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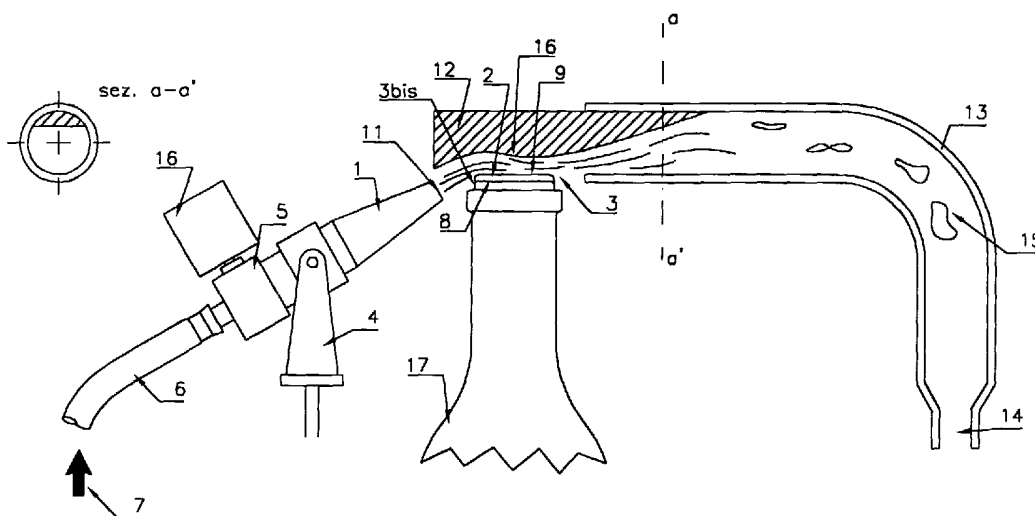
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(54) Title: BOTTLE SEAL DETACHING DEVICE



(57) Abstract: An apparatus for removing extensible plastic elastomer seals from the openings of bottles or other glass containers, which utilizes the aerodynamic pressure drop in a compressed air jet due to the constriction of its stream, caused either by the incidence of the jet on the edge of the openings of said bottles or containers or by the presence of an appropriately convex surface before of the seal. . ' -22 -

BOTTLE SEAL DETACHING DEVICE

INTRODUCTION

5 As is known, the sterilization of glass containers such as bottles 17 or jars 10, etc. has always required costly and usually inefficient washing operations prior to filling.

10 All bottles 17 designed to be filled with various liquids, as well as other glass containers 10, also designed to be filled with other sterile products are maintained in sterile conditions from the manufacturing step to the filling step, by the application of seals 2, i.e. membranes or films made of an extensible plastic elastomer, thanks to state-of-the-art
15 techniques, which form the subject of Swiss patent applications No. 1995 0235/95 and of the associated application PCT/EP 96/00342 and other associated international applications and 1997 01/97 CH and the
20 associated application PCT WO 98/32 668, which membranes or films strongly adhere against the openings 3 of the containers 10 or the bottles 17, thereby maintaining the content thereof in a sterile state until filling.

25 In order to remove these seals 2, before filling and final closure, said seals 2 have to be extracted rapidly, cost-effectively and without leaving residues on the opening 3.

30 Some apparatuses have been conceived for this purpose, which essentially involve a mechanical removal effect by rotating brushes, continuously assisted by air intake on the opening to be sealed, but such apparatuses, though effective, cause operation problems

at high processing rates and serious difficulties in sterile operations.

These drawbacks are comprehensively solved by the apparatus of this invention, which uses a possibly
5 sterilized compressed air jet, appropriately passing on the edge 3bis of the opening 3 of the bottle 17 or container 10, and thereby causing the aerodynamic constriction 9 of its stream. This effect is also specially enhanced by the provision of suitable, well-
10 positioned convex surfaces 16, which cause such a local pressure drop on the exposed surface of the seals 2, that said seals 2 are removed without being broken.

The method that uses compressed air to remove stoppers other than seals 2 made of an extensible
15 elastomer film has already been used but in a totally different manner. The compressed air coming from a traditional gun or similar tool was used in such a manner that its violent jet could detach the plug, which had a certain thickness and could oppose a
20 resistance to the shock, and only incidentally and anyway unintentionally was assisted by the negative pressure generated by the impact of a portion of the jet against the obstacle formed by the edge of the bottle opening. In fact, bottles were unsealed by
25 pressure and its direct consequences more than by aerodynamic vacuum.

In the case of the seal 2 made of a very thin (i.e. a few micron) extensible plastic elastomer film, which strongly adheres against the edge 3bis of the
30 opening 3 of the bottle 17 or general container 10, the

pressure and impact of the jet 8 are ineffective because they do not hit an obstacle but an appropriately diverted incidence of the jet 8 may generate the negative pressure required to detach the seal 2. This aerodynamic action occurs due to the deviation of the jet 8 by the rounded edge 3bis of the opening 3, which deviation is appropriately enhanced by using the solid element with a convex surface 12, which adequately constricts the stream of the jet 8 on the upper surface of the seal 2.

Hence, the compressed air used to detach the seal 2 drags the detached polymer scrap 15 and conveys it to the collection station through an optional conduit 13.

In order to collect and compact the scraps 15 so that they do not pollute the environment, a few arrangements have been provided which advantageously supplement the apparatus.

Claim 8 discloses the use of a cylindrical cone-shaped cyclone in which air coming out from the nozzle 1, after passing through the conduit 13 as claimed claim 7 is deviated tangentially to the inner surface at the upper cone- or cylinder-shaped cyclone body 19.

Then, the separated scraps 15 are collected in the conventional trap 38, whereas the exhausted air is vented from the upper portion of the cyclone, through a suitable ducted and centered hole 28.

Claim 9 provides the use of a metering screw 18 for conveying scraps 15 into the trap 38 of the cyclone or directly coming from the discharge 14 of the pipe 13.

This adequately sized metering screw may also have the functions of a compactor, of its size and the shape of its exhaust port (30) are adapted therefor.

Claim 10 discloses the use of a piston compactor, which is fed through an adequately sized hole 36 placed at the bottom dead center of the piston 21, by the conduit 13 or the cyclone trap 38. Once the cylinder 22 is full, the piston is operated and the scraps 15 will be compressed against the bottom wall. The cake of compressed scrap 15 will be discharged by means of a full section slide valve 23 which forms the bottom of the cylinder 22.

Typically, the inventive apparatus is used in mass bottling or filling plants.

Therefore, it will operate at the bottling or filling rate, i.e. it will have to remove as many seals 2 as there are bottles 17 or containers 10 to be filled.

To this end, the apparatus has an adequately oriented or tilting support 4, which allows the operation thereof in the most appropriate conditions as the bottles 17 or containers 10 quickly pass through it.

The edges 3bis of the openings 3 will pass before the orifice 11 of the nozzle 1 and possibly under the convex surface 16 as claimed in claim 2 and before the conduit 13 as claimed in claim 7, if the latter are present. Hence, they can be easily cleared of the seals 2 at the desired rate.

In order not to dissipate compressed air by

keeping the nozzle 1 open and to increase the instantaneous pressure, a valve 5 has been provided which only opens the passage of compressed air when the edges 3bis of the openings 3 pass before the opening 11
5 of the nozzle 1.

This valve may have an alternate opening and closing operation, but will be more effective if it is of the rotary type, i.e. a valve essentially composed of a spool 33, controlled by a shaft that rotates in a
10 hollow cylinder 34 having two opposite apertures.

The spool 33 will be perforated along one diameter thereof in such a manner that its two openings 35bis may coincide with those 35 of the hollow cylinder which houses it. By this arrangement, compressed air will be
15 allowed to pass every half-turn.

This valve 5 will be driven by a suitable motor 16 of any appropriate type, whereas the valve having an alternate closing and opening operation, if present, may be controlled electrically, hydraulically, or
20 pneumatically.

By appropriately timing the revolutions of the spool or the opening and closing operations with the feed of bottles 17 or containers 10, a proper mass operation will be possible.

25 To this end, a controlled feed-back system, operating with optical, electric or piezoelectric signals, will control timing.

As a supplement to the apparatus, claim 6 discloses a sterilizer.

30 Compressed air coming from a compressor is never

sterile. In fact, the waste collected in the air tank and the pipes may be conveyed to the nozzle 1. Further, germs may be present in intake air and be ejected with air from the nozzle 1 on the opening 3 of the bottle 17 or container 10, to further grow in the content thereof.

In order to avoid this serious drawback, which would affect the advantages of extensible plastic elastomer film sealing, the apparatus has been equipped with a sterilizer, e.g. a UV sterilizer. The latter includes a pressure tank 24 with air passing through it to feed the nozzle 1. If this tank has an adequate volume, the flow may be locally slowed down, hence compressed air may remain for a sufficient time in said tank 24.

This container is provided with externally powered UV bulbs 25 having tight connections for sterilizing air in transit.

By appropriately sizing the container 24 as a function of the average outflow rate and of the radiant power of UV bulbs 25, a proper exposure for the required sterility may be ensured. Said container may also be used as a condenser for the suspended lubricant particles of the compressor system. To this end, a SAS discharge 32 will be placed on the bottom of the container 24.

Figs. 10 to 12 are different views of one embodiment of the invention.

According to a first characteristic, the scrap conveying conduit has an orifice in the form of a

spherical sector-shaped cap 113 which has two recesses 213 on the opposite sides parallel to the direction of compressed air jets.

5 The two recesses allow the opening of the container to reach a position which coincides with the introduction of the pipe 13 under the cap 113. One, two or more blowing nozzles 11 are disposed on the sides of the container opening and are oriented in such a manner as to direct an air jet against the edge of the container opening between the cap 113 and said opening. 10 Particularly, in the illustrated figures, the two blowing nozzles 11 are arranged in diametrically opposite positions and perpendicular or substantially perpendicular to the container feed direction, as well as to the diametrically opposite recesses 213 of the cap 113. 15

A presence detector 40 detects the presence of a container and starts the nozzles for removing its plastic film seal.

20 Nozzles 11 are fed by pipes 6. Pressurized air is generated by a compressor (not shown) by means of a plenum chamber 41.

In accordance with an improvement, compressed air may be also heated and/or dried. In such heated and/or 25 dried condition, the removing and conveying action is generally more effective.

As an additional improvement which increases the Venturi effect whereby scraps are conveyed in the pipe 13, compressed air is additionally provided downstream 30 from the inlet of said conduit 13. Said compressed air

may be supplied through a pipe 6' from the same compressed air feed source to the nozzles 11. This additional compressed air supply in the conduit 13 increases the Venturi effect for scrap suction and conveyance. Furthermore, as is shown in the drawing, the additional compressed air jet directly supplied 6' in the conduit 13 is synchronized with nozzle operation, thanks to the valve on the outlet of the plenum 41, which is schematically shown and generally denoted as 42.

Moreover, the plenum must be imperatively placed in the proximity of the nozzle to obtain a stronger air jet and generate a shock wave which facilitates seal detachment.

Regarding film detachment arrangements, there may be also provided ultrasound systems, sound or electromagnetic wave systems, eddy current systems, or capacitive systems, which help to weaken the seal grip.

This action may be also prepared by providing a previous thermal shock on the seal, either by freezing or heating it, or by directing an air flow thereon to change the charge characteristics of the dielectric.

More particularly, the conduit 13 has an inverted U-shaped curved end. A branch 313 is connected to the rest of the conduit 13 for scrap removal, whereas the other portion 413 ends with the cap 113.

Therefore, the conduit 13 is generally profiled in such a manner as to form a curve or a loop for connecting its inlet end to the rest of the conduit 13. The additional compressed air jet is supplied at said

curve or loop, particularly at the center of said curve or loop and, if the latter has a vertical orientation, like in the inverted U-shaped illustrated arrangement, at its apex or higher.

5 With particular reference to Fig. 12, multiple inlets, i.e. seal removal stations, may be provided for the conduit 13 , arranged in succession and associated to one or more nozzles and to one or more presence detector.

10 Particularly, the conduit 13 branches off at its end by two starting portions each ending, at the inlet end, by a cap 113. The two starting portions 413', 413'' are disposed in such a manner as to be aligned, along the containers path, one behind the other, with
15 reference to the container feed direction. By this arrangement, the plastic film seal removal procedure may be started successively twice, to obtain the absolute certitude that the seal is actually removed.

At each end portion, a presence detector may be
20 provided for detecting scrap passage, and for operating the second extraction station whenever such detection signal is received, which second station may remain in the quiescent state when seal removal is detected in the first station.

25 Obviously, as shown in Fig. 12, the end portion may be shaped as described in the previous embodiments, in such a manner that each branch forms, with the conduit 13 connected thereto, an inverted U or anyway a curved portion, preferably having a vertical
30 orientation, which may or may not have an inlet for a

compressed air pipe, as shown in Figures 10 and 11.

KEY OF FIGURES.

Fig. 1 shows a typical simplified operating apparatus. It includes the following:

- 5 1 Nozzle
- 2 Seal
- 3 Bottle opening
- 3bis Opening edge 3
- 4 Support
- 10 5 General valve
- 6 Compressed air feed pipe
- 7 Compressed air flow
- 8 Jet
- 9 Stream constriction
- 15 11. Nozzle orifice
- 17 Bottle

Fig. 2 is a sectional and plan view of a general container, more specifically a jar hit by a compressed air jet. It includes the following:

- 20 1 Nozzle
- 2 Seal
- 3 Jar opening
- 3bis Opening edge 3
- 8 Jet
- 25 9 Stream constriction
- 10 Container
- 11. Nozzle orifice.

Fig. 3 is a plan and sectional view of a general crescent-shaped nozzle, cut off through an angle α° with respect to jet direction. It includes the

30

following:

1 Nozzle

12. Nozzle orifice

α° Nozzle cutoff angle.

5 Fig.4 shows a typical apparatus to be included in a filling chain, equipped with an automatic valve, a convex surface element and a scrap conveying conduit. It includes:

1 Nozzle

10 2 Seal

3 Bottle opening

3bis Opening edge 3

4 Support

5 Valve

15 6 Compressed air feed pipe

7 Compressed air flow

8 Jet

9 Stream constriction

11 Nozzle orifice

20 12 Solid element with a convex surface

13 Scrap conveying conduit

14 Throat in the conduit 13, particularly at the distal discharge port.

15 Scraps

25 16 Convex surface

17 Bottle

a-a' A given section.

Fig. 5 is a schematic view of a rotary valve. It includes the following:

30 7 Compressed air flow

- 33 Rotating spool
34 Hollow cylinder with the spool 33 therein
35 Opposite openings of the cylinder
35bis Opposite openings of the spool.
- 5 Fig. 6 shows a UV sterilizer. It includes:
7 Compressed air flow
24 Pressure container
25 UV bulbs
26 Condensate drainage system
- 10 32 S.A.S.
Fig. 7 shows a schematized cyclone, and includes:
7 Compressed air flow
13 Scrap conveying conduit
15 Scraps
- 15 19 Cyclone body
27 Scrap discharge system
28 Air intake
38 Trap
a-a' A section.
- 20 Fig. 8 shows a scrap compacting screw. It includes:
13 Scrap conveying conduit
14 Conduit throat
15 Scraps
- 25 18 Metering screw
30 Screw discharge
37 Scrap inlet hole
- Fig. 9 shows a piston compactor. It includes the following:
- 30 13 Scrap conveying conduit

- 14 Conduit throat
- 15 Scraps
- 20 Piston rod
- 21 Piston
- 5 22 Cylinder
- 23 Slide valve
- 36 Scrap inlet hole

Fig. 10 schematically shows a side elevational view of an apparatus according to the invention, in the container feed direction. The figure includes:

- 6 Air supply pipes
- 6' The pipe for supplying compressed air to the scrap extracting conduit 13
- 11 Nozzles
- 15 13 Scrap extracting conduit
- 113 Cap
- 213 Recesses in the cap 113
- 313 Straight branch of the inverted U-shaped end
- 413 Straight branch of the inverted U-shaped end
- 20 40 Container presence detector
- 41 Compressed air plenum
- 42 Valve

Fig. 11 is a perspective view of the apparatus of Fig 11 which shows the same parts as shown in Fig. 10.

25 Fig. 12 is a schematic view of a variant embodiment having two successive seal removal stations, in which the parts as shown in Figures 10 and 11 have been omitted for the sake of simplicity. This Figure includes:

- 30 13 Scrap extracting conduit

313 A common branch of the inverted U-shaped end
portion

413 The two vertical branches of the two
inverted-U shaped branches connected to an additional
5 common branch 313.

113 The caps of each branch

213 The recesses of said caps 113.

CLAIMS

1. An apparatus for detaching and extracting extensible plastic elastomer film seals, which adhere against the edges (3bis) of the openings (3) of bottles
5 (17) or other containers (10), characterized in that it comprises any suitable nozzle (1), which may be stationary or tilting in any appropriate manner, and adapted to impart a direction and a velocity to a compressed air flow (7), any suitable stationary or
10 movable support, which may adequately orient the nozzle (1), hence air flow (7) at the edge (3bis) of the opening (3) of a bottle (17) or a container (10) and any suitable and sufficient compressed air source or generator.

15 2. An apparatus as claimed in claim 1, characterized in that it has at least one stationary or possibly movable solid element, which is or may be appropriately positioned relative to the nozzle (1), and has at least one convex surface (16) curved even
20 about more than one axis. Said surface (16) of the solid element (12) shall be allowed to be appropriately disposed, when the apparatus is in the operating state, above the opening (3) of the sealed bottle (17) or container (10) in such a manner as to generate a
25 constriction (9) of the stream of the air jet (8) at the upper surface of the extensible plastic elastomer seal (2).

3. An apparatus as claimed in claims 1 and 2, wherein the orifice (11) of the nozzle (1) may even not
30 be circular, and have any suitable shape and size.

4. An apparatus as claimed in claims 1, 2 and 3, wherein the plane or minimum surface subtended by the perimeter of the orifice (11) of the nozzle (1) may not always be perpendicular to the direction of the jet
5 (8).

5. An apparatus as claimed in claims 1, 2, 3 and 4, characterized in that it has a rotary valve (5) for quickly opening and closing the air flow (7), composed of a spool (33), having a hole formed along one
10 diameter thereof, and tightly rotating inside a cylinder (34) also perforated along its diameter, in such a manner that the rotation of the spool (33) causes the four ends of the holes (35) and (35bis) to simultaneously coincide every 180° of rotation. Said
15 spool may be driven by any suitable motor, whose rotation, hence the opening and closure of the valve, may be synchronized with the position of the bottles (17) or containers (10) to be unsealed, relative to the apparatus.

20 6. An apparatus as claimed in claims 1, 2, 3, 4 and 5, characterized in that it has a UV compressed air sterilizer consisting of a pressure container (24) through which compressed air passes. A sufficient number of pressure resistant UV bulbs are arranged in
25 any suitable manner inside the container (24). The volume of said container (24) will be determined in such a manner as to allow a sufficiently long exposure of the transiting compressed air to UV radiation. Said container will also have a condensate drainage system
30 (26) on the bottom, possibly equipped with a SAS (23).

7. An apparatus as claimed in claims 1, 2, 3, 4, 5 and characterized in that it includes an open conveying conduit (13) for scraps (15), which may have any shape, even variable (14), and has one of its two openings
5 generally oriented before the orifice (11) of the nozzle (1) but positioned at the opposite side of said orifice (11) with respect to the opening (3) of the bottle (17) or container (10) to be unsealed, whereas the other opening, which has the function of a
10 discharge port, may be oriented in any suitable manner.

8. An apparatus as claimed in claim 6, characterized in that it includes any suitable container (19) with conical or cylindrical inner side walls, which has the function of a cyclone, wherein the
15 conduit (13) ends, with its longitudinal axis tangent to a conical or cylindrical surface concentric to that of the inner side wall of the container (19).

Moreover, said container (19) will have an air exhaust hole (28), possibly associated to a pipe
20 section, situated at its end wall and a discharge port (27) at the bottom, possibly with a trap (38) for separated scraps (15).

9. An apparatus as claimed in claims 7 and 8, characterized in that it has a metering screw compactor
25 (18) for the removed plastic film scraps (15), adequately connected, i.e. through a hole (37) formed in the wall of the screw (18), to the distal end (14) of the conduit (13) or any conduit coming from the bottom discharge port (27) or the bottom trap (27) of
30 the container (19) as claimed in claim 8.

Said metering screw (18) will also have a discharge port (30) at its bottom.

10. An apparatus as claimed in claims 7 and 8, characterized in that it has a compactor, made of a piston (21) sliding in a cylinder (22) connected through a hole (36) formed in the wall of the screw (18), to the distal end (14) of the conduit (13) or any conduit coming from the bottom discharge port (27) or the bottom trap (27) of the container (19) as claimed in claim 8. The piston (21) will be driven by a rod (20), preferably moved by a hydraulic or pneumatic jack. At the end-of-stroke of the piston (21), the cylinder will have a valve (23) preferably a sliding valve, for the discharge of compacted scraps (15).

11. An apparatus as claimed in one or more of the preceding claims, characterized in that it comprises means for heating the compressed air supplied to the nozzles.

12. An apparatus as claimed in one or more of the preceding claims, characterized in that it comprises means for drying the compressed air supplied to the nozzles.

13. An apparatus as claimed in one or more of the preceding claims, characterized in that it includes a compressed air supply pipe (6') which runs into the scrap conveying conduit (13) downstream from the inlet thereof.

14. An apparatus as claimed in claim 13, characterized in that the pipe for supplying compressed air downstream from the inlet of the scrap conveying

conduit (13) is connected to the same compressed air source as the nozzles (11) there being provided means for intercepting the compressed air supply to the nozzles (11) and to the pipe (6') which operate in a
5 synchronized manner.

15. An apparatus as claimed in one or more of the preceding claims, characterized in that it comprises one, two or more nozzles (11) arranged around the opening of the container.

10 16. An apparatus as claimed in claim 15, characterized in that it includes at least two diametrically opposed nozzles (11).

17. An apparatus as claimed in one or more of the preceding claims, characterized in that the scrap
15 conveying conduit (13) has at least two starting scrap conveying sections from different positions of the container along a path thereof, which at least two starting sections join together into a common conduit (13).

20 18. An apparatus as claimed in one or more of the preceding claims, characterized in that each starting section of the scrap conveying conduit (13) has an inlet with a cap (113) the opening of the container being placed thereunder, and the jet of the nozzle/s
25 being generated and oriented between said cap and the opening of the container, with the edge of the container being tilted toward the scrap conveying conduit inlet.

19. An apparatus as claimed in one or more of the
30 preceding claims, characterized in that the cap (113)

has a spherical sector shape and recesses (213) on diametrically opposite sides, which recesses are in line with the path of the container openings under the cap (113).

5 20. An apparatus as claimed in one or more of the preceding claims, characterized in that the starting section/s of the scrap conveying conduit (13) have an elongated shape.

10 21. An apparatus as claimed in claim 20, characterized in that the pipe (6') for supplying said conduit (13) with compressed air, downstream from the inlet is connected to said conduit (13) at the curved section thereof, preferably at the apex of said curved section.

15 22. An apparatus as claimed in claim 20 or 21, characterized in that the curved section has an inverted U shape.

20 23. An apparatus as claimed in one or more of the preceding claims 20 to 22, characterized in that the starting curved or inverted U-shaped section/s have a substantially vertical orientation.

25 24. An apparatus as claimed in one or more of the preceding claims, characterized in that seal detachment is assisted by the application of waves of any kind and by electric effects.

30 25. An apparatus as claimed in one or more of the preceding claims, characterized in that seal detachment is assisted by the previous application of an air flow having the function to change the chemical or physical characteristics of the seal.

26. An apparatus as claimed in one or more of the preceding claims, characterized in that seal detachment is assisted by the previous application of a thermal shock of the film, with respect to the bottle.

5 27. An apparatus as claimed in one or more of the preceding claims, characterized in that seal detachment is assisted by the previous application on the seal of a freezing gas jet.

10 28. An apparatus as claimed in one or more of the preceding claims, characterized in that seal detachment is assisted by the previous application of any heater, even microwave-operated.

15 29. An apparatus as claimed in one or more of the above claims, characterized in that air jet is made of vapor.

20

25

30

Fig. 1

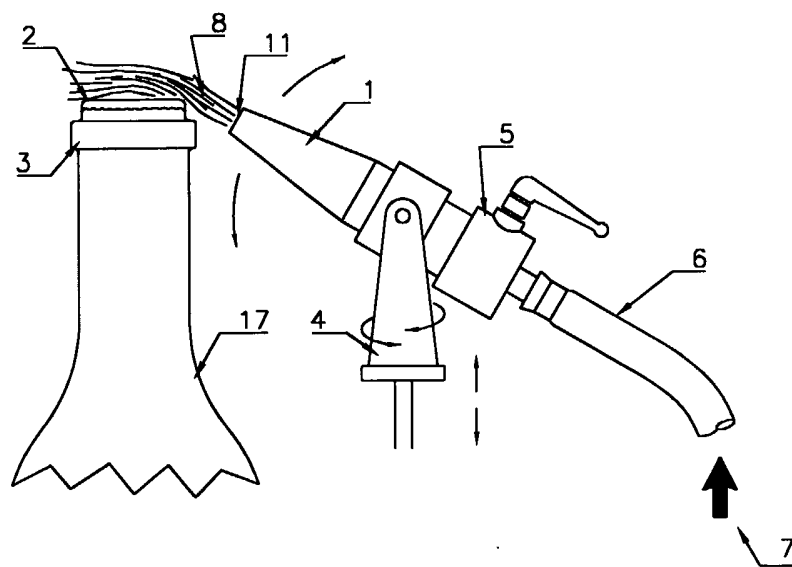


Fig. 2

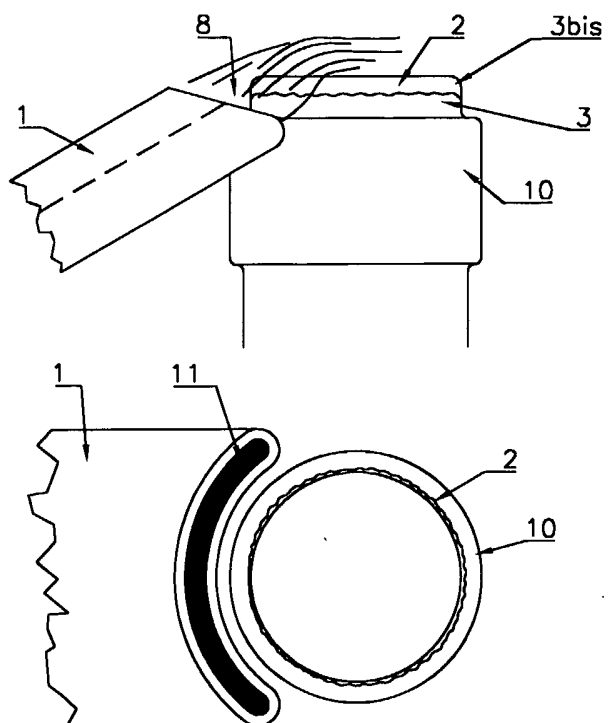


Fig. 3

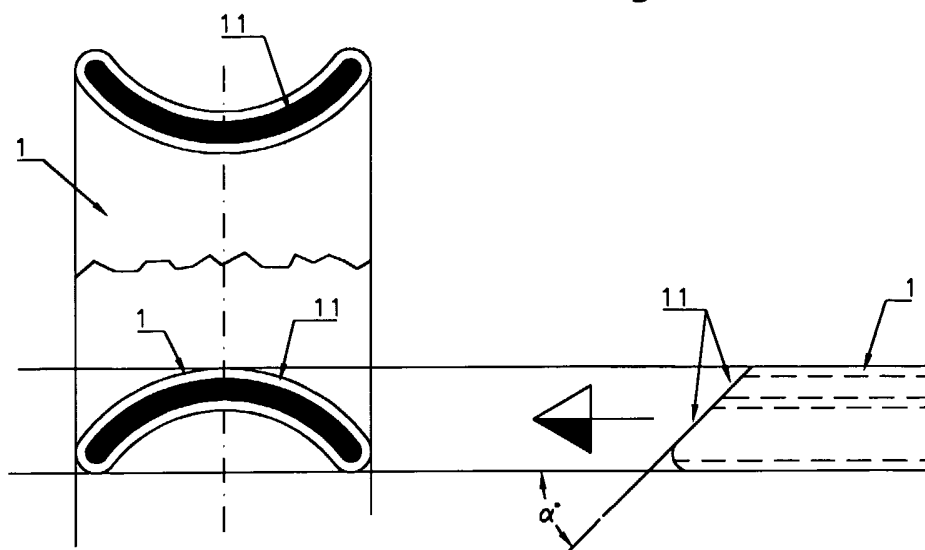


Fig. 4

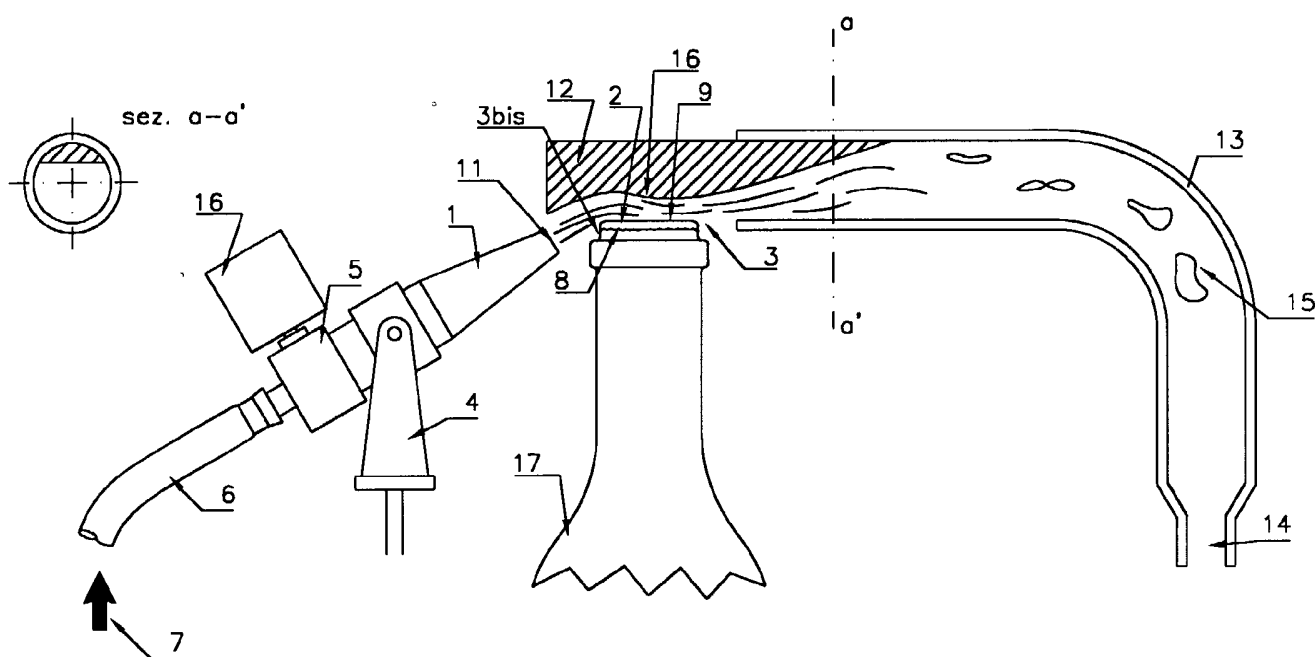


Fig. 5

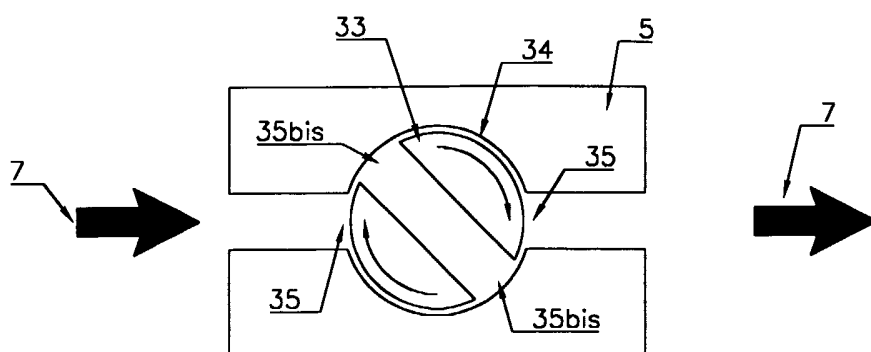


Fig. 6

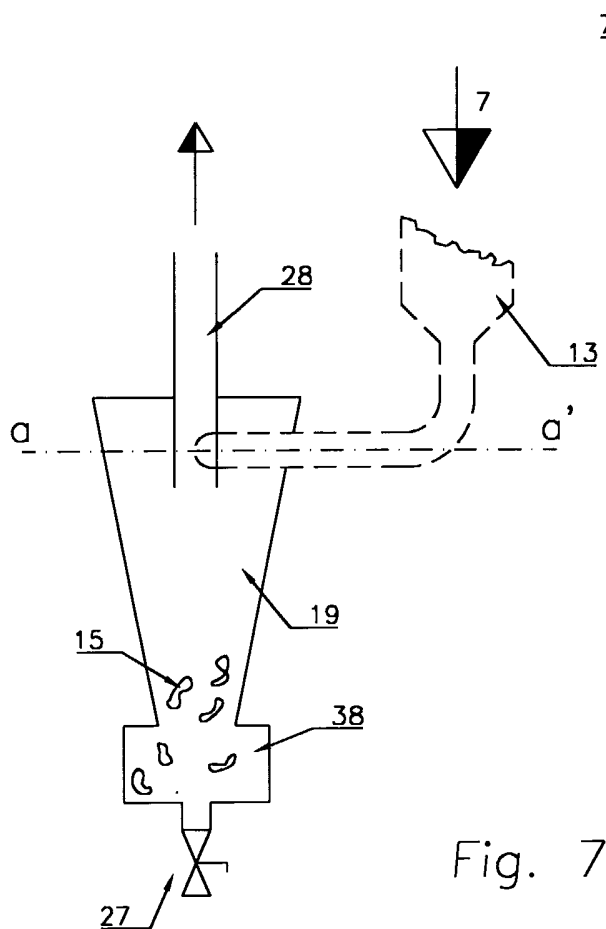
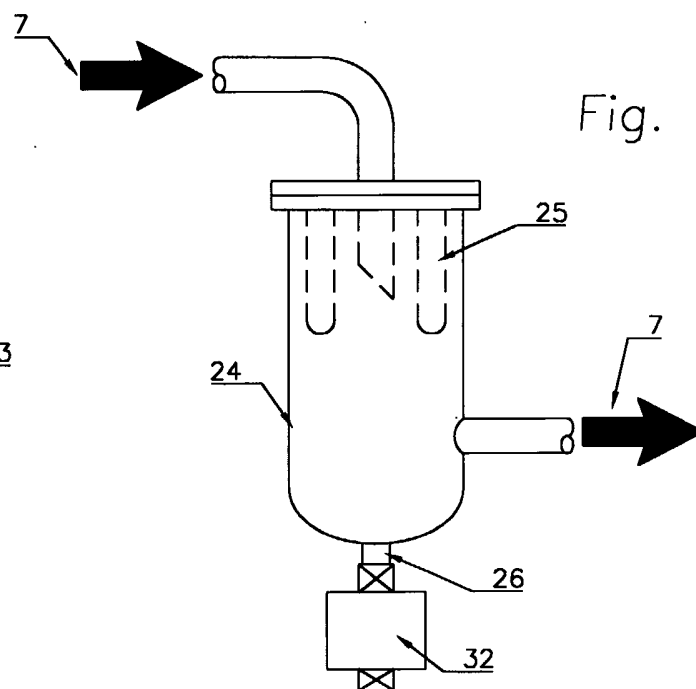


Fig. 7

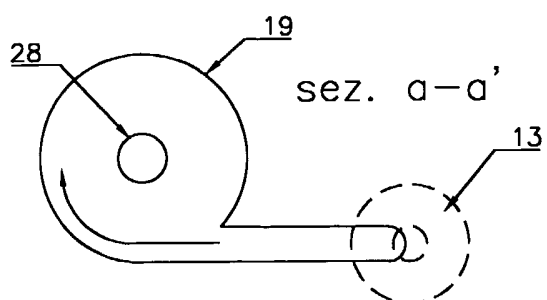


Fig. 8

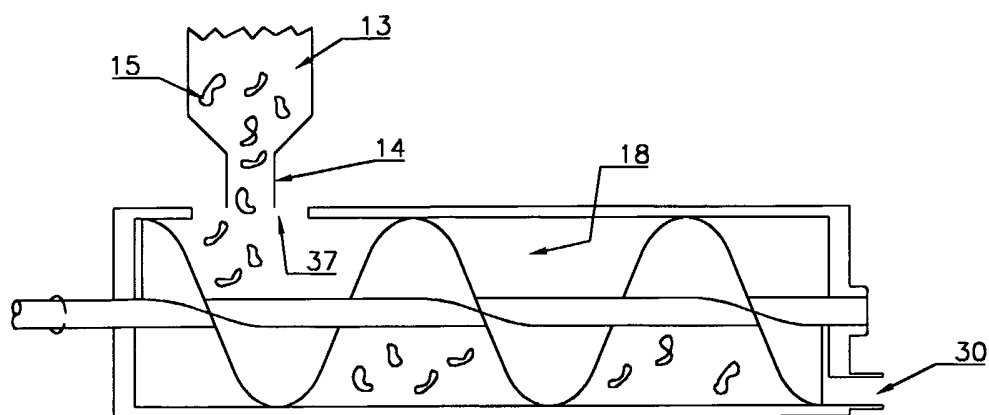


Fig. 9

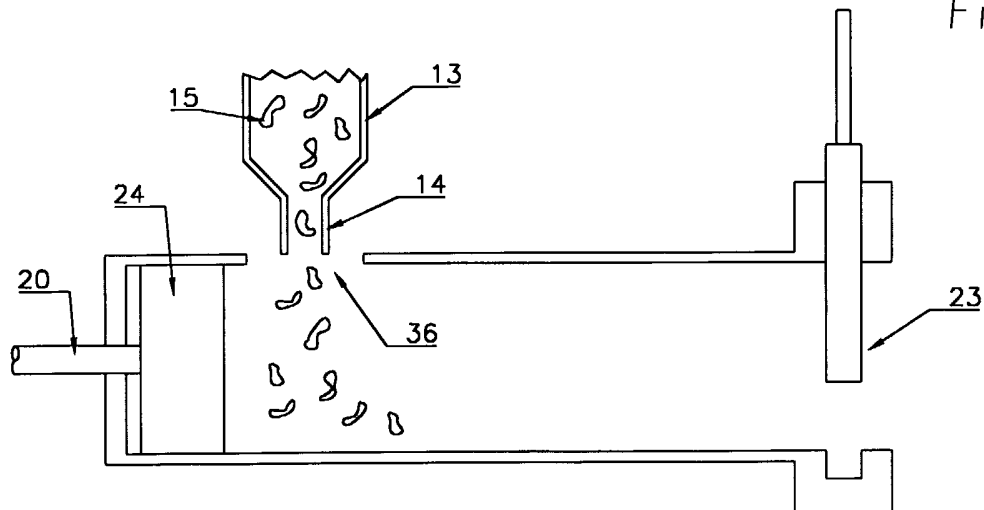


Fig. 10

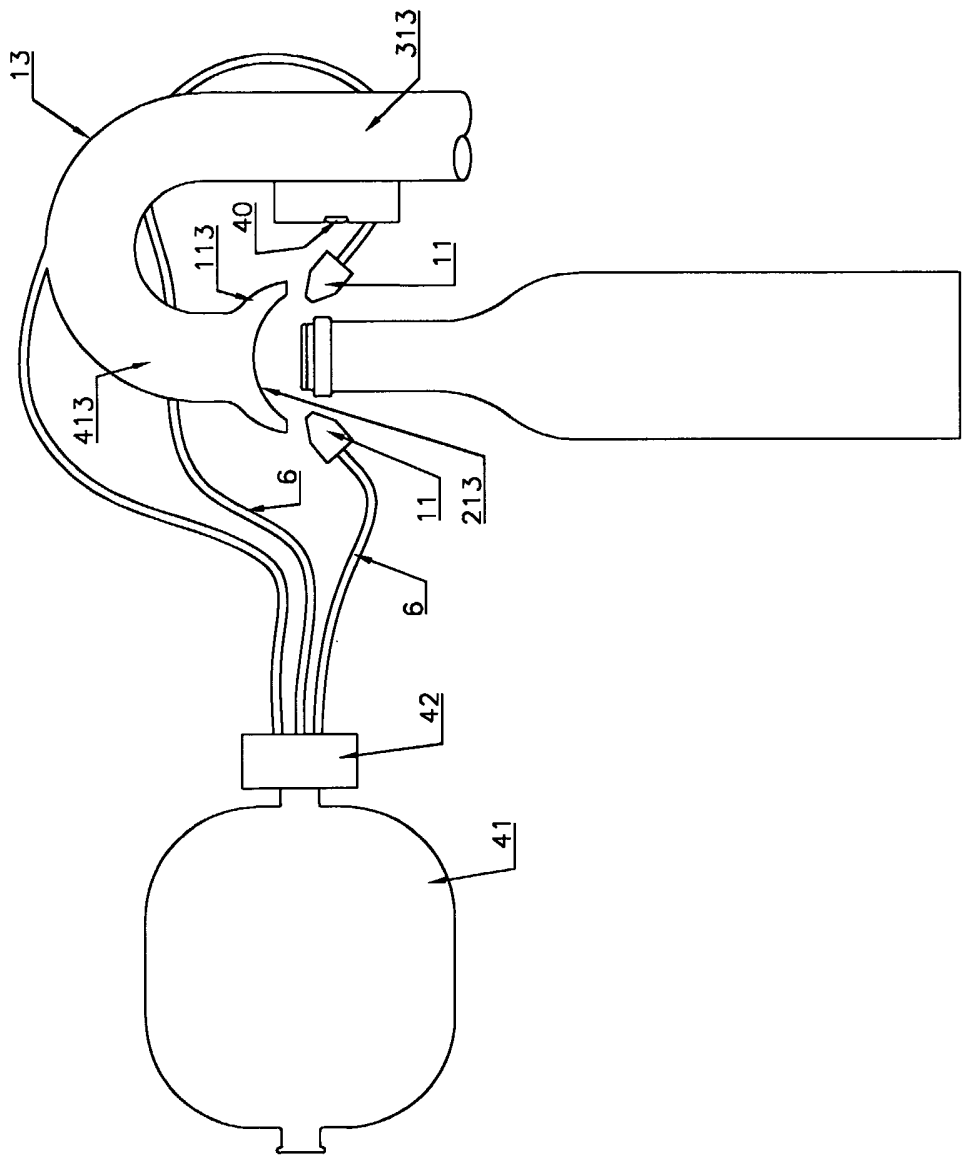


Fig. 11

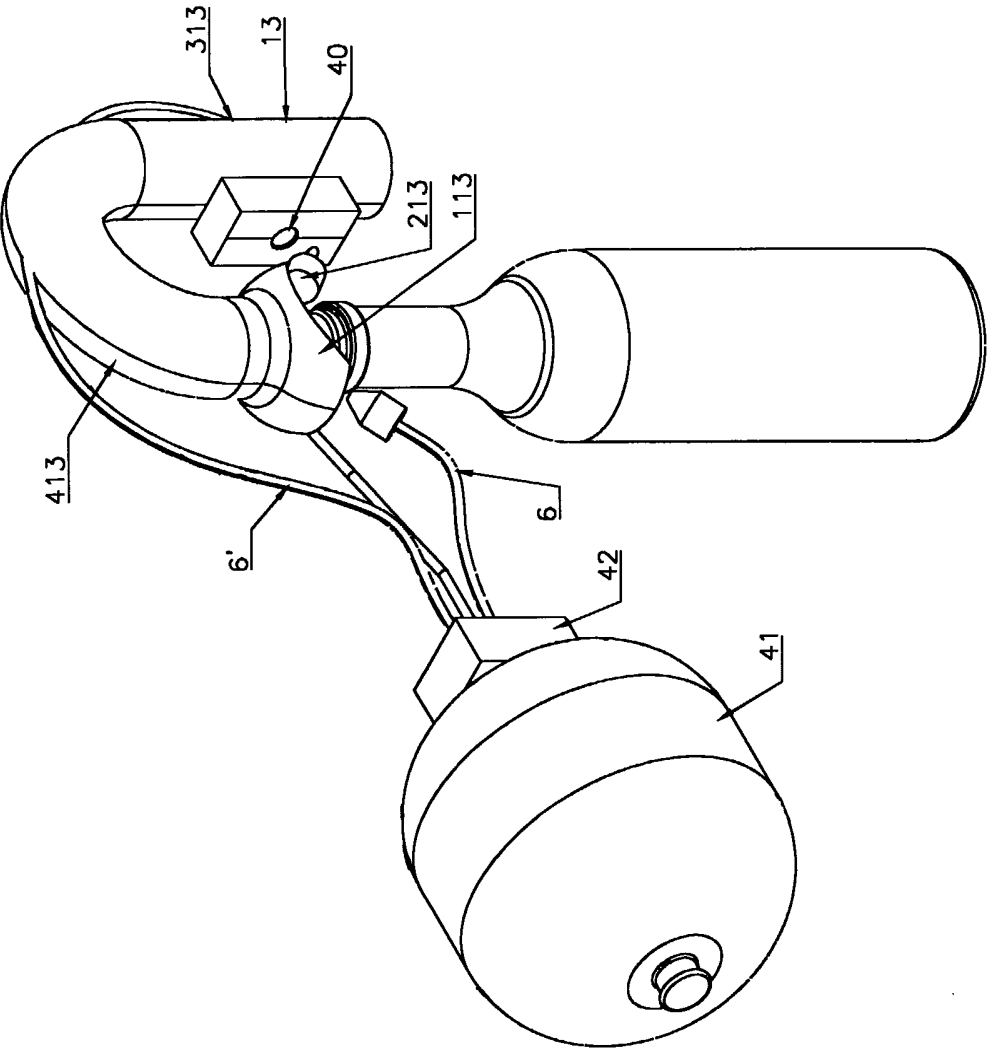
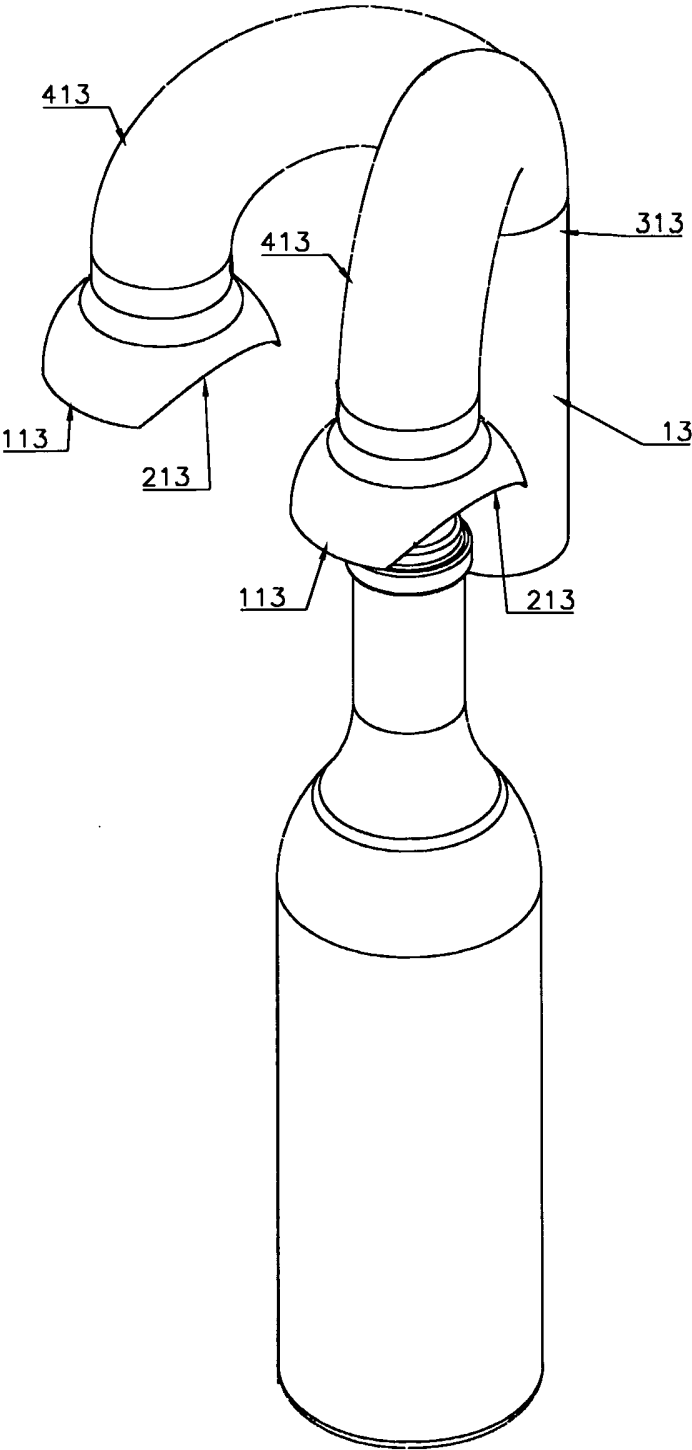


Fig. 12



INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 02/02636

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B67B7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B67B B67C B08B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 40 18 113 A (ETI TEC MASCHINENBAU) 12 December 1991 (1991-12-12) the whole document ---	1
A	US 5 442 851 A (LERNER HERSHEY ET AL) 22 August 1995 (1995-08-22) -----	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

In **1st** Application No
PCT/IB 02/02636

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