(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 February 2016 (11.02.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/020187 A1

(51) International Patent Classification:
F16K 1/30 (2006.01) *F16K 31/60* (2006.01)
F16K 35/02 (2006.01) *F17C 13/04* (2006.01)

(21) International Application Number:
PCT/EP2015/066627

(22) International Filing Date:
21 July 2015 (21.07.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1413821.8 5 August 2014 (05.08.2014) GB

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,

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WO 2016/020187 A1

(54) Title: SHUT-OFF VALVE ASSEMBLY FOR A PRESSURISED CONTAINER

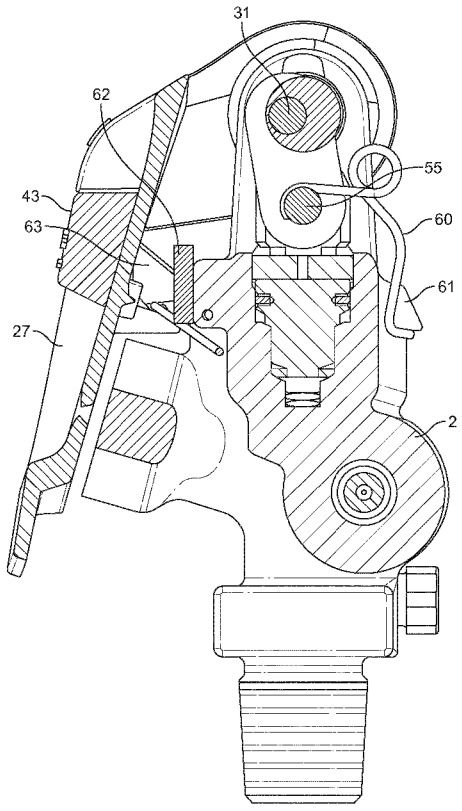


FIG. 3

(57) Abstract: A shut-off valve assembly for a pressurised cylinder. The shut-off valve comprising a valve body (2) containing a valve element which seals with a valve seat. A lever (27) is coupled to the valve element, such that rotation of the lever causes linear movement of the valve element. A spring (15) is arranged to bias the lever closed. The assembly further comprises a one or more damping members (62) between the housing and the lever to cushion the housing against impact from the lever when the lever is closed by the spring.

DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

SHUT-OFF VALVE ASSEMBLY FOR A PRESSURISED CONTAINER

The present invention relates to a pressurised fluid container having a shut-off valve.

In particular, the invention relates to a pressurised gas cylinder for use, for example, with medical gasses, welding gasses and the like.

Such cylinders are traditionally provided with a shut off valve at the top of the cylinder which is protected by a guard. The valve has a valve element which is moved towards and away from a seat by rotation of a screw mechanism. This consists of a hand wheel with a male screw which mates with a female screw thread in the valve body. The user can therefore open and close the shut off valve by rotating the hand wheel to raise and lower the valve element.

Although such mechanisms are widely used, they suffer from a number of problems. The hand wheel requires multiple rotations in order to rotate it which is time consuming and it is not particularly accessible when the guard is in place. Further, it can be stuck in a fully open or a fully closed position. Although arrows are usually present on the wheel to indicate the direction of opening and closing to the user, it is difficult to determine by sight the current position of the wheel, such that the user can, for example, attempt to open an already fully open valve and mistakenly believe the valve to be stuck.

A further difficulty with the fact that there is no clear indication of position is that a user may not fully close a

valve as there is no clear indication that the valve has reached the fully closed position, thereby leading to inadvertent leakage from the container.

A number of these problems are overcome by using a lever in place of a hand wheel.

With such a lever, it is desirable to have a bi-stable arrangement such that the lever is only generally stable when either fully open or fully closed. This prevents the valve from being left inadvertently partially open.

According to the present invention, there is provided a pressurised cylinder as defined in claim 1.

With this arrangement, the lever is biased into a closed position by a significant spring force. In the hands of an inexperienced user, it is possible that the strong spring force will cause the lever to close in an uncontrolled manner. This could cause the lever to strike the valve body producing an irritatingly loud ringing sound and potentially causing damage. The presence of the or each damping member prevents this from happening.

The or each damping member may be either on the valve body or on the lever. Preferably, the damping members are on the valve body in which position they are less exposed than they would be if they were on the lever. To further minimise the exposure of the or each damping member, the lever is preferably provided with at least one protrusion arranged to abut a respective damping member.

The lever may be coupled to the valve element by any type of coupling which will convert the rotational movement of the lever to a linear movement of the valve element. This may be cam driven, gear driven or screw driven. In each case, the spring is provided to bias the lever closed. However, preferably, the lever is coupled to the valve element via an eccentric coupling, the coupling being configured to pass through an over centre position moving from the open to the closed position, wherein the spring is arranged to bias the lever closed after the over centre position.

While the spring provides the main force to close the valve elements, if the lever is only opened to a relatively small extent, there may not be sufficient energy stored in the spring to return the lever to the closed position, particularly if there is a latch which requires a force above a certain threshold in order to engage with the lever. Therefore, preferably, the cylinder further comprises a resilient member which provides a biasing force on the eccentric coupling when the valve is closed which holds the eccentric coupling and hence the lever in a fully closed position. This helps to maintain the valve in the closed position and, if there is any play between the eccentric coupling and the valve stem in a direction of opening of the valve, this spring will prevent the rattling caused by this play. It will also facilitate closing of the valve if the lever is only opened a short distance.

The spring or the spring combination with the resilient member may provide sufficient force to hold the lever in the closed position during transportation. However, preferably, a latch is provided to latch the lever to the valve body. If

a latch is provided, the spring preferably has sufficient strength to engage the latch. The combination of the relatively strong spring, and the damping member and latch provides an arrangement which can effectively self-close in a robust manner and will then remain latched without the risk of damage and unwanted noise. The latch mechanism is preferably provided with at least one resilient component which will provide additional damping between the lever and the valve body.

An example of a valve assembly in accordance with the present invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a cross-sectional view showing the general valve layout with the valve in the closed position;
Fig. 2 is a view similar to Fig. 1 with the valve in the open in position; and
Fig. 3 is a schematic partially sectioned view similar to Fig. 1 but without the casework, and including the damping member.

The valve body 2 is typically cast from metal. Into this is screwed a valve housing 4 as described in greater detail below. All of this is covered by casework 6 which is typically moulded plastic which is a two-part housing which clips in place over the valve body 2.

The valve body has an axial gas outlet path 6. Flow through the gas outlet path 6 is controlled by a valve element 7 which selectively blocks flow to a gas outlet port (not shown) in a manner well known in the art.

Lifting the valve element 7 from its seat 11 selectively opens and closes the gas flow path out of the cylinder.

The mechanism for lifting the valve element 7 will now be described.

The valve element 7 is biased closed by a spring 15 the top end of which bears against a shoulder 16 in the valve housing 4 and the bottom of which bears against an annular flange 17 which forms part of the valve stem 18. As shown in the drawings, the valve stem 18 comprises a main stem 19 and a valve element retaining member 20 rigidly coupled to one another.

A lever 27 rotatable about a shaft 31 is provided to open the valve element 7 against the action of the spring 15.

The shaft 31 is coupled to an eccentric coupling which is connected at its lower end to a coupling pin 35 mounted in an elongate slot 39 in the main stem 19.

This provides a crank arrangement such that lifting the lever 27 from its at rest position shown in Fig. 1 initially lifts the pin 35 which picks up the main stem 19 and opens the valve.

The manner in which the lever 27 is retained in place will now be described.

The lever 27 is provided both with a pair of hooks 40, only one of which is visible in the drawings as these are a

cross-section through a median plane. There is one such hook on either side of this plane. The lever 27 has a central opening 41 through which a gauge 42 can be viewed. Also in this opening is a release member 43 rotatable about a pivot 44 as described below.

A spring 50 is mounted to the valve body 2 as described below and is arranged to receive the hooks 40 to latch the lever 27 in place.

The spring comprises a central bar 51 which is the part presented to the hooks 40 and with which the hooks 40 engage. The spring is bent such that it has end portions which engage in openings in the valve body 2.

The casework 6 has a recess 54 which engages beneath the bar 51 and lifts the bar 51 slightly above the position where it would always be in the absence of the casework. This generates a biasing force on the bar 51 and ensures that it is precisely located to receive the hooks 40.

As the lever 27 is closed, the hook picks up the bar 51 and lifts it over the apex 56 of the hook thereby resiliently biasing the bar 51 upwardly. Once over the apex, the resilience of the bar 51 causes it to ride down a ramped surface on the opposite side of the hook once it reaches the position shown in Fig. 1. In this position, the previously mentioned biasing on the spring 50 ensures that it is biased into tight engagement with the hook 40, thereby firmly securing the lever 27 and preventing it from rattling.

In order to unlatch lever 27, the user presses the release member 43 pivoting it anti-clockwise about the pivot 44. This lifts the bar 51 back up the ramped surface 57 and over the apex 56, whereupon the lever is released and the bar 51 can return to the unlatched position.

The main biasing force to cause the valve to close is provided by the spring 15. This is compressed as the lever opens, thus, once the eccentric coupling passes the over centre position and reaches the fully open position, the spring 15 acts to maintain the lever in the open position as it generates a clockwise moment on the lever (with reference to Fig. 2). In order to close the lever, it is pushed back so that the eccentric couplingpass an over centre position moving in an anti-clockwise sense (with reference to Fig. 2). Spring 15 then generates a relatively strong spring force which is sufficient to ensure that the lever cannot remain in an intermediate position but is moved to the fully closed position in Fig. 1. The spring 15 is also sufficiently strong enough on normal closing to overcome the resilient force of the spring in order to set a latch as described above.

As mentioned above, lifting the lever to a small extent from a closed position shown in Fig. 1 serves only to move the pin 35 up the elongate slot 39. At this point, no compression of the spring will have taken place. Even if the lever is moved a little further open, this will result in a relatively small amount of compression of the spring which will not be sufficient to close the valve and to set the latch. In order to compensate for this, a resilient member 60 is provided. This takes the form of a bent wire which is

engaged around the coupling pin 35 at its extremities (one end is shown in Fig. 3, but the opposite end of the resilient member 60 has the same configuration and engages with the opposite end of the pin 35). The central portion of the spring is hooked around the projection 61 of the valve body 2 such that it generates a bending moment about the shaft 31 in the anti-clockwise direction (with reference to Fig. 3). This force increases in the early part of the opening movement of the lever, but is then quickly dwarfed by the effects of the spring 15. Thus, the resilient member 60 ensures that the valve element 11 is biased closed and provides a biasing force to close the valve if the lever is opened slightly from the closed position.

As a result of the relatively strong biasing force caused by the spring 15, it is possible that the lever 27 will shut quickly without the user being in full control of this. In order to prevent the lever from striking the valve body 2 with a high force which would generate an irritating noise and potentially cause damage, dampers 62 are provided on the valve body 2. These take the form of pads of resilient material such as Sorbothane (PU/TPU, a thermoplastic polyurethane); Viton (fluoroelastomers); Nitrile rubber; Silicone; EPDM (ethylene propylene diene monomer rubber); Butadiene rubber; Nylon; ABS; Zytel; Cork; Neoprene (Chloroprene); Foamed PE; Polypropylene.The lever 27 is provided with projections 63 which engage with a respective resilient pad 62. Only one such pad and projection is shown in Fig. 3. In practice, however, there will be one such combination on either side of the median plane of the valve thereby spreading the load across two damping members. The damping members are positioned such that they will begin to

slow the progress of the lever as the hooks 40 engage with the latch bar 51 but will allow sufficient movement of the lever to ensure that the hooks latch in place.

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CLAIMS

1. A shut-off valve assembly for a pressurised cylinder, the shut-off valve comprising a valve body containing a valve element which seals with a valve seat, a valve stem coupled to the valve element, the valve stem being movable linearly to selectively move the valve element towards and away from the valve seat to selectively open the valve; a lever coupled to the valve element, such that rotation of the lever causes the linear movement of the valve element; wherein a spring is arranged to bias the lever closed; the assembly further comprising a one or more damping members between the valve body and the lever to cushion the valve body against impact from the lever when the lever is closed by the spring.

2. A valve assembly according to claim 1, wherein the lever has at least one protrusion arranged to abut a respective damping member as the lever closes.

3. A valve assembly according to claim 1 or claim 2, wherein the lever is coupled to the valve element via an eccentric coupling, the coupling being configured to pass through an over centre position moving from the open to the closed position, wherein the spring is arranged to bias the lever closed after the over centre position.

4. A valve assembly according to claim 3, further comprising a resilient member which provides a biasing force on the eccentric coupling when the valve is closed which holds the eccentric coupling and hence the lever in a fully closed position.

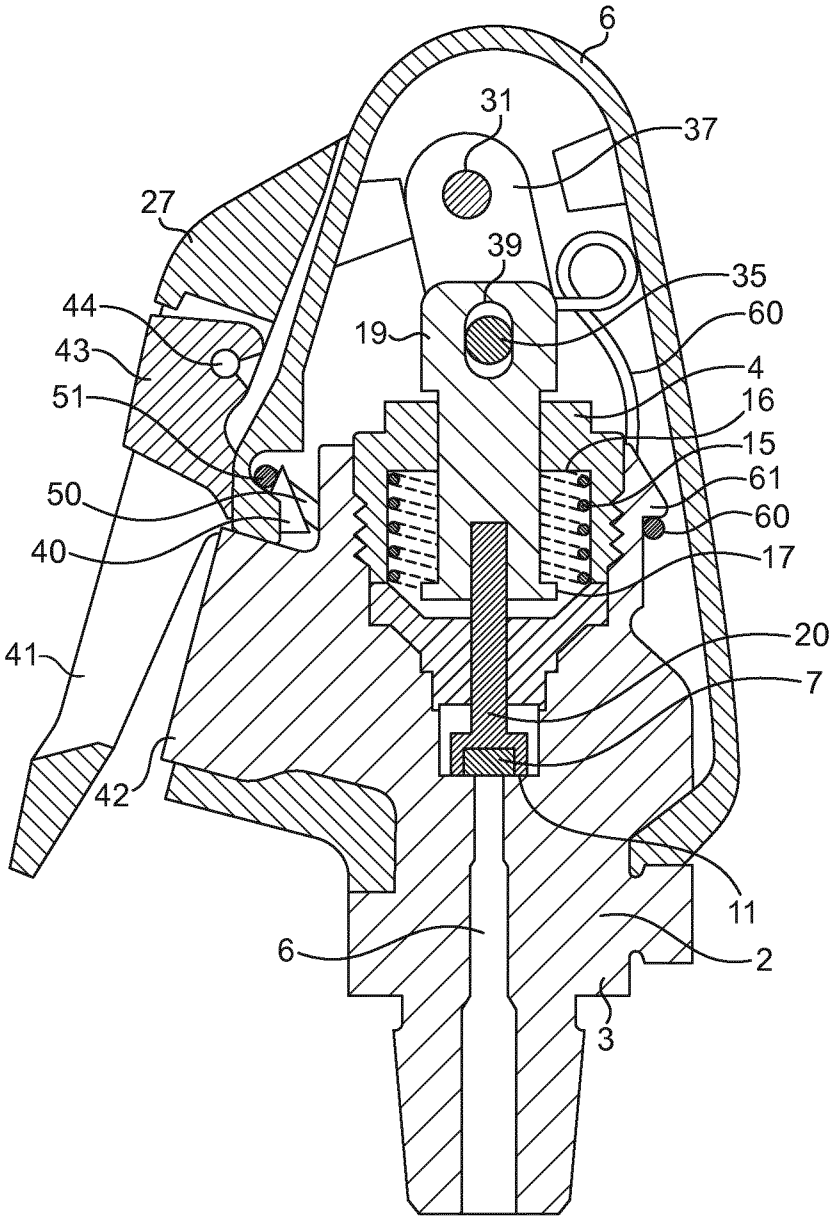


FIG. 1

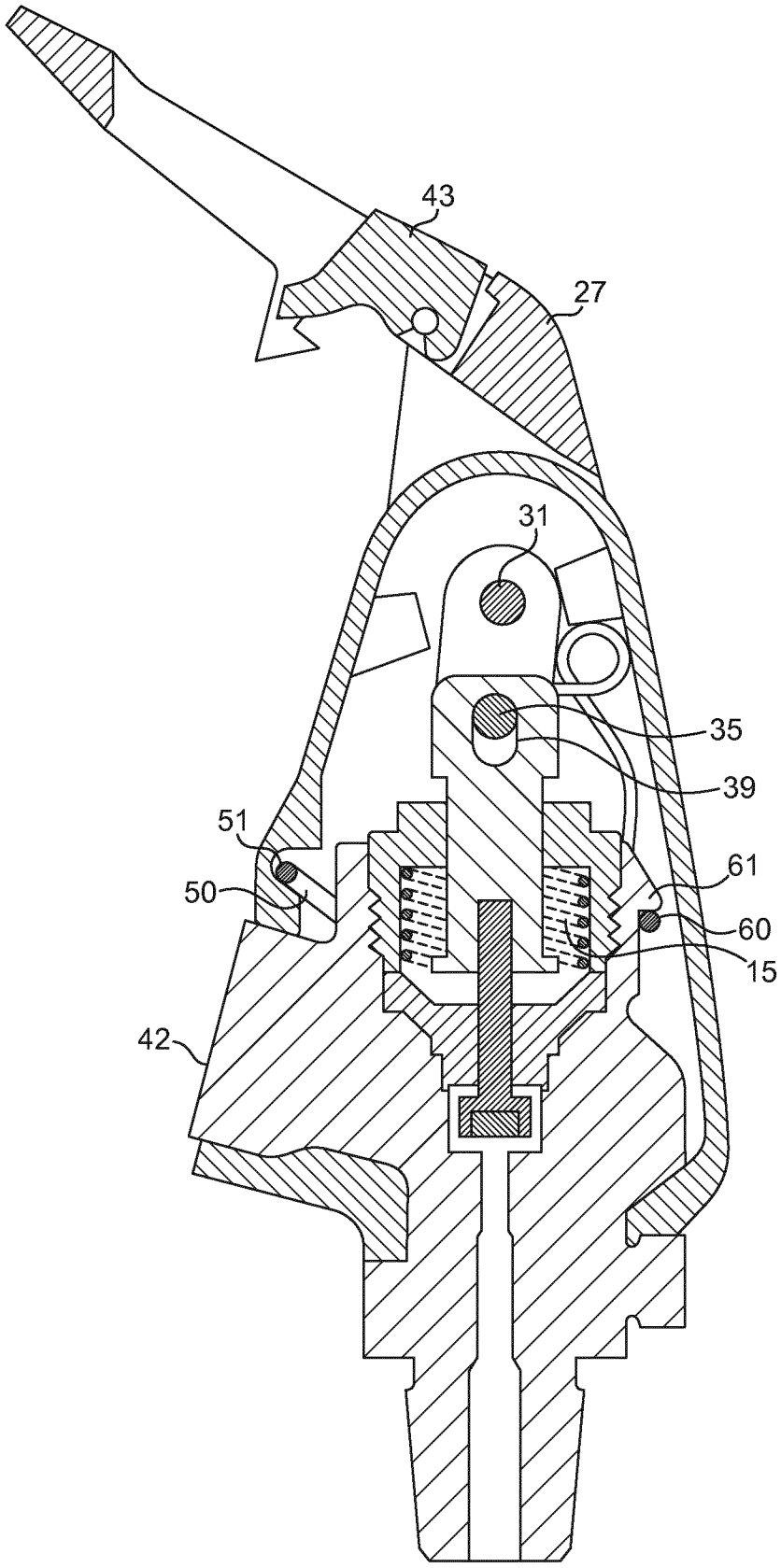


FIG. 2

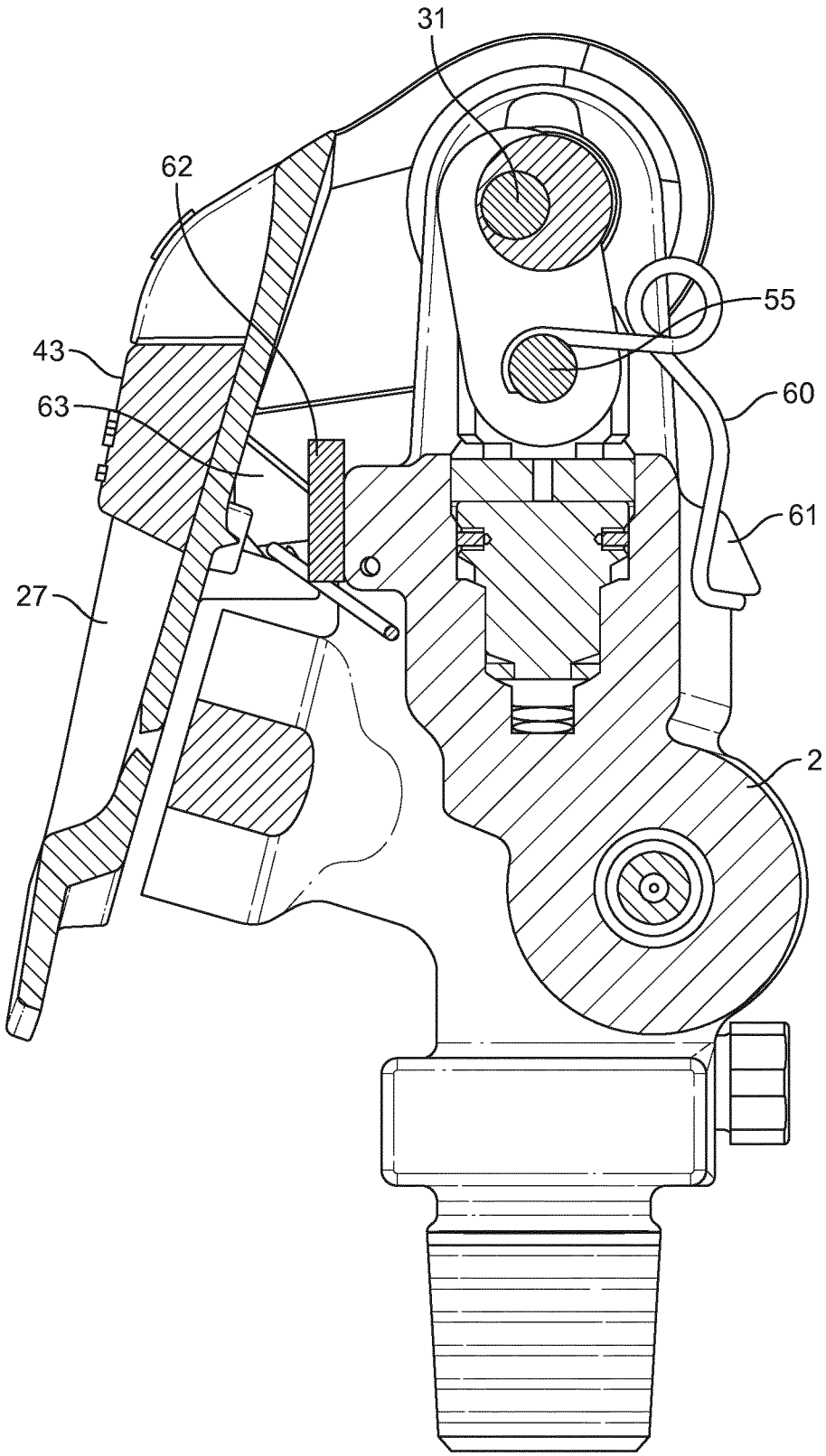


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/066627

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16K1/30 F16K35/02 F16K31/60 F17C13/04
ADD.

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)
F16K F17C

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 practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	EP 0 990 825 A1 (AIR LIQUIDE [FR]) 5 April 2000 (2000-04-05) the whole document	1,3
A	US 2003/217774 A1 (MARKHAM TREVOR K [US] ET AL) 27 November 2003 (2003-11-27) the whole document	1
A	US 2 272 132 A (GEORGE SCHAAF) 3 February 1942 (1942-02-03) the whole document	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
16 September 2015	25/09/2015

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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