



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.01.2015 Bulletin 2015/02

(51) Int Cl.:
F17C 5/06 (2006.01)

(21) Application number: **13175090.3**

(22) Date of filing: **04.07.2013**

(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
 Designated Extension States:
BA ME

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AL AT BE BG CH CY CZ 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

(54) **Device and method for filling gases into high-pressure gas cylinders having different filling terminals**

(57) The present invention relates to a device and method for filling at least one gas cylinder (1) out of a group of gas cylinders which have different filling terminals (3) with gas at a high pressure, in particular of 20 to 500 bar, a fixed reservoir system (20) being connectable to the filling terminal (3) of the gas cylinder (1) by way of a flexible line (4) and the flexible line (4) comprising a line terminal (5) which is adapted to the filling terminal (3) of the gas cylinder. According to the invention, the line terminal (5) comprises a filling head (6) comprising a receiver (7) for an intermediate piece (8) and at least one changeable intermediate piece (8) which is adapted to the filling terminal (3) of the gas cylinder (1), the filling head (6) comprising a pin (15) which can be moved parallel to the longitudinal axis (12) into at least two different positions. A specific intermediate piece (8) having a corresponding marking (11) is inserted into the receiver (7) for each type of filling terminal (3) and/or for each different gas or gas mixture, and the gas supply is only released when the marking (11) of the intermediate piece (8) has been recognised by a safety means (32) as suitable for the provided filling process. The invention makes economical industrial-scale use of filling stations for gas cylinders possible, it being possible to change between dif-

ferent gases to be filled rapidly and safely at least for the same pressure level.

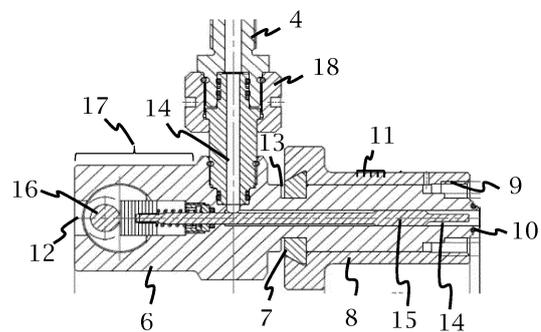


Fig. 2

Description

[0001] The present invention relates to filling high-pressure gas cylinders, it being possible for the gas cylinders to have different filling terminals. Gas cylinders comprising technical or medical gases are widely used, and after emptying or when they only have a predetermined residual pressure they have to be filled again with the correct gas at the desired pressure in each case. This is typically carried out on an industrial scale at suitable filling stations. In this context, a fixed reservoir system comprising a reservoir container for the respective gas is connected to a filling terminal of the gas cylinders to be filled by way of a flexible line, and subsequently the filling process is started up.

[0002] It is known to fill a relatively large number of gas cylinders of the same type simultaneously, arranged into pallets, each gas cylinder being connected to the fixed reservoir system individually via a flexible line. It is also known to fill gas cylinders which are assembled in batches and which comprise at least one shared filling terminal at filling stations of this type.

[0003] Typically, a fixed reservoir system contains a plurality of reservoir containers comprising different gases, which are connected via valves to a shared primary supply line. From there, via a metering unit and a shared primary discharge line, the respectively required gas reaches the flexible lines, which are in turn connected to the gas cylinders to be filled. Depending on the number of gas cylinders which are to be filled per unit time, a plurality of groups of primary discharge lines may also be provided with flexible lines.

[0004] However, for various reasons, there are different filling terminals, depending not only on the type of gas and the desired filling pressure, but also on the fittings and safety systems used on gas cylinders and on the selection of the level of automation of the filling process in each case.

[0005] Nowadays, modern gas cylinders typically comprise a protective cap, which protects the filling terminal and various fittings which are mounted on the gas cylinder. There are various embodiments of protective caps of this type, but all of them restrict the available free space for connecting a flexible line. Modern filling terminals are also equipped with various systems for maintaining a residual pressure in the gas cylinders or for meeting other specifications. For reliable filling - and, especially in the case of gas mixtures, correct filling - it is generally necessary for a central pin to be introduced into the filling terminal, where it actuates a valve or the like. The length of this pin or the penetration depth thereof into the filling terminal is different for different filling terminals.

[0006] When a plurality of gas cylinders are transported and filled simultaneously, they are typically arranged tightly against one another, the central axes of the gas cylinders being at the corners of adjacent squares. This also limits the free space available in the upper region of the gas cylinders for processes during the filling. There

are even pallets comprising even tighter arrangements, and thus having very constrained conditions for connecting flexible lines to cylinders on the inside of the group.

[0007] The present invention involves relatively high pressures, which can be controlled by all of the lines and valves of the system as a whole. All of the components therefore have to be configured for corresponding pressures of 10-500 bar, in particular 150-350 bar. At pressures of this type, most gases used on an industrial scale are liquid, but they are generally gaseous during refilling, and so in terms of fluids the installation as a whole has to be configured for gaseous gases in any case. This should be noted when sizing all of the lines and valves.

[0008] In industrial-scale installations thus far, either it has only been possible to use a single type of filling terminals, reducing the flexibility when filling different gas cylinders or necessitating different filling stations for different gases or pressure levels, or a filling station has had to be refitted in a complex manner for different types of filling terminals. It is certainly desirable for safety reasons that it is already ensured through various filling terminals that only the respectively desired gas, at the respectively desired pressure, is able to be filled into a gas cylinder, but this comes at the price of a high logistic complexity or frequent refitting of the filling installations.

[0009] A connection coupling for pressurised gas valves, which makes it possible to couple a connector to the end of a flexible line system using a quick coupling, is already known from DE 197 44 558 A1.

[0010] Starting from this prior art, the object of the present invention is to provide a device and a method for filling gases into high-pressure gas cylinders comprising different filling terminals, in which the described drawbacks are overcome in so far as possible. In particular, the same filling station should be adapted for filling as many different gas cylinders as possible comprising different protective caps and/or filling terminals, without complex refittings and removal of a large number of complex components being involved when changing between different types of gas cylinders. Where it is unavoidable that different systems of filling terminals have to be used for different filling pressure levels, simplification of the filling processes for different gases at one filling pressure level should at least be achieved.

[0011] A device according to claim 1 and a method according to claim 12 are used to achieve this object. Advantageous configurations which may occur individually or in technically reasonable combinations are specified in the respective dependent claims.

[0012] The device according to the invention for filling at least one gas cylinder having a filling terminal out of a group of gas cylinders which have different filling terminals with gas at a high pressure, a fixed reservoir system being connectable to the filling terminal of the gas cylinder by way of a flexible line and the flexible line comprising a line terminal which is adapted to the filling terminal of the gas cylinder, is distinguished in that the line terminal comprises a filling head having a geometric longitudinal

axis and comprising a receiver for an intermediate piece out of a group of at least one intermediate piece, on which receiver is changeably mountable an intermediate piece which is adapted to the filling terminal of the gas cylinder, and in that the filling head comprises a pin which can be moved parallel to the longitudinal axis into at least two different positions. High pressure refers to a pressure in the range of 20 to 500 bar, in particular of 100 to 350 bar. Usually, different types of filling terminals are used for different pressure levels, different thread diameters of the filling terminals also being provided for different gases, for example. Different-length pins, for operating residual pressure valves and the like which are integrated into the filling terminal, are also required. By way of the present invention, a single filling head can be used at least for one pressure level, and comprises a receiver for an intermediate piece, only the intermediate piece having to be changed so as to be able to connect different filling terminals for all of the gas cylinders in the relevant group of gas cylinders of the respective pressure level. In this way, it is no longer necessary to construct different filling stations for gas cylinders having different filling terminals, and no complex processes for changing the filling heads have to be carried out at a filling station. Simply by changing the intermediate piece and adjusting the pin to the necessary position, the filling head can be refitted for filling a different filling terminal from the relevant group of gas cylinders having different filling terminals. The device according to the invention can still be used with only one kind of intermediate pieces for filling only one kind of filling terminals in a filling station, but it also allows filling different kinds of filling terminals in a single filling station by just quickly exchanging the intermediate pieces.

[0013] In a preferred embodiment of the invention, the central pin can be moved from the outside by way of an adjusting lever, the adjusting lever preferably being arranged and dimensioned in such a way that, when the filling head comprising the intermediate piece is manually connected to a filling terminal, said lever has to be brought into a rest position from which it can be brought into one or more operating positions which can be distinguished using the position of the lever.

[0014] Preferably, the adjusting lever is arranged at an end of the filling head opposite the receiver for the intermediate piece. A latching or fixing device for holding the pin in at least two different positions, preferably three or more, makes safe handling easier. In this context, the latching or fixing can be brought about at the adjusting lever and/or at the pin itself. In this context, mechanical locks can be configured in such a way that the possibility of incorrect operation is largely excluded. It is also possible to determine the lever positions with suitable sensors so as to exclude the possibility of automatically false settings.

[0015] For safety and economic reasons, a gas cylinder has to be prevented from being filled with a gas other than the desired gas. It is therefore particularly advanta-

geous if each intermediate piece comprises a marking from which the properties thereof can be detected, the marking preferably being machine-readable, in particular being a bar code. In this way, operating errors, for example the wrong intermediate piece being mounted, potentially leading to connection to a gas cylinder which is not intended for a particular gas, can be detected more easily, it in particular also being possible to provide automatic locking if the wrong intermediate pieces are used. Different colours have already been used for different gases for a long time, and so coloured marking of the intermediate pieces is an obvious possibility. Locked cabinets of the appropriate colour, which unlock only when particular safety conditions are met, are possible for storing intermediate pieces which are not currently required, but automatic systems are still more strongly preferred.

[0016] According to the invention, the fixed reservoir system may comprise reservoir containers comprising different gases, which can be connected to the flexible line via valves. In this way, gas cylinders can be filled with different gases at a single filling station, only relatively simple rinsing processes and a change of the intermediate pieces being required for the change from one gas to another.

[0017] In industrial-scale applications, a plurality of flexible lines for simultaneously filling a plurality of gas cylinders with the same gas are generally connected in parallel on the fixed reservoir system.

[0018] In this context, it is advantageous if there are different intermediate pieces for different gases and/or different types of gas cylinders and/or different types of filling terminals. Since the intermediate pieces are typically relatively small, no complex devices for storing and maintaining different filling heads need to be provided in filling stations configured according to the invention. Small containers for the different intermediate pieces are sufficient.

[0019] It is particularly advantageous and safe if each intermediate piece carries a machine-readable marking and there is a safety means which reads the marking before each filling process and blocks any gas supply for which the intermediate piece is not intended.

[0020] In a preferred embodiment of the invention, the flexible line opens into the filling head approximately perpendicular to the longitudinal axis at a line flange whereby this filling flange makes it possible to twist the line. This construction is particularly favourable if the flexible lines are to extend to the gas cylinders approximately vertically from above at a filling station, and the filling heads can be connected approximately horizontally to the filling terminals of the gas cylinders which are to be filled.

[0021] If a plurality of gas cylinders is filled simultaneously, they are typically arranged standing tightly side by side, the geometric central axes of the gas cylinders being arranged at the corners of adjacent squares. In this arrangement, the spatial conditions are relatively tight; in particular if the gas cylinders comprise protective caps. There are even pallet arrangements in which there are

even smaller gaps. So as to be able to use the filling heads according to the invention even in these situations, the filling head and the intermediate piece are preferably dimensioned in such a way that the two can be used at least in an approximately diagonal direction in a gap between the filling terminals of gas cylinders which are arranged tightly against one another. This may require the gas cylinders to be arranged relatively precisely aligned in the filling station, but this can be implemented in a preparation region. For the fastest possible change processes, it is advantageous if the intermediate piece can be inserted into the receiver of the filling head using a quick fastener and can preferably be locked therein. This may for example take place using a coupling according to DE 19744558 A1, wherein it has to be suitable for the pressures which occur. The intermediate piece is preferably twistable on the receiver as also described in the cited document to allow fastening its free end including a threaded portion to a filling terminal of a gas cylinder.

[0022] The object of the invention is also achieved by a method for filling at least one gas cylinder out of a group of gas cylinders having different filling terminals and/or different gases or gas mixtures at high pressure on a fixed reservoir system, a plurality of flexible lines connected in parallel to the reservoir system being provided, each flexible line comprising a filling head, having a pin which can be moved into at least two different positions parallel to a geometric longitudinal axis and having a receiver for a changeable intermediate piece, and a specific intermediate piece having a corresponding marking being inserted into the receiver for each type of filling terminal and/or for each different gas or gas mixture, and the gas supply only being released when the marking of the intermediate piece has been recognised by a safety means as suitable for the provided filling process. Instead of merely equipping filling stations with filling heads for each individual type of filling terminal so as largely to prevent incorrect operations, the present invention makes it possible to fill gas cylinders comprising different filling terminals merely by changing intermediate pieces. The risk of incorrect operation is excluded in that the intermediate pieces comprise a marking for identifying them, and a safety means prevents a gas cylinder from being filled with a gas which is not provided for this gas cylinder.

[0023] A safety system of this type can be further improved in that each gas cylinder which is to be filled comprises a machine-readable cylinder marking relating to the gas to be filled in and/or the permissible filling pressure and/or the type of filling terminal, and the intermediate piece is selected in accordance with this information, and after the insertion thereof into the filling head the correspondence of the marking of the intermediate piece is checked before the filling process is released. Since it is usual in any case to provide gas cylinders with a machine-readable cylinder marking, for example bar codes or else electronic chips, the selection of the intermediate piece can thus be facilitated and the safety can

be increased. The present invention is also applicable to batches of gas cylinders which are interconnected and comprise a shared filling terminal. The above statements apply analogously to batches of this type.

[0024] Embodiments of the invention and further details are described in the following by way of the drawings. In a partial schematic representation:

Fig. 1 shows the region of a filling terminal of a gas cylinder,

Fig. 2 is a longitudinal section through a filling head according to the invention comprising an intermediate piece,

Fig. 3 is a longitudinal section through another embodiment of a filling head according to the invention comprising an intermediate piece,

Fig. 4 is a view from above of a batch of gas cylinders during the filling process,

Fig. 5 is an overview of a filling station according to the invention, and

Fig. 6 is a schematic drawing of a filling station while filling batches of gas cylinders.

[0025] Fig. 1 shows the upper part of a gas cylinder 1, in particular a high-pressure gas cylinder for typical industrial or medical applications, comprising a sketched protective cap 2 which protects any fittings or valves positioned on the gas cylinder 1. Inside the protective cap 2 there is a filling terminal 3, the shape of which is typically standardised for different gases and pressure levels and which generally comprises an external thread. In most cases, a valve (one-way valve or residual gas pressure valve, not shown) is arranged inside the filling terminal, and can be actuated by means of a pin 15 which is pressed into the centre of the filling terminal 3. A line terminal 5 with a filling head 6 is connected to the filling terminal 3 via an intermediate piece 8, and keeps the intermediate piece 8 twistable in a receiver 7, in particular a quick fastener 13. The filling head 6 comprises a lateral line flange 18, to which a flexible line 4 can be connected. An adjusting lever 16 for operating a pin (not shown) also projects laterally from the filling head 6, and can take on various axial positions. The lateral line flange 18, the filling head 6 with the lever 16 and the intermediate piece 8 are the basic components of the line terminal 5.

[0026] Fig. 2 is a longitudinal section of a first embodiment of a filling head 6 according to the invention, which has a geometrical longitudinal axis 12. A flexible line 4, twistable on a line flange 18, opens into the filling head 6 approximately perpendicular to this geometric longitudinal axis 12. A gas path 14 passes through the line flange 18 into the region of the geometric longitudinal axis 12 of the filling head 6 and from there along the geometric

longitudinal axis 12 to a region which is formed as a counter piece for a filling terminal 3 of a gas cylinder 1 (not shown here). Seals 10, in particular adapted to high pressures, are associated therewith. According to the invention, the filling head 6 is not formed for a particular type and size of filling terminal, but has a receiver 7 for an intermediate piece 8 which can be changed, a different intermediate piece 8 being used for each size of terminal. The filling terminals for different gases typically differ in terms of the diameter of the external thread thereof, in such a way that the intermediate piece 8 comprises an internal thread 9 which is adapted to a particular type of gas cylinders. However, the principle according to the invention of adapting a filling head 6 to different terminal sizes may also be implemented by means other than different thread sizes, for example using differently offset projections and grooves or the like. So as to make it possible to change the intermediate piece 8 rapidly, the receiver 7 is preferably formed on the filling head 6 as a quick fastener 13. Preferably the intermediate piece 8 is mounted twistable on the receiver 7. This allows rotating the intermediate piece 8 to fastening its internal thread 9 to the filling terminal 3 of a gas cylinder 1. The intermediate piece 8 according to the present embodiment has a tubular shaped portion which can be mounted around a portion of the filling head 6, preferably shaped to be fitted into the tubular portion and to stabilize the rotation. Each intermediate piece 8 carries a marking 11, which should preferably be machine-readable, in particular in the form of a bar code. In the inside, the filling head 6 comprises a pin 15, which can be actuated mechanically via an adjusting lever 16. This adjusting lever 16 is arranged at an end 17 of the filling head opposite the receiver 7 for the intermediate piece 8. The pin extends within the gas path 14 and centrally within the intermediate piece 8, in such a way that it can be slid into the filling terminal 3, where it can actuate a valve, by moving the adjusting lever 16. Different axial positions, for which the pin 15 or the filling lever 16 comprises suitable markings or blocks or latching means, may be required for different filling terminals 3. The mechanical configuration of the pin 15 and the adjusting lever 16 and the cooperation thereof depend on the spatial conditions and the safety requirements during operation.

[0027] Fig. 3 shows a somewhat differently dimensioned embodiment of the invention, the reference numerals for like components corresponding to those in Fig. 2. The embodiment of Fig. 3 shows a somewhat different form and dimensioning of the thread 9 and the seals 10 in the start region of the gas path 14 in connection with a final form of the gas path 14 and pin 15 which is configured for a different pressure level.

[0028] In the cooperation of the filling head 3 and the intermediate piece 8, the embodiments of Fig. 2 and 3 each lead to forms known per se of filling heads for conventional filling terminals 3 of different pressure levels, only according to the present invention it is not necessary to use a completely different filling head or a complex

adapter for each pressure level and each different gas, but it is sufficient for the intermediate piece 8 to be changed and for the pin 15 to be suitably positioned, at least when a particular group of gas cylinders are filled.

[0029] Fig. 4 illustrates the size of the filling head 6 and the intermediate piece 8, in particular in the direction of the geometric longitudinal axis 12 of the filling head 6 or intermediate piece 8. If a plurality of gas cylinders 1 are combined into a pallet 34 or filled side by side, the geometric peaks of the gas cylinders are generally located on the corners of adjacent squares, as indicated by dashed lines. Any protective caps 2 which are present further restrict the available space for filling heads. Nevertheless, Fig. 4 shows that filling heads 6 according to the invention comprising intermediate pieces 8 can be used for filling groups of gas cylinders 1 arranged tightly against one another even if the filling heads 6 are arranged in an approximately diagonal direction in gaps 19 between the gas cylinders 1. Preferably the overall axial length of a filling head 6 with a mounted intermediate piece 8 should be less than 20 cm, especially less than 15 cm or even less than 10 cm. In some cases, it may be required the filling terminals 3 of the gas cylinders 1 to be orientated in a particular manner, in such a way that outer gas cylinders 1 in the batch 34 can be connected laterally to filling heads 6, whilst inner gas cylinders 1 can be connected to filling heads 6 arranged in the gaps 19. This principle can still be implemented even if the gas cylinders 1 are arranged even more tightly.

[0030] Fig. 5 is an overview of a filling station for industrial-scale filling of gas cylinders 1, in particular including batches 34 (not shown in this fig.) of gas cylinders 1 or gas cylinders 1 arranged as pallets 31, which can be moved in the filling station by a transport system 30. The filling station comprises a fixed reservoir system 20, comprising reservoir containers 21 for different gases and also a reservoir container 23 for a rinse gas if required. These reservoir containers 21 are connected via typical valve arrangements to a shared primary supply line 22, from which they reach a shared primary discharge line 29 (or two or more shared primary discharge lines 29 simultaneously if a plurality of pallets 31 of gas cylinders 1 are being filled) via a metering unit 25. For precise metering, the metering unit 25 may for example comprise a small admission valve 26, a medium admission valve 27 and a large admission valve 28. Conventional rinse outlets 24 for rinsing out all of the lines when changing between different gases, as well as typical connections (not discussed in greater detail) to a vacuum pump and overpressure safeguards are provided in a known manner. Since the filling heads 6 according to the invention comprising a changeable intermediate piece 8 result in the theoretical possibility of incorrect operation, according to the invention a safety means 32 comprising a marking reader 35 is provided, and can stop any filling via one or more valves which are connected to the safety means 32, or prevent it from starting, if the read cylinder markings 33 on the gas cylinders 1 and the markings 11 on

the intermediate pieces 8 do not confirm the correct cooperation of these parts. In particular, the marking reader 35 may be a bar code reader. The position of the adjusting lever 16, for example detected using sensors, can also be included in a safety system of this type.

[0031] Fig. 6 shows schematically that it is also possible to fill batches 34 of gas cylinders, which each comprise at least one shared filling terminal 3, using the system according to the invention. Overall, the invention makes it possible to dispense with highly specialised filling stations for only one or a few types of filling terminals, pressure levels or gases in favour of universal filling stations which can be used in various manners and can thus be operated at high capacity. In this context, it is also worth equipping a filling station with a transport system 30, for example a floor conveyor, which transports pallets 31 or batches 34 of gas cylinders 1 from an empty container region 37 to the filling station and from there to a storage region 38. In the empty container region, filling processes can be prepared in a suitable sequence (and intermediate pieces 8 may already be mounted in advance), in such a way that the filling station can carry out filling processes in relatively quick succession. It is also conceivable for filling stations to be configured for a large number of gases and different purity levels, in such a way that only gases which are relatively easy to fill, but also high-purity gases or precisely specified mixtures, can be handled at a single filling station, which has to comprise all of the means for even the complicated filling processes in this case. In any case, according to the present invention the large number of different filling terminals no longer restricts the use of a filling station, and which types of gas cylinders are filled in what sequence in a filling station can instead be decided on the basis of economic considerations.

[0032] Even when a plurality of technical features is disclosed together in these drawings for simplicity, it is not absolutely necessary for them to be combined. Rather, technical details can also be exchanged and/or combined with different technical details of the description or other drawings, unless it is explicitly excluded here.

[0033] The invention makes economical industrial-scale use of filling stations for gas cylinders possible, it being possible to change between different gases to be filled rapidly and safely at least for the same pressure level.

List of reference numerals

[0034]

- | | |
|---|------------------------------------|
| 1 | Gas cylinder |
| 2 | Protective cap |
| 3 | Filling terminal |
| 4 | Flexible line |
| 5 | Line terminal |
| 6 | Filling head |
| 7 | Receiver for an intermediate piece |

- | | |
|----|-------------------------------------|
| 8 | Intermediate piece |
| 9 | Thread |
| 10 | Seal |
| 11 | Marking |
| 5 | 12 Geometric longitudinal axis |
| 13 | Quick fastener |
| 14 | Gas path |
| 15 | Pin |
| 16 | Adjusting lever |
| 10 | 17 Opposite end of the filling head |
| 18 | Line flange |
| 19 | Gap |
| 20 | Reservoir system |
| 21 | Reservoir container |
| 15 | 22 Shared primary supply line |
| 23 | Reservoir tank for rinse gas |
| 24 | Rinse outlet |
| 25 | Metering unit |
| 26 | Small admission valve |
| 20 | 27 Medium admission valve |
| 28 | Large admission valve |
| 29 | Shared primary discharge line |
| 30 | Transport system |
| 31 | Pallet |
| 25 | 32 Safety means |
| 33 | Cylinder marking |
| 34 | Batch of gas cylinders |
| 35 | Marking reader (bar code reader) |
| 36 | Primary valve |
| 30 | 37 Empty container region |
| 38 | Storage region |

Claims

- 35
1. Device for filling at least one gas cylinder (1) having a filling terminal (3) out of a group of gas cylinders which have different filling terminals with gas at a high pressure, in particular of 20 to 500 bar, a fixed reservoir system (20) being connectable to the filling terminal (3) of the gas cylinder (1) by way of a flexible line (4) and the flexible line (4) comprising a line terminal (5) which is adapted to the filling terminal (3) of the gas cylinder (1), **characterised in that** the line terminal (5) comprises a filling head (6) having a geometric longitudinal axis (12) and comprising a receiver (7) for an intermediate piece (8) out of a group of at least one intermediate piece, on which receiver (7) is changeably mountable an intermediate piece (8) which is adapted to the filling terminal (3) of the gas cylinder (1), and **in that** the filling head (6) comprises a pin (15) which can be moved parallel to the longitudinal axis (12) into at least two different positions.
- 40
- 45
- 50
- 55
2. Device according to claim 1, wherein the intermediate piece (8) comprises a marking (11) from which the properties thereof can be detected, the marking

- (11) preferably being machine-readable, in particular being a bar code.
3. Device according to either claim 1 or claim 2, wherein the central pin (15) can be moved from the outside by way of an adjusting lever (16). 5
 4. Device according to claim 3, wherein the adjusting lever (16) is arranged at an end (17) of the filling head (6) opposite the receiver (7) for the intermediate piece (8), and a latching or fixing device is provided for holding the pin (15) in at least two different positions, preferably three or more. 10
 5. Device according to any one of the preceding claims, wherein the fixed reservoir system (20) comprises reservoir containers comprising different gases, which can be connected to the flexible line (4) via valves (26, 27, 28). 15
 6. Device according to any one of the preceding claims, wherein a plurality of flexible lines (4) for simultaneously filling a plurality of gas cylinders (1) with the same gas are generally connected in parallel on the fixed reservoir system (20). 20
 7. Device according to any one of the preceding claims, wherein there are different intermediate pieces (8) for different gases and/or different types of gas cylinders (1) and/or different types of filling terminals (3). 25
 8. Device according to claim 6, wherein each intermediate piece (8) carries a machine-readable marking (11) and there is a safety means (32) which reads the marking (11) and blocks any gas supply for which the intermediate piece (8) is not intended. 30
 9. Device according to any one of the preceding claims, wherein the filling head (6) comprises a geometric longitudinal axis (12) together with the intermediate piece (8) and the flexible line (4) opens into the filling head (6) approximately perpendicular to the longitudinal axis (12) at a line flange (18). 35
 10. Device according to any one of the preceding claims, wherein the filling head (6) and the intermediate piece (8) are dimensioned in such a way, especially with an overall axial length of less than 20 cm, preferably less than 15 cm or even less than 10 cm, that the two can be used at least in an approximately diagonal direction in a gap (19) between the filling terminals (3) of gas cylinders which (1) are arranged tightly against one another in the square. 40
 11. Device according to any one of the preceding claims, wherein the intermediate piece (8) can be inserted into the receiver using a quick fastener (13) and can preferably be locked therein. 45
 12. Method for filling at least one gas cylinder (1) out of a group of gas cylinders having different filling terminals (3) and/or different gases or gas mixtures at high pressure on a fixed reservoir system, wherein a plurality of flexible lines (4) connected in parallel to the reservoir system (20) are provided, each flexible line (4) comprising a filling head (6), having a pin (15) which can be moved into at least two different positions parallel to a geometric longitudinal axis (12) and having a receiver (7) for a changeable intermediate piece (8), and wherein a specific intermediate piece (8) having a corresponding marking (11) is inserted into the receiver (7) for each type of filling terminal (3) and/or for each different gas or gas mixture, and the gas supply is only released when the marking (11) of the intermediate piece (8) has been recognised by a safety means (32) as suitable for the provided filling process. 50
 13. Method according to claim 12, wherein each gas cylinder (1) which is to be filled comprises a machine-readable cylinder marking (33) relating to the gas to be filled in and/or the permissible filling pressure and/or the type of filling terminal (3), and the intermediate piece (8) to be used is selected in accordance with this information, and after the insertion thereof into the filling head (6) the correspondence of the marking (11) of the intermediate piece (8) is checked before the filling process is released. 55
 14. Method according to either claim 12 or claim 13, wherein at least one batch (34) of gas cylinders (1) is filled via at least one shared filling terminal (3).
 15. Method according to any one of claims 12 to 14, wherein a filling station for connecting gas cylinders (1) is equipped for different gases of different purity and/or for filling pallets (31) and batches (34), pallets (31) or batches (34) of gas cylinders (1) being transported from an empty container region (37) to the filling station, and from there to a storage region (38) after the filling process, by means of a transport system.

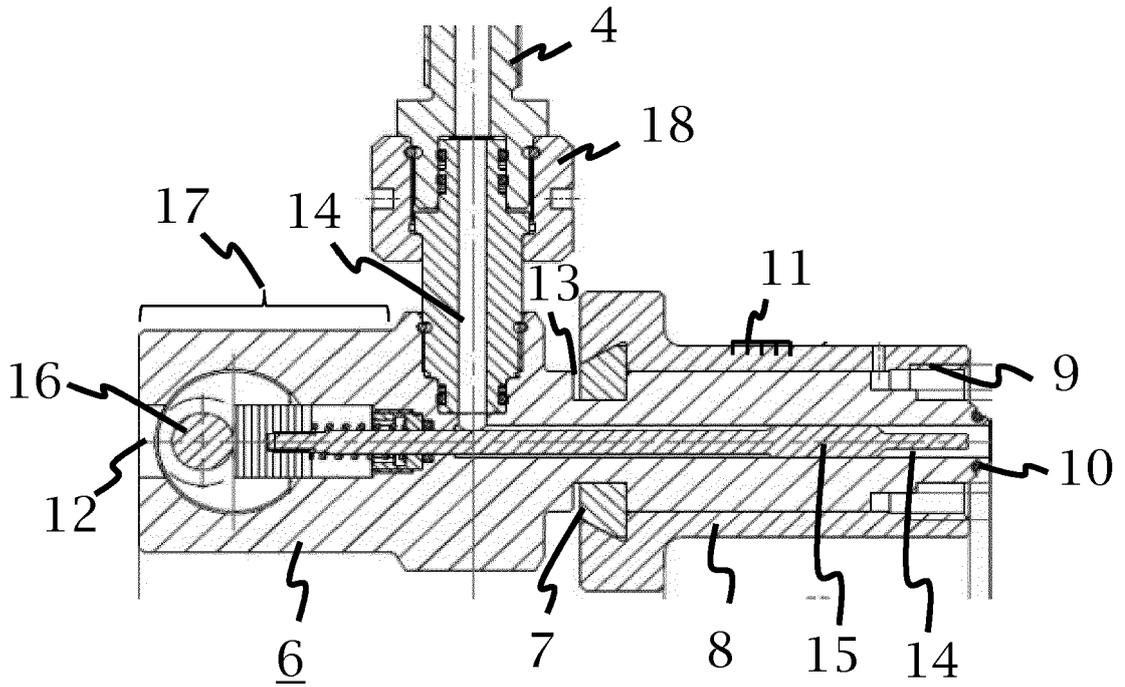


Fig. 2

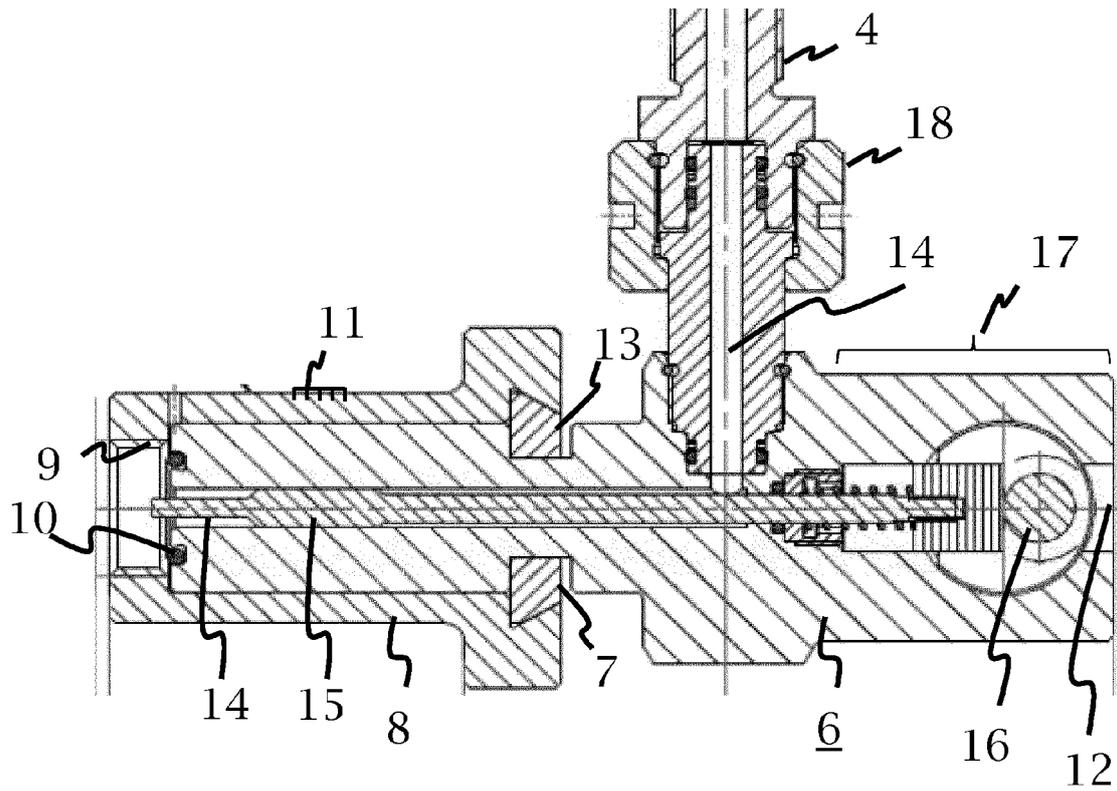


Fig. 3

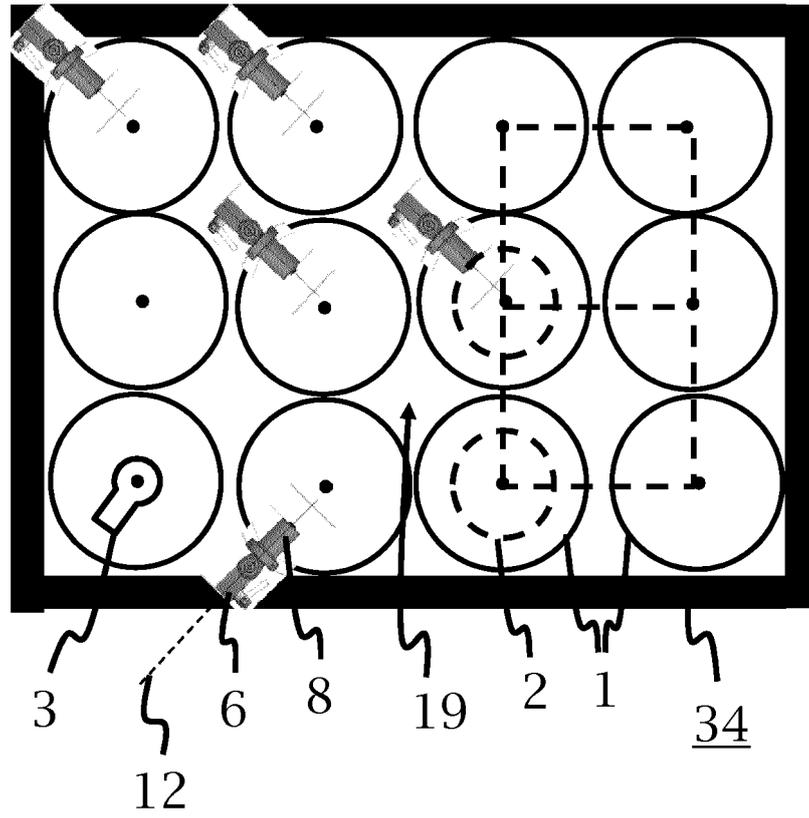


Fig. 4

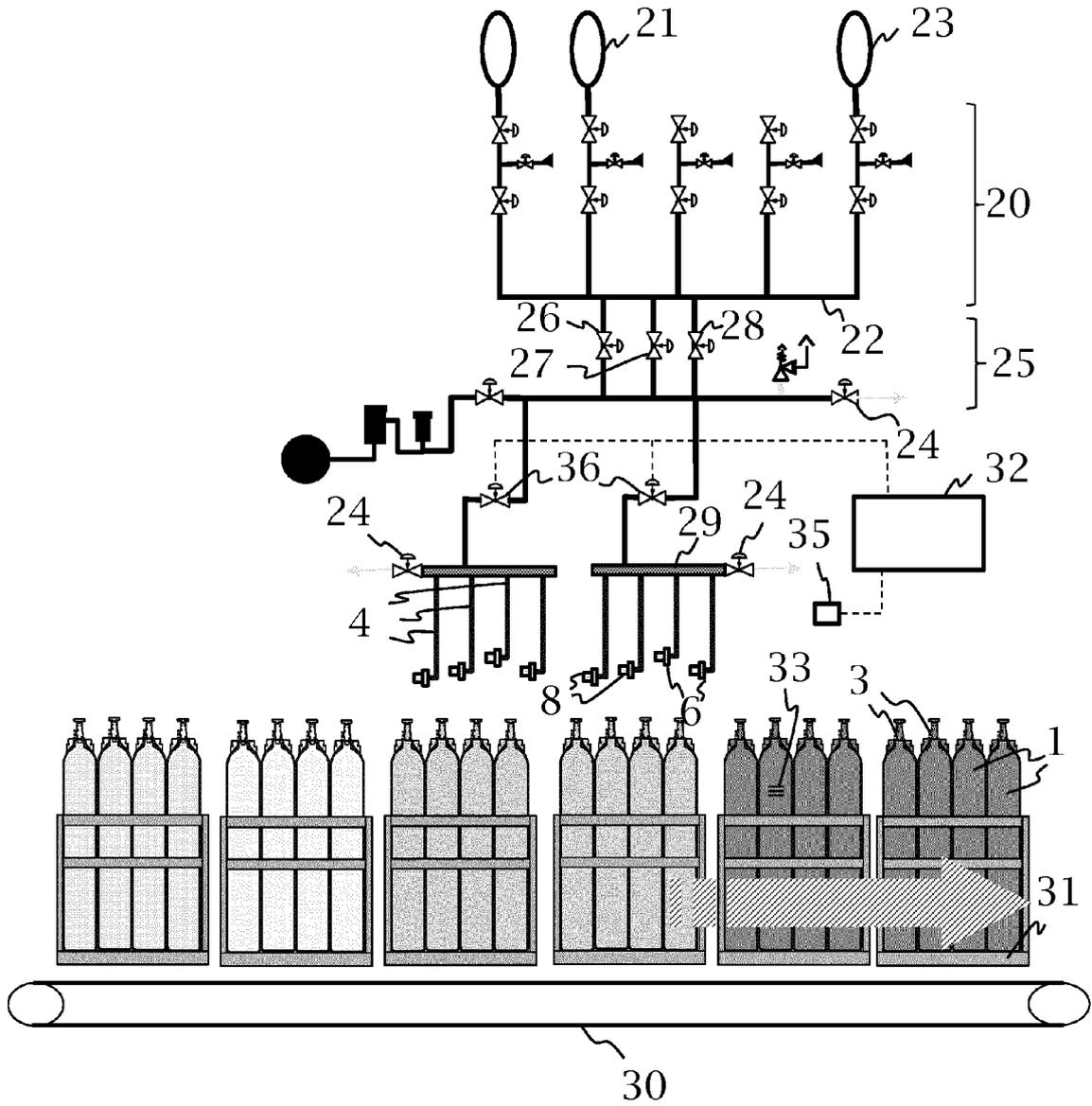


Fig. 5

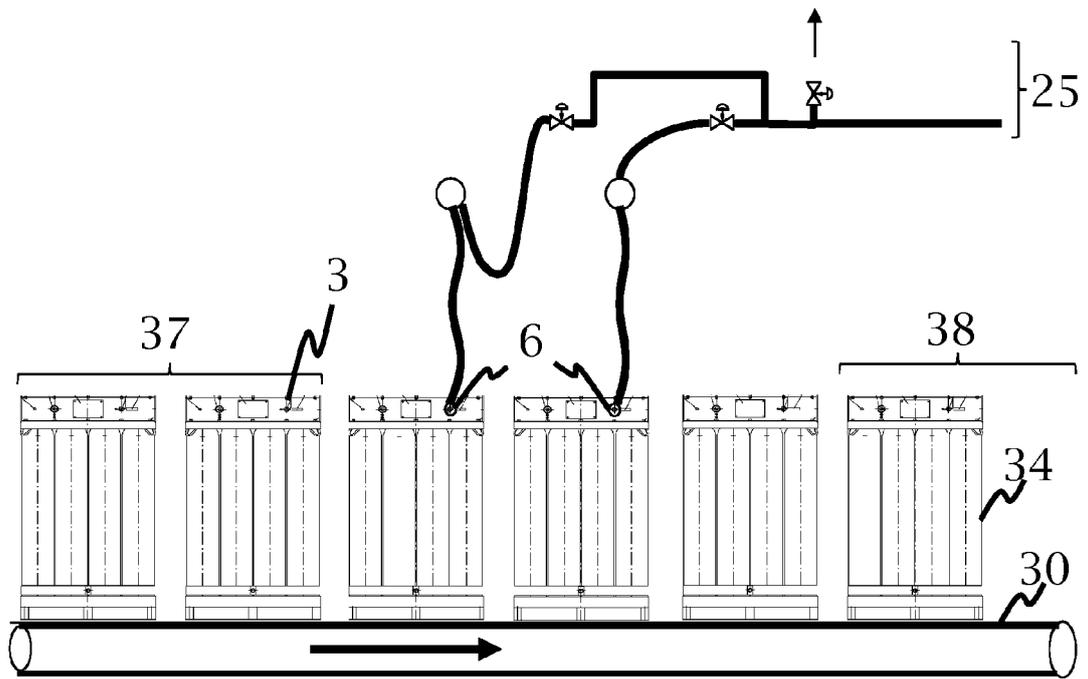


Fig. 6



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