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(54) **Liquid filling nozzle**

Flüssigkeitsfüllstutzen

Ajutage de remplissage pour liquides

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to liquid filling devices for use in filling containers with fluid food such as milk.

[0002] Liquid filling nozzles of the type mentioned are already known which comprise a vertical tubular nozzle body having a discharge opening at the lower end thereof, and an upwardly or downwardly movable plug for opening or closing the discharge opening, the plug being provided with a seal portion disposed at the lower end of an outer peripheral wall thereof and shaped in conformity with the shape of the discharge opening, the seal portion being provided with a spreader portion positioned thereabove and tapered upward, the spreader portion being in the form of a cone having a tapered part (see, for example, the publication of JP-U No. 4-65709).

[0003] The liquid to be filled is discharged from the filling nozzle in a direction substantially along the spreader portion. If the spreader portion is given a relatively small taper angle with a vertical, the liquid to be filled is discharged downward to impinge directly on the liquid surface in the container and markedly bubble up the liquid. Further since it is difficult to give a large area to the discharge opening, there is a need to increase the upward and downward stroke of the plug. An increased stroke results in a prolonged operation control time and gives increased weight to the plug.

[0004] Conversely if the spreader portion is tapered at a relatively large angle with a vertical, the impingement of the liquid on the liquid surface is easily avoidable, but the liquid impinges on the wall of the container with a great impact, entailing the problem of causing marked bubbling and resulting in a lower filling capacity. Especially if the liquid is splashed on the upper edge portions of inner surface of the container to be sealed, there arises the problem of producing a faulty seal.

SUMMARY OF THE INVENTION

[0005] An object of the present invention is to provide a liquid filling nozzle which ensures an efficient filling operation by preventing the bubbling of the liquid to be filled or splashing of the liquid on the container portions to be sealed and wherein the plug need not be given an increased upward and downward stroke.

[0006] The present invention provides a liquid filling nozzle according to claim 1.

[0007] With the liquid filling nozzle of the invention, the liquid to be filled is discharged in a direction close to a vertical at the start of the filling operation, so that the liquid is unlikely to impinge on the wall of the container. With the progress of the filling operation, the liquid is guided toward a direction closer to a horizontal and as shifted from the direction close to a vertical. The liquid is therefore prevented from impinging on the ascending liquid

surface and from bubbling up to ensure an efficient filling operation. Furthermore, the liquid is unlikely to splash on the upper edge portions of inner surface of the container to be sealed at the start or upon completion of the filling operation, while the plug need not be given an increased upward and downward stroke.

[0008] When the reference points are two in number, and if the contour is defined by two straight lines, the plug can be of a relative simple shape.

[0009] The plug may be in the form of a cone having two tapered parts positioned one above the other.

[0010] If the reference points are infinite in number to define the contour by a curve, the plug can be given a desired shape.

[0011] The plug may be in the form of a paraboloid of revolution.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a view in vertical longitudinal section of a filling nozzle according to the invention;

FIG. 2 is a view in section taken along the line II-II in FIG. 1;

FIG. 3 includes diagrams showing the shape of a plug for use in the filling nozzle in detail; and

FIG. 4 includes diagrams corresponding to those of FIG.

3 and showing another example of plug.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Embodiments of the invention will be described below with reference to the drawings.

[0014] Referring to FIG. 1, a liquid filling nozzle comprises a vertical tubular nozzle body 11, a check valve 12 disposed inside the nozzle body 11 at an intermediate portion of the height thereof, and a shutoff valve 13 provided at the lower end of the nozzle body 11.

[0015] A hydraulic cylinder 22 facing vertically downward is mounted by a vertical tubular yoke 21 on the upper end of the nozzle body 11. The hydraulic cylinder 22 has a piston rod 23 extending into the nozzle body 11 through a top wall of the nozzle body 11. The piston rod 23 has a portion positioned inside the nozzle body 11 and sealed off by bellows 24. The nozzle body 11 has a peripheral wall provided with an inlet 25 close to the upper end of the wall. The inlet 25 is connected to an unillustrated metering cylinder by a connecting duct 26. The liquid to be filled is fed to the nozzle body 11 intermittently in a specified amount at a time. The nozzle body 11 has a discharge opening 27 at its lower end.

[0016] The check valve 12 comprises a seat ring 31 provided on the inner surface of the nozzle body 11 at an intermediate portion of the height thereof, a valve element 33 resembling the combination of two cones with

their bases fitting to each other, having an O-ring 32 attached to an outer peripheral edge of the element and vertically movable into intimate contact with the seat ring 31 from below, a vertical stem 35 extending straight upward from the center of the top wall of the valve element 33 and provided at its upper end with a spring retainer 34 which is opposed to the lower end of the piston rod 23 and spaced therefrom by a small distance, a stem guide 37 provided around the stem 35 and attached to the seat ring 31 by arms 36 extending from circumferential portions of the ring 31 obliquely upwardly inward, and a compression coil spring 38 fitted around the stem 35 and provided between the spring retainer 34 and the upper ends of the arms 36.

[0017] The shutoff valve 13 comprises a generally conical plug 41 movable into or out of the discharge opening 27, and a vertical stem 42 extending straight upward from the upper end of the plug 41 and having an upper end integral with the lower end of the valve element 33.

[0018] The stem 42 is provided with three radial guide vanes 43 extending from a lower portion of the stem 42 to the outer peripheral wall of the plug 41 and positioned at three locations dividing the plug 41 into three equal portions along the circumference thereof. As shown in detail in FIG. 2, each of the guide vanes 43 is provided at its outer end with a circular-arc guide face 44 in sliding contact with the inner surface of the nozzle body 11.

[0019] When the liquid to be filled is sent into the nozzle body 11 from the metering cylinder, the check valve 12 is opened with the pressure of the liquid. Simultaneously with this, the plug 41 is pushed down, discharging the liquid from the opening 27.

[0020] When the piston rod 23 of the hydraulic cylinder 22 is advanced to depress the stem 35 of the check valve 12, the valve element 33 is moved away from the seat ring 31 and the plug 41 is moved away from the discharge opening 27, whereby both the check valve 12 and the shutoff valve 13 are held open. The filling nozzle is cleaned and sterilized by causing a cleaning disinfectant solution to flow through the nozzle in this state.

[0021] FIG. 3 shows the shape of the plug 41 in detail. The plug 41 is provided at the lower end of its outer peripheral wall with an annular seal portion 51 shaped in conformity with the shape of the discharge opening 27. Extending upward from the seal portion 51 is an upwardly tapered spreader portion 52. The spreader portion 52 is in the form of a cone comprising an upper tapered part 61 and a lower tapered part 62.

[0022] Suppose the upper tapered part 61 has an upper end diameter D_1 , the upper tapered part 61 and the lower tapered part 62 have a boundary diameter D_2 , the lower tapered part 62 has a lower end diameter D_3 , the upper tapered part 61 has a height L_1 , and the lower tapered part 62 has a height L_2 . The taper $(D_2-D_1)/L_1$ of the upper tapered part 61 is greater than the taper $(D_3-D_2)/L_2$ of the lower tapered part 62. When the contour of one side of a vertical longitudinal section of the spreader portion 52 is observed to describe the shape of the

spreader portion 52 in another way, the contour has an upper straight line M1 and a lower straight line M2. The angle θ_1 the upper line M1 makes with a vertical is greater than the angle θ_2 the lower line M2 makes with a vertical.

[0023] FIG. 3(a) shows the state of the discharge opening 27 immediately after the start of a filling operation. In this state, the lower edge of the nozzle body 11 defining the discharge opening 27 is opposed to the lower tapered part 62. The liquid to be filled is discharged from between the lower edge defining the opening 27 and the lower tapered part 62 and spread along the outer surface of the lower tapered part 62.

[0024] FIG. 3 (b) shows the discharge opening 27 as almost fully opened. In this state, the lower edge defining the discharge opening 27 is opposed to the upper tapered part 61 instead of the lower tapered part 62. While the liquid to be filled spreads along the outer surface of the upper tapered part 61, the liquid is spread in a direction closer to a horizontal and as shifted from a direction close to a vertical. In other words, the liquid flow is guided closer to the downward direction in the state of FIG. 3(a) than in the state of FIG. 3(b). For this reason, the liquid to be filled is less likely to be directed toward the wall of the container, and the upper edge portions of inner surface of the container to be sealed are unlikely to become wet with the liquid to be filled. The liquid is guided closer to a direction toward the container wall in the state of FIG. 3(b) than in the state of FIG. 3(a). Consequently, the liquid is prevented from impinging on the liquid surface gradually ascending with the progress of the filling operation.

[0025] FIG. 4 shows a plug 41 of different shape. Like the plug already described, this plug 41 comprises a seal portion 51 and a spreader portion 52. The spreader portion 52 comprises a paraboloid of revolution.

[0026] FIG. 4 shows an upper straight line N1 and a lower straight line N2. The upper line N1 is a tangent line at an upper reference point O1. The lower line N2 is a tangent line at a lower reference point O2. The upper line N1 and the lower line N2 correspond to the lines M1, M2, respectively. The angle θ_1 the upper line N1 makes with a vertical is greater than the angle θ_2 the lower line N2 makes with a vertical.

[0027] When reference points are provided in succession from above downward along the spreader portion 52, the angle the tangent lines at the respective reference points make with vertical lines gradually decreases from point to point downward.

[0028] It will be understood that when the plug 41 shown in FIG. 41 is used, the liquid to be filled, as directed downward at the start of filling operation, is guided in a direction closer to a horizontal and as shifted from a direction close to a vertical with the progress of the filling operation.

Claims

1. A liquid filling nozzle comprising a vertical tubular nozzle body (11) having a discharge opening (27) at a lower end thereof, and an upwardly or downwardly movable plug (4) for opening or closing the discharge opening (27), the plug (41) being provided with a seal portion (51) disposed at a lower end of an outer peripheral wall thereof and shaped in conformity with the shape of the discharge opening (27), the seal portion (51) being provided with a spreader portion (52) positioned thereabove and tapered upward, **characterised in that** in the contour of one side of a vertical longitudinal section of the spreader portion (52), tangent lines at respective reference points arranged on the spreader portion (52) from above downward are positioned closer to a vertical from point to point downward, so that the liquid to be filled and discharged from the opening is caused to spread by the spreader portion (52) toward a direction closer to a horizontal and as shifted from a direction close to a vertical, as the seal portion (51) is moved away from the discharge opening (27).
2. A liquid filling nozzle according to claim 1 **characterised in that** the reference points are two in number, and the contour is defined by two straight lines.
3. A liquid filling nozzle according to claim 2 **characterised in that** the plug is in the form of a cone having two tapered parts positioned one above the other.
4. A liquid filling nozzle according to claim 1 **characterised in that** the reference points are infinite in number, and the contour is defined by a curve.
5. A liquid filling nozzle according to claim 4 **characterised in that** the plug is in the form of a paraboloid of revolution.

Patentansprüche

1. Eine Flüssigkeitsabfülldüse mit einem vertikalen, rohrförmigen Düsenkörper (11), der an seiner Unterseite eine Auslassöffnung (27) aufweist, und einem nach oben oder nach unten bewegbaren Stopfen (41) zum Öffnen oder Schließen der Auslassöffnung (27), wobei der Stopfen (41) mit einem Dichtungsbereich (51) versehen ist, der an einem unteren Ende einer äußeren Umfangswand von diesem angeordnet und entsprechend der Form der Auslassöffnung (27) ausgebildet ist, wobei der Dichtungsbereich (51) mit einem darüber positionierten und nach oben geneigten Verteilerbereich (52) versehen ist, **dadurch gekennzeichnet, dass** in der Kontur von einer Seite eines vertikalen Längsschnitts des

Verteilerbereichs (52) Tangentenlinien an entsprechenden Referenzpunkten, die an dem Verteilerbereich (52) von oben nach unten angeordnet sind, von Punkt zu Punkt nach unten näher zu einer Vertikalen positioniert sind, so dass die abzufüllende und von der Öffnung abzugebende Flüssigkeit durch den Verteilerbereich (52) dazu gebracht wird, sich von einer Richtung nahe einer Vertikalen in eine Richtung näher zu einer Horizontalen zu verteilen, wenn der Dichtungsbereich (51) von der Auslassöffnung (27) wegbewegt wird.

2. Eine Flüssigkeitsabfülldüse nach Anspruch 1, **dadurch gekennzeichnet, dass** die Referenzpunkte zwei in der Zahl sind und die Kontur durch zwei gerade Linien definiert wird.
3. Eine Flüssigkeitsabfülldüse nach Anspruch 2, **dadurch gekennzeichnet, dass** der Stopfen die Form eines Konus hat, der zwei geneigte Teile hat, welche übereinander positioniert sind.
4. Eine Flüssigkeitsabfülldüse nach Anspruch 1, **dadurch gekennzeichnet, dass** die Referenzpunkte unbegrenzt in der Zahl sind und die Kontur durch eine Kurve definiert ist.
5. Eine Flüssigkeitsabfülldüse nach Anspruch 4, **dadurch gekennzeichnet, dass** der Stopfen in der Form eines Rotationsparaboloids vorliegt.

Revendications

1. Ajustage de remplissage pour liquides comprenant un corps d'ajutage tubulaire vertical (11) ayant une ouverture d'évacuation (27) à une extrémité inférieure de celui-ci, et un bouchon mobile vers le haut ou vers le bas (41) pour ouvrir ou fermer l'ouverture d'évacuation (27), le bouchon (41) étant muni d'une partie d'étanchéité (51) disposée à une extrémité inférieure d'une paroi périphérique extérieure de celui-ci et formée en continu avec la forme de l'ouverture d'évacuation (27), la partie d'étanchéité (51) étant munie d'une partie d'écartement (52) positionnée au-dessus de celle-ci et fuselée vers le haut, **caractérisé en ce que** dans le contour d'un côté d'une partie longitudinale verticale de la partie d'écartement (52), des lignes tangentes à des points de référence respectifs agencés sur la partie d'écartement (52) par dessus et vers le bas sont positionnées plus près d'une verticale de point à point vers le bas, de sorte que le liquide à remplir et évacuer de l'ouverture est amené à s'écarter par la partie d'écartement (52) vers une direction plus proche d'une horizontale et en décalage par rapport à une direction proche d'une verticale lorsque la partie d'étanchéité (51) est éloignée de l'ouverture d'évacuation (27).

2. Ajustage de remplissage pour liquides selon la revendication 1, **caractérisé en ce que** les points de référence sont au nombre de deux et le contour est défini par deux lignes droites.
- 5
3. Ajustage de remplissage pour liquides selon la revendication 2, **caractérisé en ce que** le bouchon est sous la forme d'un cône ayant deux parties fuselées positionnées l'une au-dessus de l'autre.
- 10
4. Ajustage de remplissage pour liquides selon la revendication 1, **caractérisé en ce que** les points de référence sont de nombre infini, et le contour est défini par une courbe.
- 15
5. Ajustage de remplissage pour liquides selon la revendication 4, **caractérisé en ce que** le bouchon est sous la forme d'un paraboloïde de révolution.
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- 25
- 30
- 35
- 40
- 45
- 50
- 55

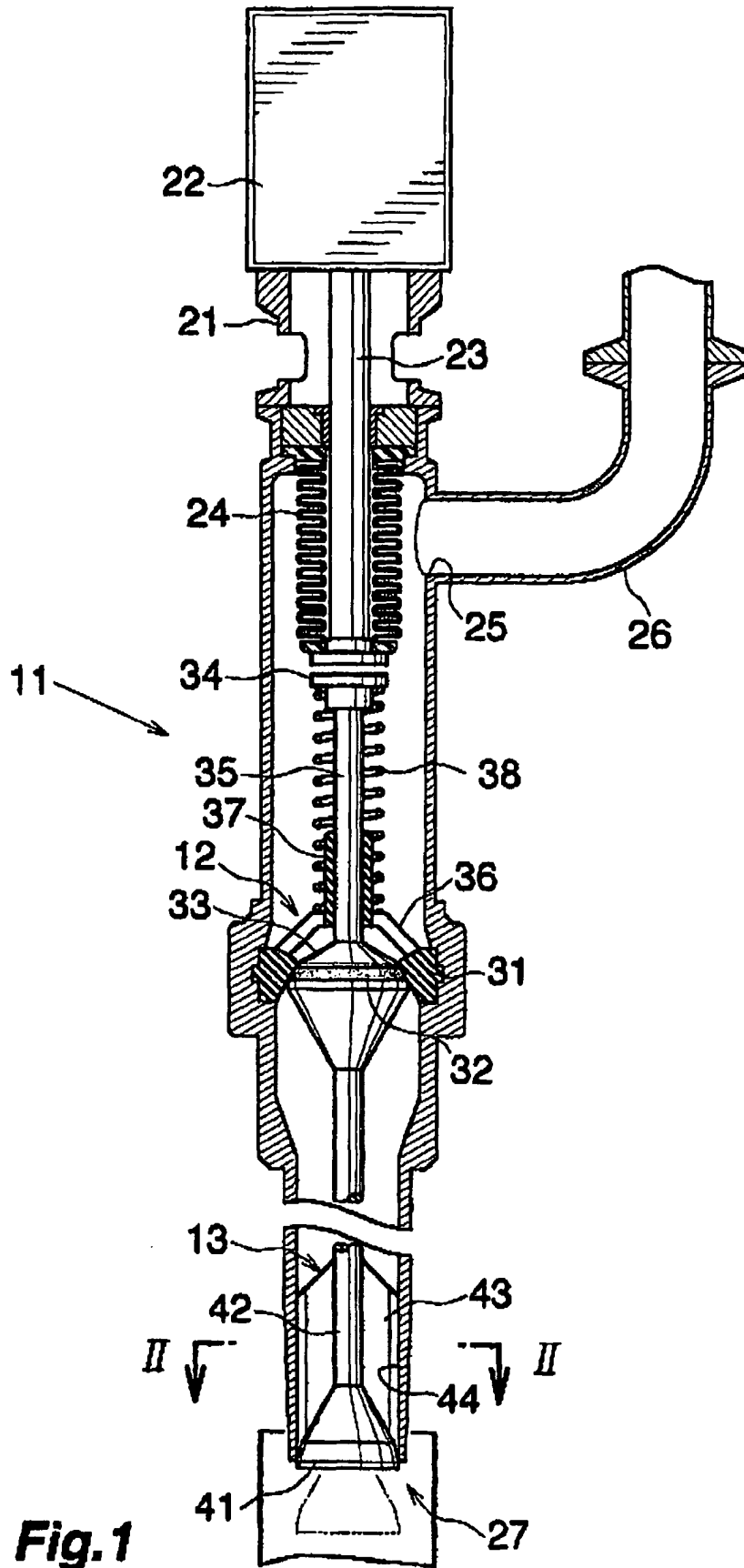


Fig. 1

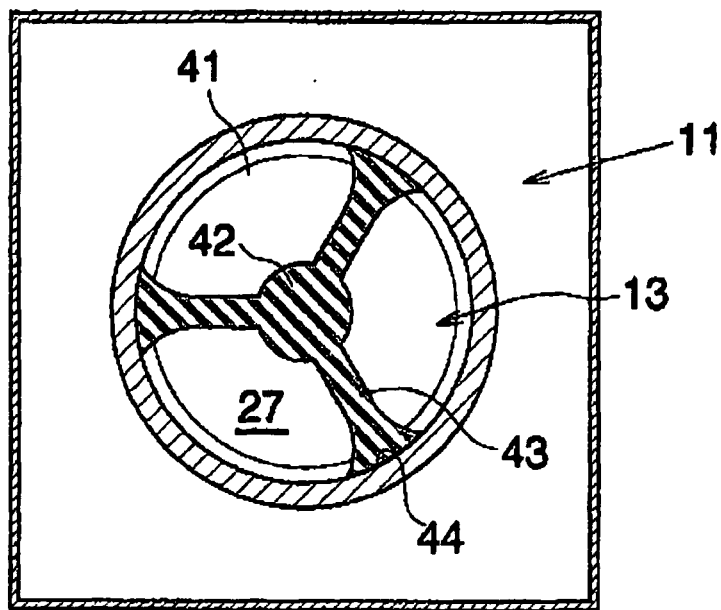
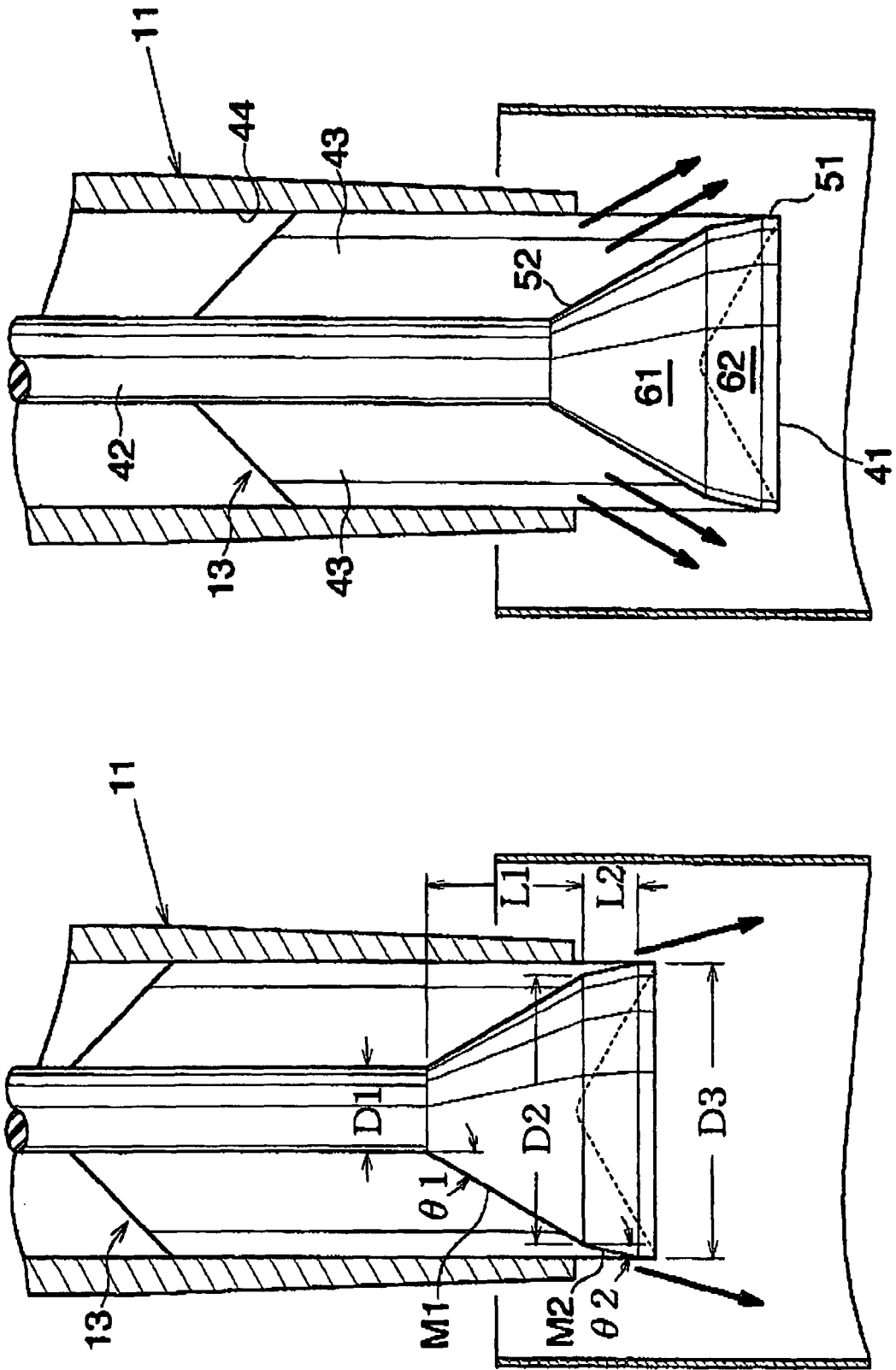


Fig.2



(b)

Fig.3

(a)

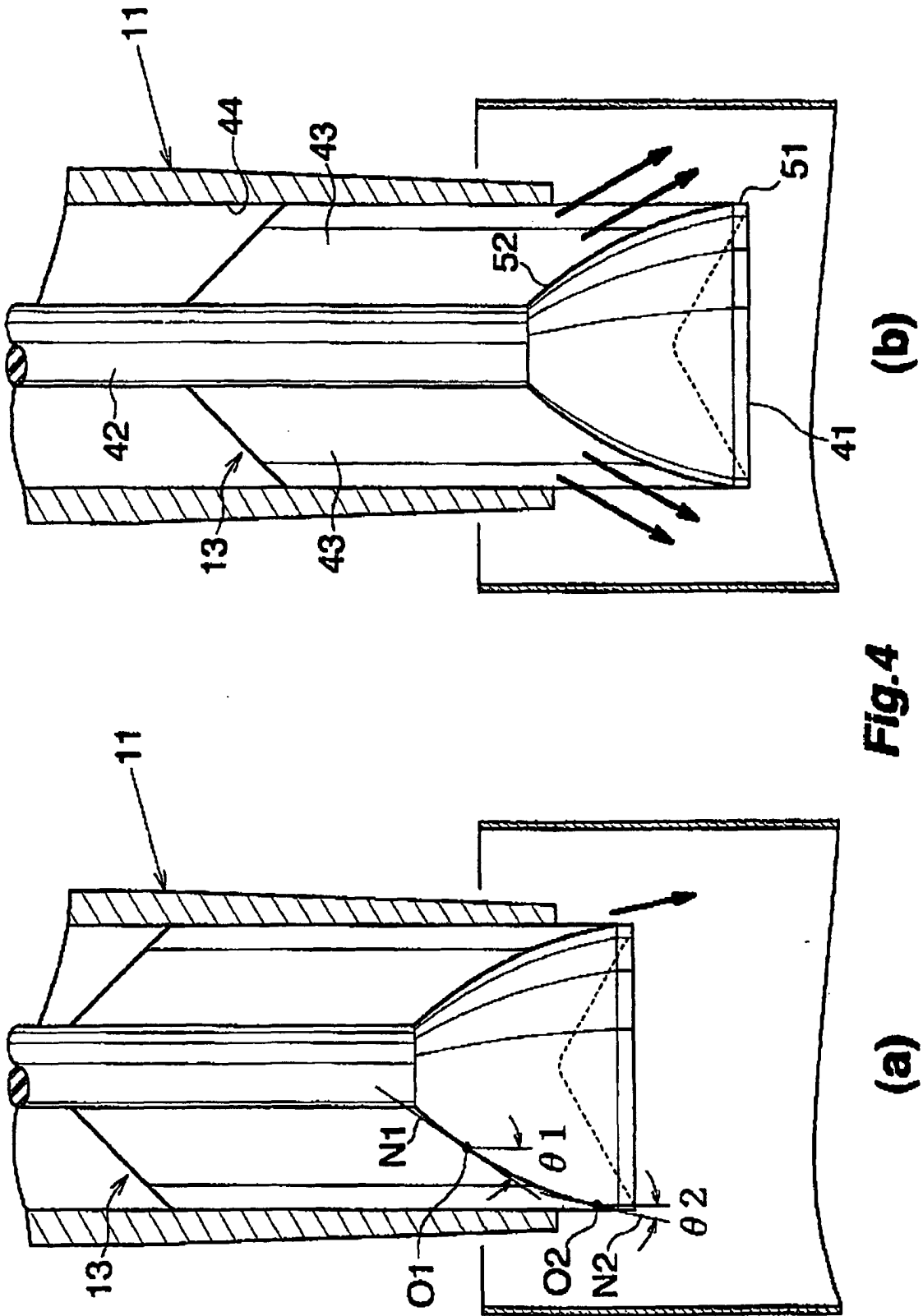


Fig.4 (b)

(a)

REFERENCES CITED IN THE DESCRIPTION

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