



(11) **EP 4 387 923 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:

13.05.2026 Bulletin 2026/20

(21) Application number: **22782961.1**

(22) Date of filing: **16.08.2022**

(51) International Patent Classification (IPC):
B67D 1/04 (2006.01)

(52) Cooperative Patent Classification (CPC):
B67D 1/0406

(86) International application number:
PCT/IB2022/057645

(87) International publication number:
WO 2023/021410 (23.02.2023 Gazette 2023/08)

(54) **COMPACT BEVERAGE DISPENSER WITH UMBILICAL SUPPLY LINE**

KOMPAKTER GETRÄNKESPENDER MIT VERSORGUNGSSCHLAUCHLEITUNG

DISTRIBUTEUR DE BOISSON COMPACT

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **17.08.2021 GB 202111763**

(43) Date of publication of application:
26.06.2024 Bulletin 2024/26

(73) Proprietor: **Polykeg S.r.l.**
24064 Grumello del Monte (BG) (IT)

(72) Inventors:

- **WALTON, Philip Andrew**
Durham DL14 7AX (GB)

- **SONZOGNI, Sergio**
Grumello del Monte 24064 (BG) (IT)

(74) Representative: **Craske, Stephen Allan**
Craske & Co.
Shallowford
Holsworthy Road
Hatherleigh
Okehampton Devon EX20 3LE (GB)

(56) References cited:
EP-A2- 2 228 336 WO-A1-96/12644
DE-A1- 3 320 525

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

TECHNICAL FIELD OF THE INVENTION

[0001] This invention relates to a beverage dispenser of the kind which includes a source of pressurised gas, a dispensing font, and a dispensing coupler which is configured to engage a beverage container with a two-port valve.

BACKGROUND

[0002] Carbonated beverages such as beer are generally dispensed from pressurized containers, e.g. kegs, by supplying a pressurized gas such as CO₂ to the head space of the container whilst drawing liquid from the bottom of the container. If the beverage is required to be served chilled a cooling device may also be used between the container and the dispensing tap (often referred to as a "font"). Various two-port keg valves and dispensing couplers have been developed to facilitate simultaneous connection of these two separate paths, examples of which are described in WO 2020 141 320-A1. Such valves and couplers are widely used to connect the pressured gas supply and beverage feed lines to beer kegs and other beverage containers.

[0003] In recent years so-called bag-in-keg containers have been introduced. Since the pressurized gas does not come into direct contact with the beverage it is practical to dispense oxygen-sensitive beverages, e.g. beer, using compressed air instead of CO₂, and small air compressors can be used instead of a gas cylinder.

[0004] These developments have made it possible to have draft beer installations in places where previously it was not thought practical, including smaller restaurants, retail outlets, and homes. This has in turn led to the introduction of compact dispensers and smaller kegs, e.g. 5, 8, 12 litres. A typical compact dispenser, an example of such a dispenser is shown in EP 2 228 336, includes a main dispensing unit which combines the source of pressurised gas, a dispensing font, and a cooling system. However, the keg coupling system still uses the same couplers as those used in professional establishments such as bars and public houses, which are connected to the dispensing unit by two separate tubes. The connecting pipework therefore tends to be bulky and unsightly. Furthermore, installation requires making two separate connections (air and beverage) from the dispensing equipment to the keg coupler. The tube connections on the existing couplers typically use individual push-in tube connectors. These may be the same diameter, so it is easy to reverse the connections causing dispensing problems. They can also be disconnected while the coupler is connected to the keg with potential uncontrolled high pressure beer discharge. Similar push-in connectors are generally used on the dispensing unit so that problems with reverse-connection and uncontrolled discharge can potentially occur at this position

also. From time to time it may be necessary to change the connecting tubes, e.g. when it is desired to fit a larger keg or locate the keg further away from the dispensing unit. Hygiene considerations also make it desirable that the tubes should be washed out and cleaned regularly to prevent bacterial contamination, which is again very inconvenient with the need to undo and remake four separate tube connections.

[0005] An objective of present invention is to provide a new and inventive form of beverage dispenser in which the size of the pipework connecting the beverage container and the dispensing unit can be significantly reduced to achieve a neater and uncluttered appearance whilst maintaining the flexibility of the interconnection and a sufficient flow of beverage.

[0006] A further objective is to prevent, or at least reduce, the risk of accidental disconnection of the interconnecting pipework which could result in unintended spillage.

[0007] An additional objective is to enable the interconnecting pipework to be easily removed and re-connected when required, to facilitate cleaning or replacement.

SUMMARY OF THE INVENTION

[0008] When viewed from one aspect the present invention proposes a beverage dispenser with a dispensing unit which includes a source of pressurised gas and a dispensing font. A dispensing coupler, which is configured to engage a two-port valve closure of a beverage container, is connected to the dispensing unit by an umbilical having an outer wall, and first and second passages both travel within the outer wall. The first passage conducts pressurised gas from the dispensing unit to the dispensing coupler and the second passage conducts beverage from the dispensing coupler to the dispensing unit.

[0009] In a preferred embodiment the first passage is defined within an inner wall, which may be concentric with the outer wall and relatively thin. The second passage is defined between the inner and outer walls.

[0010] Preferably the umbilical is connected to the dispensing coupler by a releasable connector. The connector may be non-reversible and may include spring-loaded latches which can be prevented from unlatching when the dispensing coupler is operated to open a two-port valve closure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The following description and the accompanying drawings referred to therein are included by way of non-limiting example in order to illustrate how the invention may be put into practice. In the drawings:

Figure 1 is a general front view of a compact beverage dispenser;

Figure 2 is a general rear view of the beverage dispenser;

Figure 3 is a general view of an umbilical to connect a beverage container to the dispenser;

Figure 4 is a longitudinal section through the umbilical together with its end connectors, including an inset cross-sectional detail;

Figure 5 is an enlarged view of one of the sectioned end connectors, including an inset detail;

Figure 6 is a general view of a dispensing coupler for use with the umbilical connector, shown in an uncoupled condition;

Figure 7 is a side view of the dispensing coupler, again in the uncoupled condition;

Figure 8 is a side view of the dispensing coupler shown in a coupled condition;

Figures 9a-d show connection and disconnection of the umbilical connector and the beverage dispenser.

DETAILED DESCRIPTION OF THE DRAWINGS

[0012] Referring to **Fig.s 1 and 2**, the compact beverage dispenser includes a dispensing unit 1 which is supplied by an external keg-type beverage container 2 through an umbilical 3. The dispensing unit has a housing 4 which contains a source of pressurised gas. The front of the housing 4 is provided with a dispensing font 5 from which a beverage such as beer may be dispensed into a drinking glass placed above a perforated drip tray 6.

[0013] In the present embodiment the dispenser is intended to be used with carbonated beverages which are supplied in bag-in-keg containers 2. The source of pressurised gas may therefore be a small air compressor. It is noted however that the containers need not necessarily have an internal bag. In some embodiments the dispensing gas could be supplied by a carbon dioxide cylinder.

[0014] The present bag-in-keg container 2 may be blow moulded from plastic, the upper end of which is provided with a two-port valve closure 8, which may be as described in WO 2020 141 320-A1. Before connection to the dispenser the valve ports are closed to seal the contents within the container, but when a dispensing coupler 9 is engaged with the closure 8 the ports are opened to simultaneously admit pressurised dispensing gas into the head space through one port whilst the beverage is withdrawn via a dip tube and exits through the second port. Since such valve closures and dispensing couplers are well known they will not be described in greater detail.

[0015] Referring to the external view of **Fig. 3**, the

umbilical 3 is a length of flexible tube having an outer wall 10 which extends from the dispensing coupler 9 to the dispensing unit 1. At each end, the umbilical is provided with a two-port connector 11, 12, both of which may be the same as in the example shown. Each connector 11, 12 has a connector body 14 with a trailing end 15, to which the umbilical 3 is joined, and an opposite leading end 16. A pair of mutually parallel spigots 17 and 18 protrude from the leading end 15, the spigot 17 being of smaller diameter than the spigot 18. Each spigot 17, 18 is provided with a respective O-ring seal 19, 20. The connector body 14 also carries a pair of spring-loaded latches 21 and 22 which are pivotally connected to opposite sides of the connector body by pivot pins 23.

[0016] As can be seen in the enlarged inset detail of **Fig. 4**, the flexible outer wall 10 of the umbilical 3 is substantially circular. Contained within the outer wall 10 is a further length of flexible tubing which forms a substantially circular inner wall 24 defining an inner passage 25 to conduct pressurised gas from the dispensing unit 1 to the keg coupler 9. The outer diameter of the inner wall 24 is substantially smaller than the internal diameter of the outer wall 10 so that an annular space is formed between the two walls 10 and 24, which thus define an outer passage 26 to conduct beverage from the keg coupler 9 to the dispensing unit 1. The inner and outer passages, 25 and 26, both travel within the outer wall 10 throughout the length of the umbilical 3. Considering **Fig. 4** in combination with **Fig. 5**, it can be seen that the trailing end 15 of each connector 11, 12 has a tubular projection 29 onto which the adjacent end of the outer wall 10 is secured by a ferrule 30. The inner wall 24 continues through the connector body 14 and is sealably received in the smaller diameter spigot 17 by means of an internal ferrule 27 (see **Fig. 5** inset detail) so that the inner passage 25 continues through the spigot 17. The outer passage 26 extends through the connector body 14 via an internal duct 31 which in turn continues through the larger diameter spigot 18. **Fig. 5** also shows that the leading ends of the latches 21 and 22 both have inwardly-directed locking projections 32 which each have an inclined leading end face 33. The opposite trailing ends of the latches are urged apart by respective compression springs 34 which are received over respective locating pins 35 on the connector body 14, so that the locking projections 32 are urged inwardly towards the spigots 17 and 18.

[0017] Referring to **Fig. 6**, the dispensing coupler 9, which is not part of the invention but which can be used with containers fitted with conventional two-port keg valves, is configured as an inverted-cup shaped body with a cylindrical side wall 40 and a circular top wall 41 provided with a pivoted handle 42. The side wall 40 may be configured to engage the keg valve by means of a standard bayonet-type or other connection. When thus engaged, the handle 42 can be rotated from an uncoupled position shown in **Fig.s 6 and 7** to a coupled position shown in **Fig. 8**, which causes a reciprocable

probe 43 to be advanced from the bottom end of the coupler to open separate gas and liquid flow paths in a way which is known and described in the art. The two flow paths extend through the probe 43 and exit through separate ports 44 and 45 (**Fig. 6**) which are accessed through a window 46 in the side wall of the coupler. It will be noted that when the probe is in the uncoupled position the ports 44 and 45 are positioned at the top of the window 46, but as the probe extends, the ports move to the bottom of the window between a pair of projections 47 (**Fig. 7**). When the ports are at the top of the window one of the umbilical connectors 11 (or 12) can be mated with the coupler by inserting the spigots 17 and 18 into the ports 44 and 45. Since the spigots are of different sizes, as are their mating ports, the connector can only be inserted on one orientation. When the connector is inserted the sloping faces 33 of the locking projections 32 cause the projections to initially move apart before locating in corresponding latching recesses 49 on the probe 43 under spring pressure. Once the locking projections are thus engaged the latches 21 and 22 must be squeezed together against their spring loading to allow the connector to be removed. As the probe 43 moves to the extended position the connector moves between the projections 47 which prevent the latches 21 and 22 from pivoting (**Fig. 8**). The connector cannot therefore be disconnected from the dispensing coupler until the probe is moved back to the uncoupled position by the handle 42. This prevents the umbilical being disconnected while the dispensing coupler is holding the keg valve open.

[0018] It is also desirable to prevent, or deter, accidental disconnection of the dispenser end of the umbilical 3. Referring to **Fig. 9a-d**, the second connector 12 (or 11) may be connected to the dispensing unit by a connecting block 50 having a bottom face with similar connecting ports to the ports 44 and 45. The connecting block may also have latching recesses similar to the recesses 49 of the keg coupler. A drop-down cover 51 is slidably mounted on the connecting block 50. When the connector is engaged with the block 50 the cover overlies the leading end of the latches 21 and 22 preventing the latching projections 32 from being accidentally disengaged, as shown in **Fig. 9a**. In order to remove the connector 12 the cover 51 must be slid upwards and held in the raised position as in **Fig. 9b** enabling the latches to be squeezed together and released, **Fig. 9c**, which permits the connector to be removed, **Fig. 9d**. As an extra safeguard the cover could be associated with an electrical sensor which switches off the gas supply when the cover is moved to the release position, or a mechanical interlock which prevents the cover being moved while the dispenser is switched on.

[0019] To emphasise the significance of the present umbilical arrangement the following should be noted:

- Although the two umbilical passages could be moulded into one extruded tube the symmetrical arrangement of unconnected coaxial inner and outer

tubes ensures that the umbilical is equally flexible in all directions, making the umbilical easy to route between the beverage container and the dispensing unit resulting in a neater and uncluttered appearance.

- The cross sectional area of the annular outer pathway is significantly greater than that of the innermost pathway. By routing the pressurised dispensing gas through the innermost pathway the flow of beverage is maximised. Compared with using two separate feed tubes the same flow can be achieved within a substantially smaller overall cross sectional area.
- During transfer of beverage the pressures within the gas and beverage passageways are normally very similar. Therefore, the gas tube can have a much thinner wall than if it was exposed to external air pressure. Such a reduction in wall thickness again allows the overall cross section of the transfer tubes to be reduced, maximising the liquid flow and increasing the flexibility of the interconnecting pipework.
- Since the connectors are not reversible the air supply cannot be accidentally connected to the beverage dispensing port, or vice versa. Furthermore, the danger of accidental disconnection of the interconnecting pipework resulting in unintended spillage is prevented, or substantially reduced. On the other hand, the connectors ensure that the pipework is quick and easy to disconnect and re-connect to facilitate cleaning and sterilisation or replacement, e.g. to change the length of the interconnection.

[0020] Although the embodiment described above relates specifically to beer kegs and dispensers it will be appreciated that the apparatus can also be used to dispense other beverages, carbonated or still, chilled or ambient.

[0021] Whilst the above description places emphasis on the areas which are believed to be new and addresses specific problems which have been identified, it is intended that the features disclosed herein may be used in any combination which is capable of providing a new and useful advance in the art.

Claims

1. A beverage dispenser:

- a dispensing unit (1) which includes a source of pressurised gas and a dispensing font (5),
- a dispensing coupler (9) configured to engage a two-port valve closure (8) of a beverage container,
- a first passage (25) to conduct pressurised gas

from the dispensing unit to the dispensing coupler,

- a second passage (26) to conduct beverage from the dispensing coupler to the dispensing unit;

characterised in that

- the dispensing coupler (9) is connected to the dispensing unit (1) by an umbilical (3);

- the umbilical (3) has an outer wall (10) extending from the dispensing coupler (9) to the dispensing unit (1);

- the first and second passages (25, 26) both travel within said outer wall (10) throughout the length of the umbilical.

2. A beverage dispenser according to claim 1 wherein the cross-sectional area of the first passage (25) is less than the cross-sectional area of the second passage (26).

3. A beverage dispenser according to claim 1 wherein the first passage (25) is defined by an inner wall (24) which is located within the outer wall (10).

4. A beverage dispenser according to claim 3 wherein the inner wall (24) is not connected to the outer wall (10) along the length of the umbilical.

5. A beverage dispenser according to claim 3 wherein the thickness of the inner wall (24) is less than the thickness of the outer wall (10).

6. A beverage dispenser according to claim 3 wherein the second passage (25) is defined by and between the inner and outer walls (24, 10).

7. A beverage dispenser according to claim 1 wherein the umbilical (3) is connected to the dispensing coupler (9) by a releasable connector (11, 12), the releasable connector (11, 12) contains the first and second passages (25, 26) and is configured to connect said passages with corresponding ports (44, 45) of the dispensing coupler (9) such that the connections between the said ports and passages are non-reversible.

8. A beverage dispenser according to claim 7 wherein the releasable connector (11, 12) includes latching means (21, 22) to releasably engage the dispensing coupler (9).

9. A beverage dispenser according to claim 8 wherein the latching means (21, 22) comprise spring-loaded latches.

10. A beverage dispenser according to claim 1 wherein the umbilical (3) is connected to the dispensing unit (1) by a releasable connector (12, 11), the releasable

connector (11, 12) contains the first and second passages (25, 26) and is configured to connect said passages with corresponding ports of the dispensing unit (1) such that the connections between the said ports and passages are non-reversible.

11. A beverage dispenser according to claim 10 wherein the releasable connector (11, 12) includes latching means (21, 22) to releasably engage the dispensing unit (1).

12. A beverage dispenser according to claim 11 wherein the latching means (21, 22) comprise spring-loaded latches.

13. A beverage dispenser according to claim 11 wherein the dispensing unit (1) includes a cover (51) which can operate to prevent disengagement of the latching means (21, 22).

Patentansprüche

1. Ein Getränkespender:

- eine Ausgabeeinheit (1) mit einer Druckgasquelle und einem Ausgabebehälter (5),
- ein Ausgabekupplungsstück (9) zum Anschluss eines Zweiwegeventils (8) eines Getränkebehälters,
- ein erster Kanal (25) zur Zufuhr von Druckgas von der Ausgabeeinheit zum Ausgabekupplungsstück,
- ein zweiter Kanal (26) zur Zufuhr von Getränk vom Ausgabekupplungsstück zur Ausgabeeinheit;

dadurch gekennzeichnet, dass

- das Ausgabekupplungsstück (9) über eine Versorgungsleitung (3) mit der Ausgabeeinheit (1) verbunden ist;
- die Versorgungsleitung (3) eine Außenwand (10) aufweist, die sich vom Ausgabekupplungsstück (9) zur Ausgabeeinheit (1) erstreckt;
- der erste und der zweite Kanal (25, 26) über die gesamte Länge der Versorgungsleitung innerhalb dieser Außenwand (10) verlaufen.

2. Getränkespender nach Anspruch 1, wobei die Querschnittsfläche des ersten Kanals (25) kleiner ist als die Querschnittsfläche des zweiten Kanals (26).

3. Getränkespender nach Anspruch 1, wobei der erste Kanal (25) durch eine Innenwand (24) gebildet wird, die sich innerhalb der Außenwand (10) befindet.

4. Getränkespender nach Anspruch 3, wobei die Innenwand (24) entlang der Verbindungsleitung nicht mit der Außenwand (10) verbunden ist.

5. Getränkespender nach Anspruch 3, wobei die Dicke der Innenwand (24) geringer ist als die Dicke der Außenwand (10).
6. Getränkespender nach Anspruch 3, wobei der zweite Kanal (25) durch die Innen- und Außenwand (24, 10) gebildet wird und zwischen diesen liegt. 5
7. Getränkespender nach Anspruch 1, wobei die Versorgungsleitung (3) über einen lösbaren Verbinder (11, 12) mit dem Ausgabeteil (9) verbunden ist. Der lösbare Verbinder (11, 12) enthält den ersten und zweiten Kanal (25, 26) und ist so konfiguriert, dass er diese Kanäle mit entsprechenden Anschlüssen (44, 45) des Ausgabeteils (9) verbindet, sodass die Verbindungen zwischen den Anschlüssen und Kanälen nicht reversibel sind. 10 15
8. Getränkespender nach Anspruch 7, wobei der lösbare Verbinder (11, 12) Verriegelungsmittel (21, 22) zur lösbaren Verbindung mit dem Ausgabeteil (9) aufweist. 20
9. Getränkespender nach Anspruch 8, wobei die Verriegelungsmittel (21, 22) federbelastete Verriegelungen umfassen. 25
10. Getränkespender nach Anspruch 1, wobei die Versorgungsleitung (3) über einen lösbaren Verbinder (12, 11) mit der Ausgabeeinheit (1) verbunden ist. Der lösbare Verbinder (11, 12) enthält den ersten und zweiten Kanal (25, 26) und ist so konfiguriert, dass er diese Kanäle mit entsprechenden Anschlüssen der Ausgabeeinheit (1) verbindet, wobei die Verbindungen zwischen den Anschlüssen und Kanälen nicht reversibel sind. 30 35
11. Getränkespender nach Anspruch 10, wobei der lösbare Verbinder (11, 12) Verriegelungsmittel (21, 22) zur lösbaren Verbindung mit der Ausgabeeinheit (1) aufweist. 40
12. Getränkespender nach Anspruch 11, wobei die Verriegelungsmittel (21, 22) federbelastete Verriegelungen umfassen. 45
13. Ein Getränkespender nach Anspruch 11, wobei die Ausgabeeinheit (1) eine Abdeckung (51) aufweist, die so betätigt werden kann, dass ein Lösen der Verriegelungseinrichtung (21, 22) verhindert wird. 50

Revendications

1. Distributeur de boissons:
 - une unité de distribution (1) comprenant une source de gaz sous pression et un réservoir de

distribution (5),

- un raccord de distribution (9) conçu pour s'engager dans un robinet à deux voies (8) d'un récipient de boisson,
- un premier passage (25) acheminant le gaz sous pression de l'unité de distribution vers le raccord de distribution,
- un second passage (26) acheminant la boisson du raccord de distribution vers l'unité de distribution;

caractérisé en ce que

- le raccord de distribution (9) est relié à l'unité de distribution (1) par un cordon ombilical (3);
- le cordon ombilical (3) présente une paroi extérieure (10) s'étendant du raccord de distribution (9) à l'unité de distribution (1);
- les premier et second passages (25, 26) sont tous deux situés à l'intérieur de ladite paroi extérieure (10) sur toute la longueur du cordon ombilical.

2. Distributeur de boissons selon la revendication 1, dans lequel la section transversale du premier passage (25) est inférieure à celle du second passage (26).
3. Distributeur de boissons selon la revendication 1, dans lequel le premier passage (25) est délimité par une paroi intérieure (24) située à l'intérieur de la paroi extérieure (10).
4. Distributeur de boissons selon la revendication 3, dans lequel la paroi intérieure (24) n'est pas reliée à la paroi extérieure (10) sur toute la longueur du tuyau.
5. Distributeur de boissons selon la revendication 3, dans lequel l'épaisseur de la paroi intérieure (24) est inférieure à celle de la paroi extérieure (10).
6. Distributeur de boissons selon la revendication 3, dans lequel le second passage (25) est délimité entre les parois intérieure et extérieure (24, 10).
7. Distributeur de boissons selon la revendication 1, dans lequel le cordon ombilical (3) est relié au coupleur de distribution (9) par un connecteur amovible (11, 12). Ce connecteur amovible (11, 12) comporte un premier et un second passage (25, 26) et est conçu pour relier ces passages aux orifices correspondants (44, 45) du coupleur de distribution (9), de sorte que les connexions entre ces orifices et passages soient irréversibles.

coupleur de distribution (9).

9. Distributeur de boissons selon la revendication 8, dans lequel les moyens de verrouillage (21, 22) sont des loquets à ressort. 5
10. Distributeur de boissons selon la revendication 1, dans lequel le cordon ombilical (3) est relié à l'unité de distribution (1) par un connecteur amovible (12, 11). Ce connecteur amovible (11, 12) comporte un premier et un second passage (25, 26) et est conçu pour relier ces passages aux orifices correspondants de l'unité de distribution (1), de sorte que les connexions entre ces orifices et passages soient irréversibles. 10 15
11. Distributeur de boissons selon la revendication 10, dans lequel le connecteur amovible (11, 12) comprend des moyens de verrouillage (21, 22) permettant de le fixer de manière amovible à l'unité de distribution (1). 20
12. Distributeur de boissons selon la revendication 11, dans lequel les moyens de verrouillage (21, 22) sont des loquets à ressort. 25
13. Un distributeur de boissons selon la revendication 11 dans lequel l'unité de distribution (1) comprend un couvercle (51) qui peut fonctionner pour empêcher le désengagement des moyens de verrouillage (21, 22). 30

35

40

45

50

55

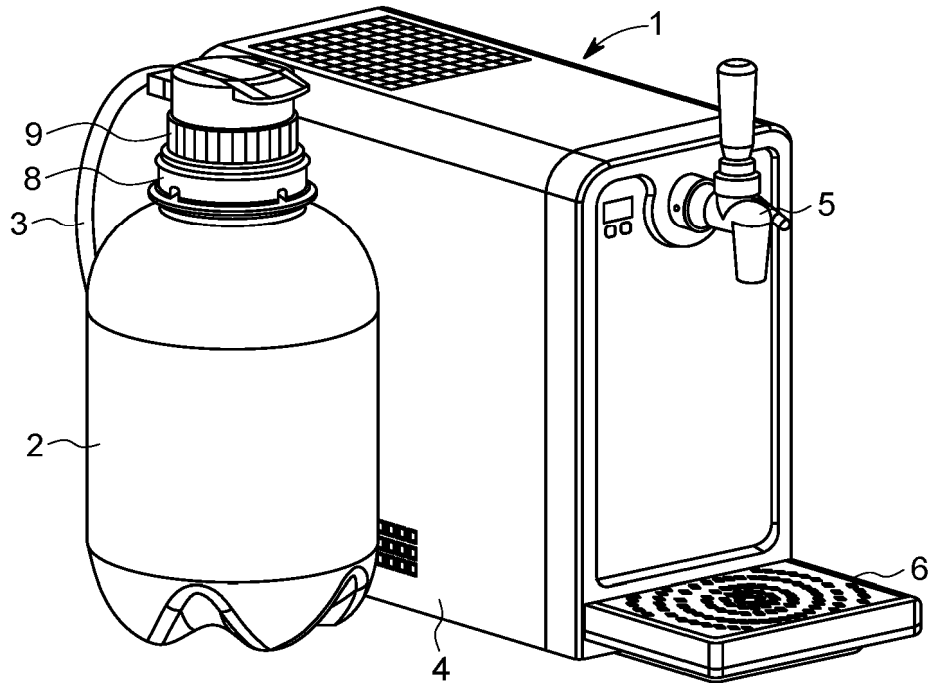


FIG. 1

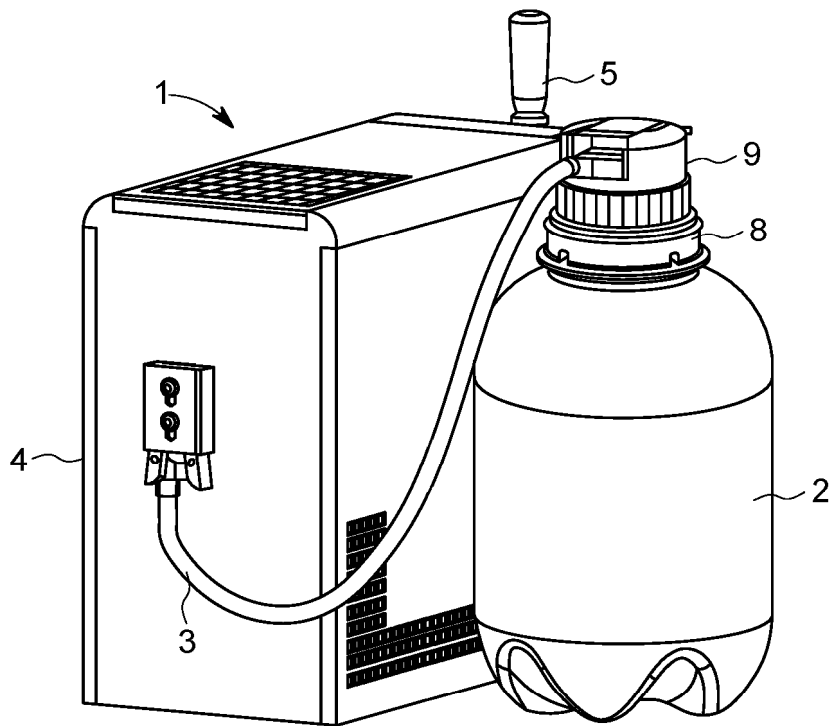


FIG. 2

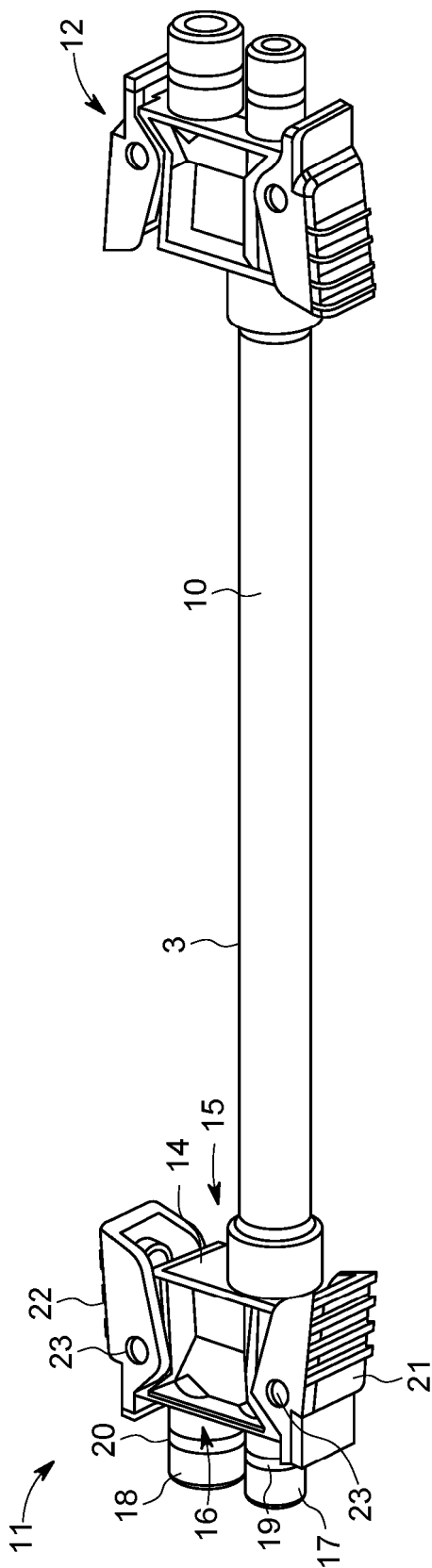


FIG. 3

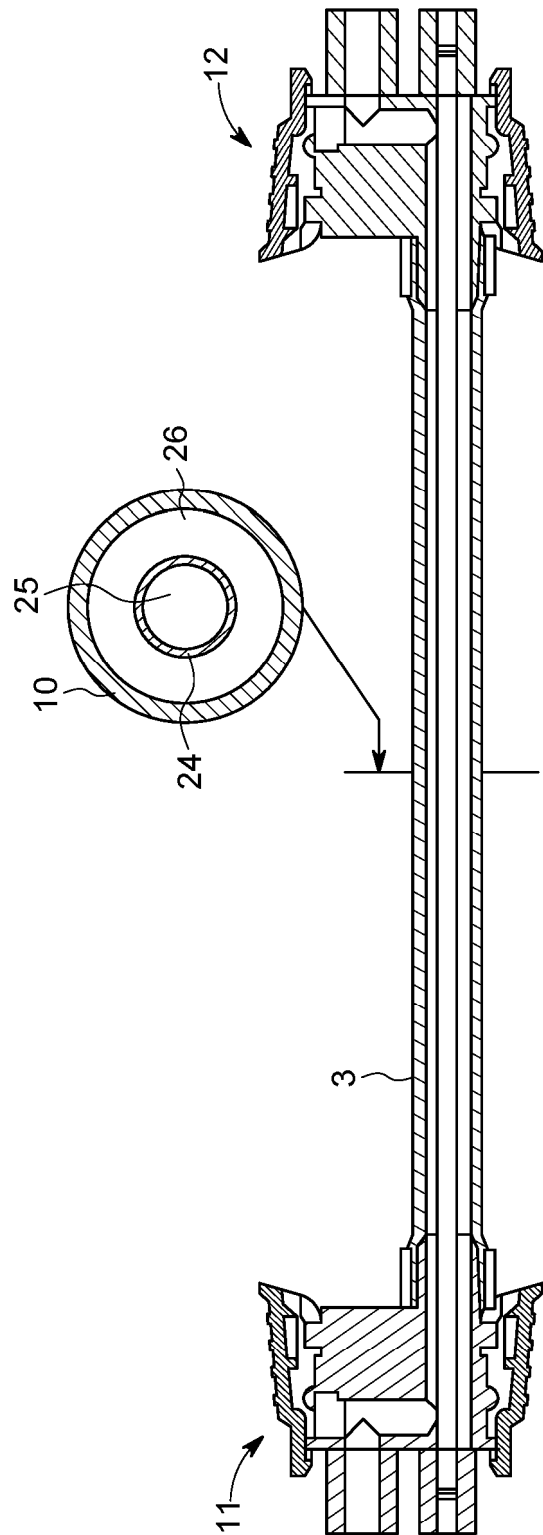


FIG. 4

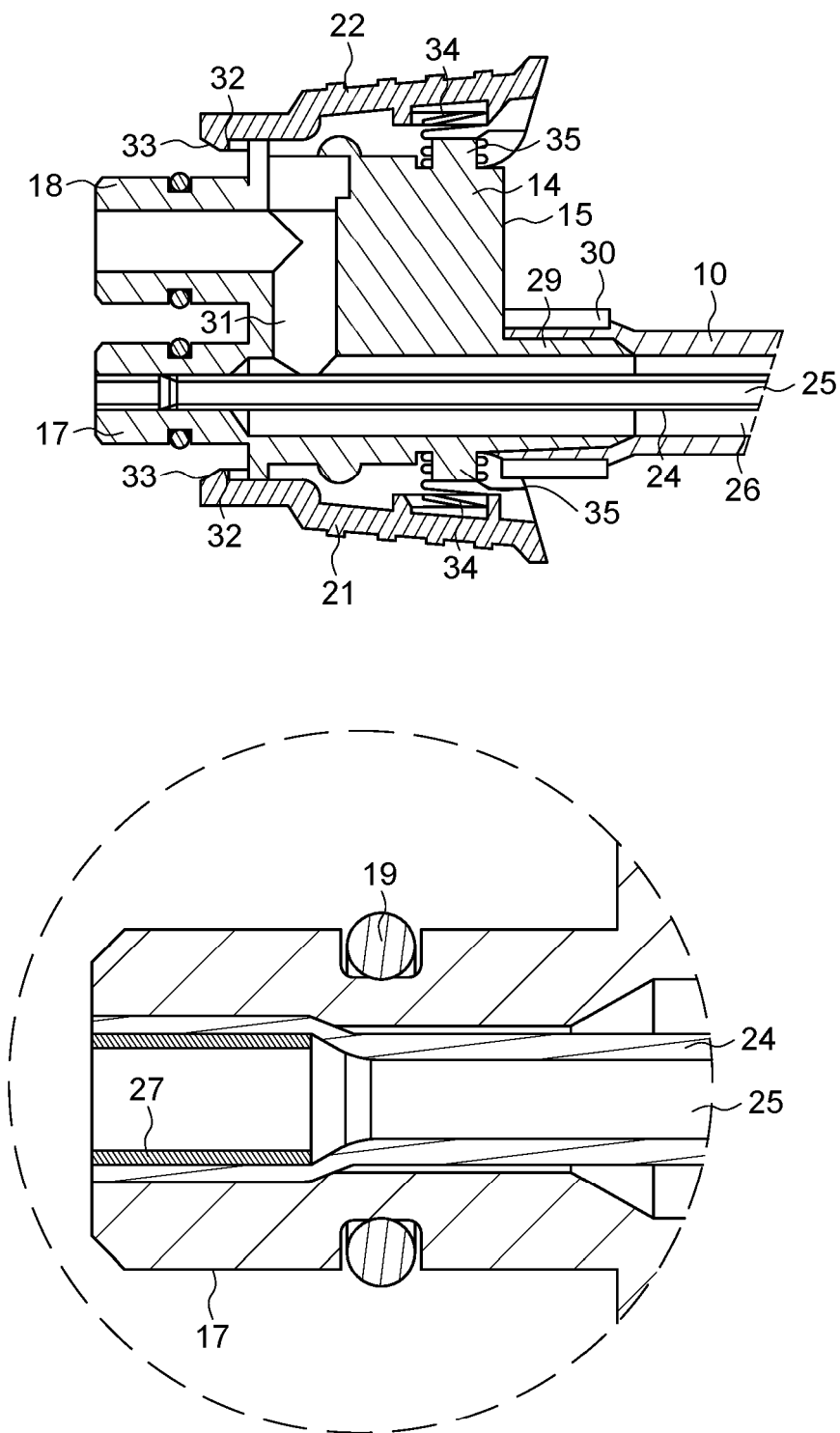


FIG. 5

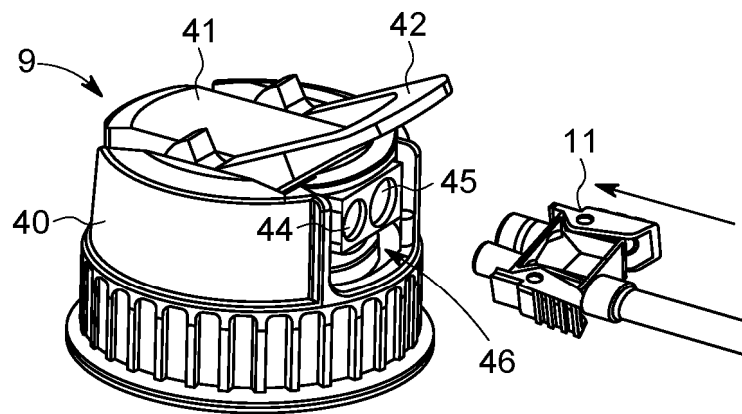


FIG. 6

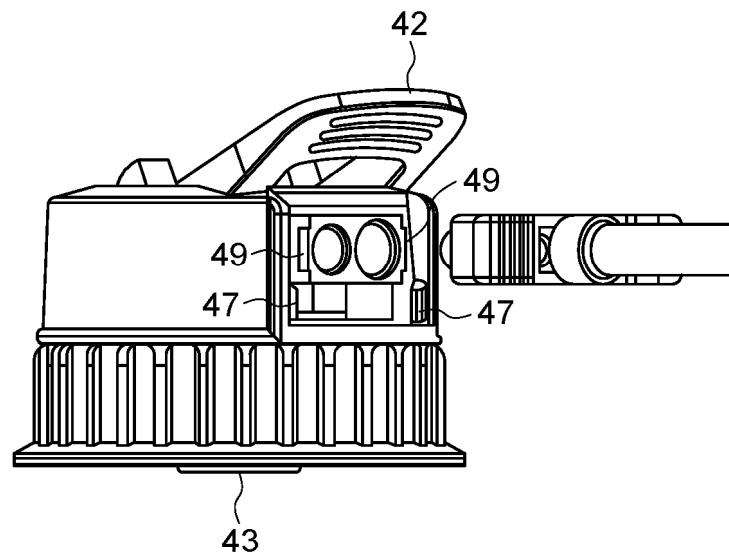


FIG. 7

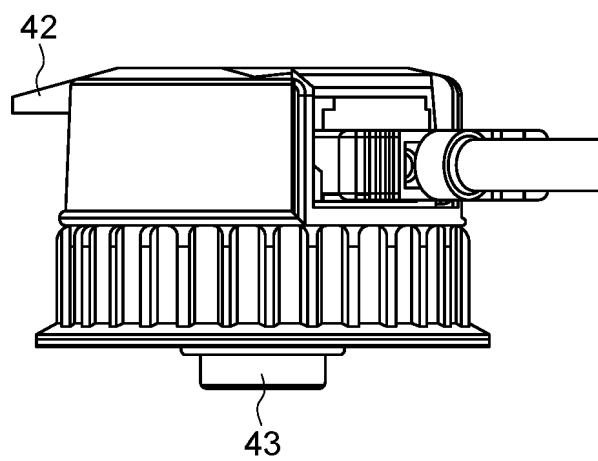


FIG. 8

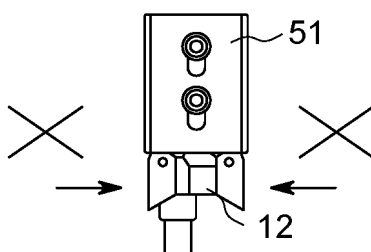


FIG. 9a

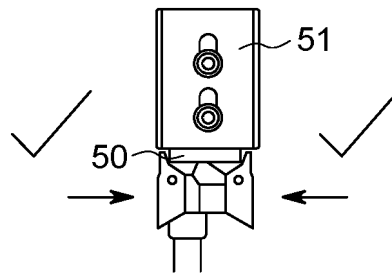


FIG. 9b

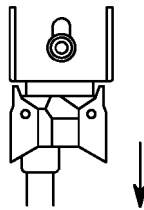


FIG. 9c

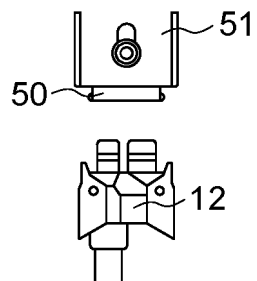


FIG. 9d

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2020141320 A1 [0002] [0014]
- EP 2228336 A [0004]