019-233, Aza Araisawa, Kuden-cho, Sakae-ku Yokohama-shi, Kanagawa (JP) Inventor : Fujioka, Mituru 184-4, Kosuzume-cho, Totsuka-ku Yokohama-shi, Kanagawa (JP) Inventor : Kitada, Akiharu 6, Kitaterao 6-chome, Tsurumi-ku Yokohama-shi, Kanagawa (JP) ⑦④ Representative : Charlton, Peter John et al Elkington and Fife, Prospect House, 8 Pembroke Road Sevenoaks, Kent TN13 1XR (GB)
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⑤④ **Liquid supply nozzle.**

⑤⑦ A liquid supply nozzle is disclosed which is used for filling a container such as a tank with the liquid such as fuel. The nozzle comprises a cylindrical nozzle body including a base end portion having an open end (14) and a free end portion (16) having a closed end (18), and a plurality of discharge openings (20) formed in an upper area of the free end portion and through the wall of the nozzle body. The liquid fed into the nozzle body (12) from the base end portion is ejected via the discharge openings (20) upwardly, i.e. in a direction opposite to a liquid level, and then drops onto the level due to a gravity. A flow velocity when the liquid reaches the level is thus lowered as compared with an ejection directly toward the level, reducing a foaming on the level. The plural discharge openings divide the liquid flow into streams having a smaller mass when ejected, to further restrain the foaming. The nozzle may have within, a chamber for generating a vertical flow of the liquid in order to separate and discharge gaseous contaminants from the liquid.

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FIG. 3



The present invention relates to a liquid supply nozzle for use in filling a container with a liquid and, more particularly, to an improvement in the nozzle in order to reduce a foaming on liquid level during the filling.

A liquid supply nozzle has widely been used in various industries, one of typical examples being found in a gas station where a tank in automobile is filled with a fuel by using the nozzle coupled to a liquid regulator which in turn is connected with a hose. When filling the fuel, the nozzle is inserted into a filler neck connected to the tank and ejects the fuel from its discharge opening. Other examples are those nozzles used in filling liquid raw materials or products into a transporting container such as a tank rolly.

In using the nozzles it is naturally desirable to shorten a filling time, and this can be achieved by increasing a flow velocity at which the liquid ejects from the nozzle. The increased velocity, however, causes a foaming on a liquid level in the container due to a large mechanical energy of the ejected liquid, the foaming being a consequence of mixture of air or other gases with the liquid. The foaming is further activated if the liquid to be supplied contains gaseous contaminants. A problem resulting from the foaming is that it tends to prevent a level gauge from detecting a true liquid level because the gauge often indicates the foaming as the liquid level erroneously. Once such an error occurs, exact filling of the container becomes impossible.

It has thus been proposed in the art concerned to restrain the foaming through various means, and there are two major proposals. One of them involves a baffle board which is arranged in the container to face the discharge opening of the nozzle. The liquid ejected from the nozzle beats against the baffle board before it reaches the liquid level, lowering the flow velocity to result in a reduced foaming. However, provision of such a board in the container necessarily diminishes an effective volume of the container. Another major proposal uses a computer-controlled nozzle which intermittently ejects the liquid in accordance with a program stored in the computer. The program is so prepared that the ejection of the liquid is suspended for a predetermined period of time during which the foaming disappears. While this system is believed almost satisfactory, it increases the cost of the nozzle significantly. Further, the intermittent ejection elongates the filling time and loses an efficiency.

Accordingly, an object of the invention is to provide a liquid supply nozzle which has a simple structure and can be manufactured with low cost but yet may restrain a foaming on liquid level.

Another object of the invention is to provide a liquid supply nozzle capable of restraining the foaming without reducing an effective volume of a container to be filled with the liquid.

A further object of the invention is to provide a

liquid supply nozzle which may efficiently fill the container with the liquid while restraining the foaming.

According to the invention, a liquid supply nozzle comprises a cylindrical body including a base end portion having an open end and a free end portion having a closed end, and a plurality of discharge openings formed in an upper area of the free end portion and through the wall of the nozzle body.

With these arrangements, the liquid fed into the nozzle body from the base end portion is ejected via the discharge openings. Since the openings are formed in the upper area, i.e. the area which is positioned opposite to a liquid level, the ejection is directed upwardly and the liquid then drops onto the level due to a gravity. This significantly reduces a flow velocity when the liquid reaches the level, as compared with an ejection directly toward the level, whereby the foaming is restrained. Additionally, the plurality of discharge openings divide the liquid flow into plural streams when ejected, so that the foaming is further reduced due to a fact that each stream has a relatively small mass.

In an embodiment of the invention, the nozzle body is curved in such a manner that the free end portion is positioned at a level below the base end portion when the latter is held in a horizontal plane. Each discharge opening is in the form of a slot having a major axis which extends along the longitudinal axis of the nozzle body. Three discharge openings are formed within an angular extent of about 120° in the upper area with the middle of those openings being located at the top section of the nozzle body. A drain hole is provided in a lower area of the free end portion for draining a residual liquid that has not ejected from the discharge openings.

Preferably, the nozzle includes a chamber provided within the nozzle body for generating a vortical flow of the liquid, that is fed into the nozzle body, to thereby separate gaseous contaminants from the liquid, and means for discharging the separated gaseous contaminants from the nozzle body. This enables to further reduce the foaming as the liquid ejected from the nozzle has already been filtered and contains little gaseous contaminants.

The chamber may be defined by a cyclone having a cylindrical part closed at an upstream end thereof and a downstream conical part integral with the cylindrical part, the conical part being tapered toward a head thereof remote from the cylindrical part. An inlet may be formed through the wall of cylindrical part to introduce the liquid into the chamber along a tangent of the cylindrical part at the inlet.

The discharge means may comprise a removal pipe in the nozzle body, which pipe has a proximal end extending in the chamber along an axial center thereof and a distal end opened toward the outside of the nozzle body. The proximal end has formed through the wall thereof a plurality of orifices to permit

the gaseous contaminants to flow into the removal pipe. The distal end may project through the closed end of the nozzle body and be bent toward the upper area. Alternatively, the distal end may be received in the nozzle body and bent toward the upper area to terminate within one of the discharge openings.

The conical part of the cyclone may have a plurality of pores to permit the liquid to flow out of the chamber. A partition may be provided to sealingly divide an annular space between the nozzle body and the cyclone into upstream and downstream sides. The inlet opens into the upstream side while the pores opens into the downstream side.

Other objects, features and advantages of the invention will be apparent from the following description of the preferred embodiments thereof when taken in conjunction with the accompanying drawings.

FIG. 1 is a longitudinally sectioned schematic view illustrating a liquid supply nozzle according to a first embodiment of the invention;

FIG. 2 is a cross sectional view taken along line II-II in FIG. 1;

FIG. 3 is a longitudinally sectioned schematic view illustrating a liquid supply nozzle according to a second embodiment of the invention;

FIG. 4 is a cross sectional view taken along line IV-IV in FIG. 3;

FIG. 5 is a view similar to FIG. 3 but showing a liquid supply nozzle according to a third embodiment of the invention; and

FIG. 6 is a cross sectional view taken along line VI-VI in FIG. 5.

Referring now to FIGS. 1 and 2 of the drawings, a liquid supply nozzle 10 according to a first embodiment of the invention comprises a cylindrical nozzle body 12 having a base end portion 14 and a free end portion 16. The base end portion 14 is coupled to a liquid regulator (not shown) which in turn is connected with a hose (also not shown) through which a liquid is fed into the nozzle body 12 under a pressure, while the free end portion 16 terminates at a closed end 18. As seen from FIG. 1, the nozzle body 12 is formed to have a large radius of curvature so that when the base end portion 14 is held in a horizontal plane, the free end portion 16 takes a position at a level below the base end portion 14. The nozzle 10 is to be used with such an attitude, and the terms relating to "upper" and "lower" used herein for indicating portions of nozzle body 12 should be construed as indicating those portions when the nozzle 10 is of the attitude in FIG. 1.

The nozzle body 12 has a circular cross section and is provided at the free end portion 16 with plural discharge openings 20 each formed through the wall of nozzle body, which opening 20 is in the shape of slot having a major axis extending along the longitudinal axis of nozzle body. It is essential in the invention that all of these openings 20 are provided in the upper area of the free end portion 16 of nozzle body.

In the illustrated example, three openings 20 are formed at substantially equal intervals within an angular extent of about 120°. Also provided in the free end portion 16 but at the lower area thereof is a drain hole 22 which extends obliquely relative to the longitudinal axis of nozzle body 12 through the closed end 18 and the wall of nozzle body with interconnected by an inside space thereof.

It is now assumed that the base end portion 14 is coupled to a liquid regulator connected with a hose and the free end portion 16 is inserted into a container (also not shown) to be filled with a liquid, such as a gasoline tank of an automobile. When the liquid is fed under a pressure through the hose and the liquid regulator to the nozzle 10, it flows within the nozzle body 12 and is ejected via the three openings 20 at the free end portion 16. Since the openings 20 are formed in the upper area, the liquid is ejected upwardly from the openings, i.e. in the direction opposite to a liquid level L in the container, and then drops onto the level L due to a gravity. Accordingly, a velocity of the liquid when it reaches the level L becomes much smaller as compared with a case where the liquid is ejected directly toward the level L. Further, the liquid flow is divided into three streams by the three openings 20 when discharged, so that each stream has a relatively small mass and therefore a small kinetic energy. These result in a remarkable reduction of foaming caused by the liquid drop onto the level L. After the liquid supply is finished, a part of liquid which was not ejected from the openings 20 is drained via the drain hole 22, preventing a residual liquid from staying within the nozzle 10.

The nozzle body 12 is illustrated as having the circular cross section, but it may be in the form of sleeve having any cross section.

FIGS. 3 and 4 show a liquid supply nozzle according to a second embodiment of the invention, the nozzle 30 comprising a cylindrical nozzle body 32 which is substantially identical with the nozzle body 12 in the first embodiment except that it has a diametrically enlarged section 33 adjacent a base end portion 34. Defined within the enlarged section 33 is a chamber 44 for generating a vortical flow of the liquid that enters the nozzle body 32 from the base end 34. The chamber 44 is confined by a cyclone 46 comprising a cylindrical part 48 which is closed at one end facing the base end portion 34 and a conical part 50 which is integrally formed with the cylindrical part 48 and tapered toward a head remote from the cylindrical part. A plurality of inlets 52 are formed through the side wall 49 of cylindrical part 48 in order to introduce the liquid into the chamber 44. Each inlet 52 is provided by punch-pressing the side wall 49 so that a part of the wall adjacent the inlet forms a deflector 54 extending substantially parallel to a tangent of the side wall 49 at a point of the inlet.

Reference numeral 56 denotes a removal pipe of

which closed end is located within the chamber 44. The removal pipe 56 is fixedly secured to the cyclone 46 at the tapered head thereof and extends in the nozzle body 32 along its longitudinal axis. A distal end 58 of the pipe 56 projects through a closed end 38 of nozzle body 32 and is so bent as to open upwardly, i.e. toward the side of free end portion 36 where discharge openings 40 are formed. A suitable seal is provided between the pipe 56 and the closed end 38 to avoid any leakage therefrom. The proximal end 57 of the pipe 56 in the chamber 44 is perforated to have a number of orifices 60, while the wall of conical part 50 has a lot of pores 62 which communicates the chamber 44 with an annular space 64 defined between the cyclone 46 and nozzle body 32. This space 64 is divided into an upstream side and a downstream side by a ring-shaped partition 66 that is fixed at one end to the inner surface of nozzle body 32 and at the other end to the cyclone 46 at between the cylindrical and conical parts. The partition 66 thus serves to support the cyclone 46 while preventing the liquid from bypassing the chamber 44.

The liquid fed to the nozzle 30 via the liquid regulator coupled to the base end 34 is introduced into the chamber 44 through the inlets 52 which cooperates with the deflectors 54 to generate a vortical flow of the liquid. This vortical flow is intensified by the conical part 50 to create a centrifugal force which acts on the liquid, resulting in a separation of gaseous contaminants contained in the liquid due to a difference in density. The thus separated gaseous contaminants gather around the axis of the chamber 44 and flow into the removal pipe 56 via the orifices 60 for discharge from the upwardly directed opening of distal end 58. On the other hand, the remaining liquid, which contains little gaseous contaminants, flows along the wall of conical part 50 and passes through the pores 62 into the downstream side of space 64. The liquid is finally ejected from the openings 40 in the free end portion 36 as in the first embodiment but with a significantly reduced volume of gaseous contaminants. Therefore, the foaming at the liquid level is further restrained. As in the above embodiment, residual liquid is drained via a hole 42.

In a third embodiment shown in FIGS. 5 and 6, a liquid supply nozzle 70 is different from that of the second embodiment in that a distal end 74 of removal pipe 72 is arranged within the nozzle body 32. The distal end 74 is bent substantially at a right angle to the longitudinal axis of nozzle body 32 and its open end 76 is received in one of the discharge openings 40, i.e. in the middle opening in the illustrated example. As seen from the figures, the open end 76 is located within the length of the discharge opening 40, the length being defined by the thickness of the wall of nozzle body 32. During the ejection of the liquid a negative pressure is created in the discharge opening 40 and acts on the removal pipe 72 through the open

end 76, so that the gaseous contaminants gathered in the pipe may be sucked out from the open end 76. This ensures a prevention of reverse flow of the gaseous contaminants into the chamber 44. Other structures of this embodiment are the same as those of the second embodiment, and further description is therefore omitted.

As it may be understood from the foregoing description, the liquid supply nozzle according to the present invention enables to reduce a mechanical energy of the liquid by lowering both of the velocity and mass thereof when it reaches the liquid level, thus preventing or at least significantly reducing the foaming on the liquid level. It is important that such an effect can be achieved by the simple arrangement of the discharge openings. By providing the vortical flow generating chamber within the nozzle body, this advantageous effect is further enhanced as the gaseous contaminants which may be contained in the liquid are removed before the liquid is discharged from the openings.

Although the present invention has been described with reference to the preferred embodiments thereof, many modifications and alterations may be made within the spirits of the invention.

Claims

1. A liquid supply nozzle comprising a cylindrical nozzle body including a base end portion having an open end and a free end portion having a closed end, and a plurality of discharge openings formed in an upper area of said free end portion and through the wall of said nozzle body.
2. A liquid supply nozzle as claimed in claim 1, wherein said nozzle body is curved in such a manner that said free end portion is positioned at a level below said base end portion when said base end portion is held in a horizontal plane.
3. A liquid supply nozzle as claimed in claim 1, wherein said discharge opening is in the form of a slot having a major axis extending along the longitudinal axis of said nozzle body.
4. A liquid supply nozzle as claimed in claim 1, wherein three said discharge openings are formed within an angular extent of about 120° in said upper area with the middle of said three discharge openings being located at the top section of said nozzle body.
5. A liquid supply nozzle as claimed in claim 1, further comprising a drain hole formed in a lower area of said free end portion for draining a residual liquid that has not been ejected from said dis-

charge openings.

6. A liquid supply nozzle as claimed in claim 1, further comprising a chamber provided within said nozzle body for generating a vortical flow of the liquid that is fed into said nozzle body to thereby separate gaseous contaminants from the liquid, and means for discharging the separated gaseous contaminants from said nozzle body.

7. A liquid supply nozzle as claimed in claim 6, wherein said chamber is defined by a cyclone having a cylindrical part closed at an upstream end thereof and a downstream conical part integral with said cylindrical part, said conical part being tapered toward a head thereof remote from said cylindrical part.

8. A liquid supply nozzle as claimed in claim 7, wherein said cylindrical part has formed through the side wall thereof an inlet adapted to introduce the liquid into said chamber along a tangent of said cylindrical part at said inlet.

9. A liquid supply nozzle as claimed in claim 8, wherein said inlet is formed by punch-pressing the side wall of said cylindrical part while providing a deflector.

10. A liquid supply nozzle as claimed in claim 7, wherein said discharging means comprises a removal pipe in said nozzle body, said removal pipe having a proximal end extending in said chamber along an axial center thereof and a distal end opened toward the outside of said nozzle body.

11. A liquid supply nozzle as claimed in claim 10, wherein said proximal end has formed through the wall thereof a plurality of orifices to permit the gaseous contaminants to flow into said removal pipe.

12. A liquid supply nozzle as claimed in claim 7, wherein said conical part of said cyclone has formed through the wall thereof a plurality of pores to permit the liquid to flow out of said chamber.

13. A liquid supply nozzle as claimed in claim 12, further comprising a partition sealingly dividing an annular space between said nozzle body and said cyclone into upstream and downstream sides, and wherein said inlet opens into said upstream side while said pores open into said downstream side.

14. A liquid supply nozzle as claimed in claim 13, wherein said partition is secured at one end thereof to the inner surface of said nozzle body

and at the other end thereof to said cyclone at between said cylindrical part and said conical part.

15. A liquid supply nozzle as claimed in claim 10, wherein said distal end of said removal pipe projects through said closed end in said free end portion and is bent toward said upper area where said discharge openings are formed.

16. A liquid supply nozzle as claimed in claim 10, wherein said distal end of said removal pipe is received in said nozzle body and is bent toward said upper area to terminate within one of said discharge openings.

17. A liquid supply nozzle comprising:
a cylindrical nozzle body including a base end portion having an open end and a free end portion having a closed end;
a plurality of discharge openings formed in an upper area of said free end portion and through the wall of said nozzle body;
a chamber in said nozzle body for generating a vortical flow of the liquid that is fed into said nozzle body to thereby separate gaseous contaminants from the liquid; and
means for discharging the separated gaseous contaminants from said nozzle body.

18. A liquid supply nozzle as claimed in claim 17, wherein said chamber is defined by a cyclone having cylindrical part closed at an upstream end thereof and a downstream conical part integral with said cylindrical part, said conical part being tapered toward a head thereof remote from said cylindrical part.

19. A liquid supply nozzle as claimed in claim 18, wherein said cylindrical part has formed through the side wall thereof an inlet adapted to introduce the liquid into said chamber along a tangent of said cylindrical part at said inlet.

20. A liquid supply nozzle as claimed in claim 19, wherein said inlet is formed by punch-pressing the side wall of said cylindrical part while providing a deflector.

21. A liquid supply nozzle as claimed in claim 18, wherein said discharging means comprises a removal pipe in said nozzle body, said removal pipe having a proximal end extending in said chamber along an axial center thereof and a distal end opened toward the outside of said nozzle body.

22. A liquid supply nozzle as claimed in claim 21, wherein said proximal end has formed through

the wall thereof a plurality of orifices to permit the gaseous contaminants to flow into said removal pipe.

23. A liquid supply nozzle as claimed in claim 18, wherein said conical part of said cyclone has formed through the wall thereof a plurality of pores to permit the liquid to flow out of said chamber. 5
24. A liquid supply nozzle as claimed in claim 23, further comprising a partition sealingly dividing an annular space between said nozzle body and said cyclone into upstream and downstream sides, and wherein said inlet opens into said upstream side while said pores open into said downstream side. 10 15
25. A liquid supply nozzle as claimed in claim 24, wherein said partition is secured at one end thereof to the inner surface of said nozzle body and at the other end thereof to said cyclone at between said cylindrical part and said conical part. 20
26. A liquid supply nozzle as claimed in claim 21, wherein said distal end of said removal pipe projects through said closed end in said free end portion and is bent toward said upper area where said discharge openings are formed. 25
27. A liquid supply nozzle as claimed in claim 21, wherein said distal end of said removal pipe is received in said nozzle body and is bent toward said upper area to terminate within one of said discharge openings. 30 35
28. A liquid supply nozzle as claimed in claim 18, wherein said nozzle body has a diametrically expanded section adjacent said base end portion, and wherein said cyclone is accommodated in said expanded section. 40

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FIG. 1

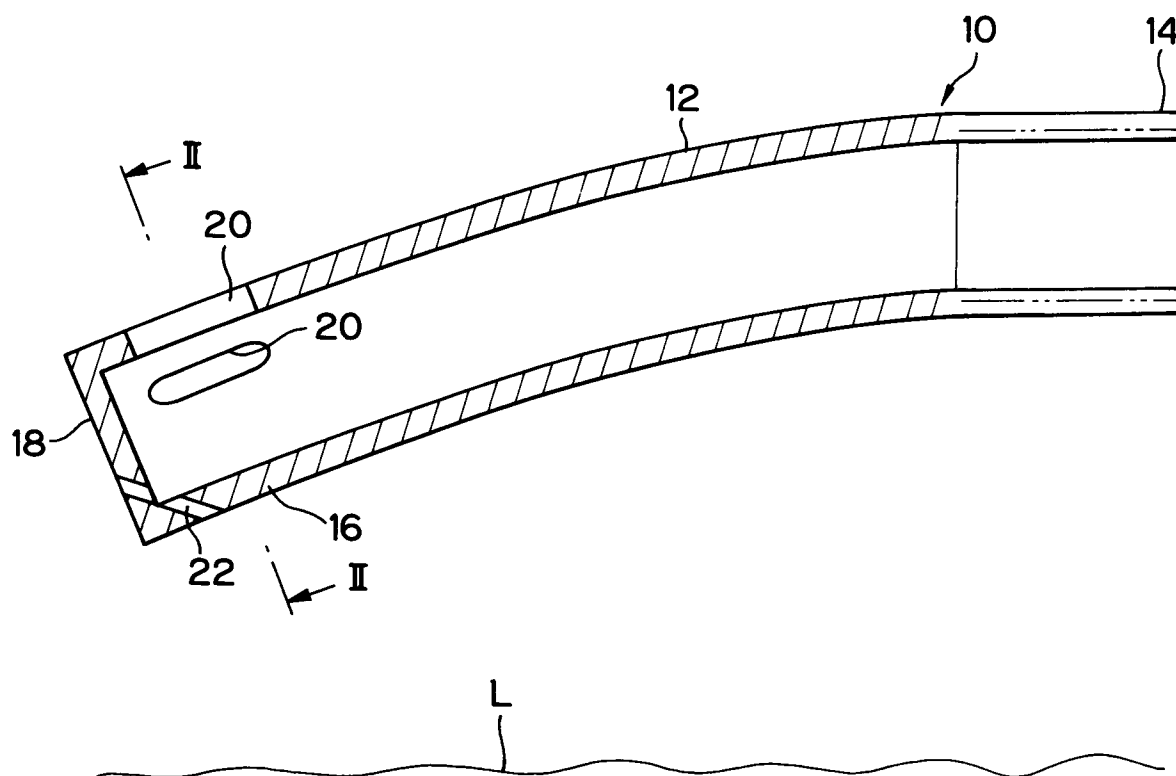


FIG. 2

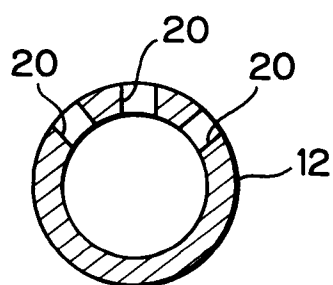


FIG. 3

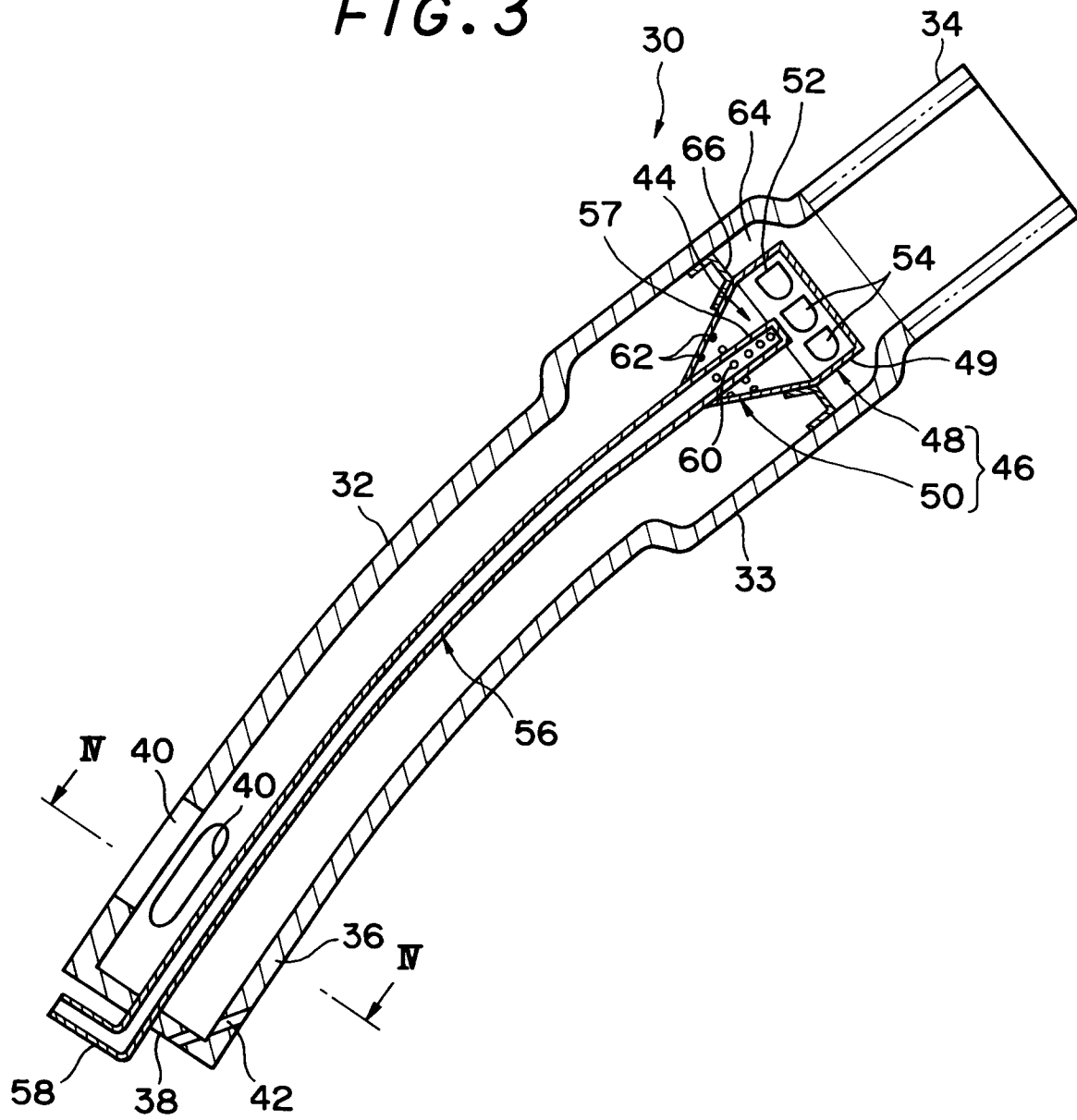


FIG. 4

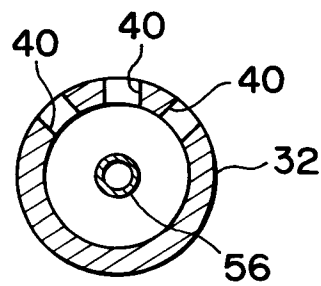


FIG. 5

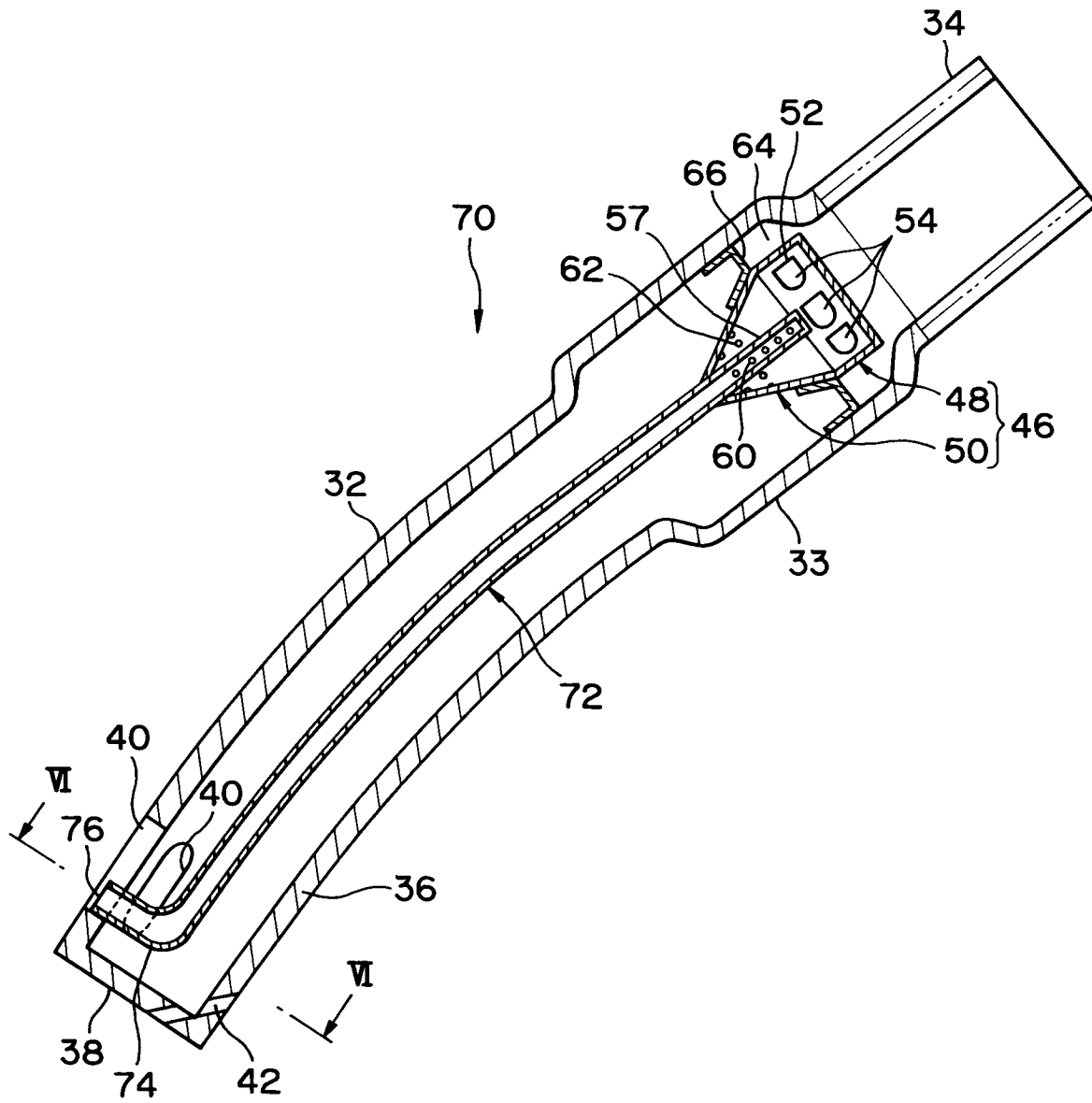
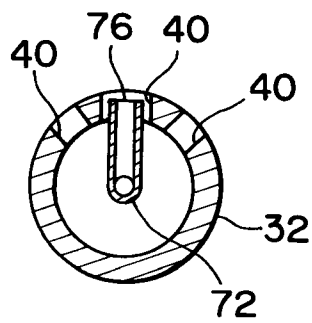


FIG. 6





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 6459

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
P, X	WO-A-9 014 995 (VEMCO, INC.) * page 10, line 26 - page 11, line 2; figures 1-3 *	1, 2	B67D5/37 B67D5/58
X	FR-A-1 273 813 (DEVÈZE)	1-3	
Y	* column 1, last paragraph - column 2, paragraph 4 *	6, 17	
A	* figure 2 *	4	
Y	US-A-3 715 863 (ZANONI) * column 6, line 38 - line 45; figure 2 *	6, 17	
X	US-A-1 660 627 (SEGELKEN) * figure 2 *	1-3	
A	DE-C-576 838 (SIEMENS & HALSKE AG) * figure 1 *	7, 18	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B67D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23 OCTOBER 1991	Examiner MARTINEZ NAVARRO A.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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