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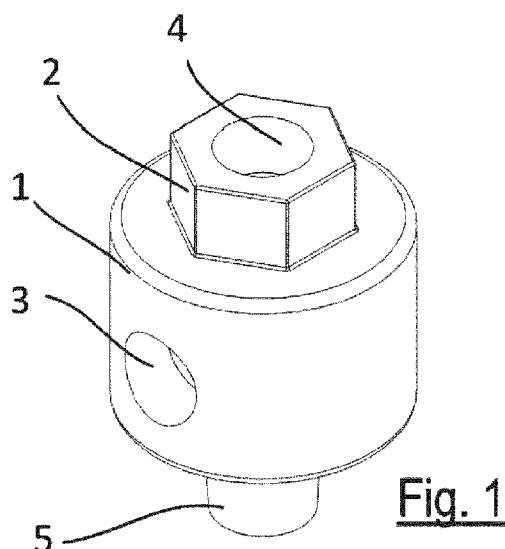
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(54) Title: PRESSURE GAUGE CONNECTOR



(57) Abstract: A pressure gauge connector is provided, for connecting a pressure gauge to a space of interest. The pressure gauge connector has a housing defining an internal chamber having an interior space. The housing is provided with: a pressure gauge port configured to expose a pressure gauging surface to a pressure within in the interior space; and a barrier port comprising a pressure-equalizing barrier configured between the interior space and the space of interest.

PRESSURE GAUGE CONNECTOR

Field of the Invention

In a first aspect, the present invention relates to a pressure gauge connector. In another aspect, the present invention relates to a wellhead comprising such a pressure gauge connector.

Background of the Invention

Pressure monitoring of pressure equipment is widely applied in various field of industry. An example in the oil and gas industry is well integrity monitoring, which involves surface pressure gauging on a well annulus in a wellhead. Petroleum Technology Company (PTC) has published a white paper under the title "A new approach to Annulus Pressure Monitoring: Improving Data Reliability and Well Integrity, while Reducing Lifecycle Costs" (2016), which explains the benefits of PTC's "VR Sense" solution.

Traditionally, to monitor annulus pressure, a pressure gauge is installed on an instrument flange, with either one or two gate valves between it and the wellhead side outlet (of the annulus). It has various drawbacks, including susceptibility to accidental damage. It only offers a single barrier to a pressurized annulus.

The "VR Sense" solution aims to address the challenges faced in the traditional method. The VR Sense fits on the VR profile, which is a threaded profile machined into the side outlets of wellheads. Instead of a regular plug, the VR Sense can be placed. The VR Sense incorporates a pressure / temperature sensor. Data is communicated electronically (wired or wireless).

It has been found that mounting the VR Sense on a live (pressurized) annulus is quite elaborate. Furthermore, the

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pressure / temperature sensor is integral to the VR Sense and cumbersome to replace.

Summary of the invention

The invention provides a pressure gauge connector for
5 connecting a pressure gauge to a space of interest, said
pressure gauge connector comprising a housing defining an
internal chamber having an interior space, said housing
comprising:

- a pressure gauge port configured to expose a pressure
10 gauging surface to a pressure within in the interior space;
and

- a barrier port comprising a pressure-equalizing barrier
configured between the interior space and the space of
interest.

15 The invention further provides a wellhead comprising such
a pressure gauge connector. The pressure gauge connector may
be connected to a Christmas tree (or other type of wellhead
spool) on the wellhead.

Brief description of the drawing

20 The appended drawing, which is non-limiting, comprises
the following figures:

Fig. 1 schematically shows an external perspective view
of a pressure gauge connector;

Fig. 2 schematically shows a cross sectional view of the
25 pressure gauge connector of Fig. 1 being provided with grease
fittings and a pressure gauge;

Fig. 3 schematically shows a close-up cross sectional
view of the pressure gauge connector of Fig. 1 in neutral
position;

30 Fig. 4 schematically shows a close-up cross sectional
view of the pressure gauge connector of Fig. 1 in
intermediate position;

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Fig. 5 schematically shows a close-up cross sectional view of the pressure gauge connector of Fig. 1 in injecting position;

Fig. 6 schematically shows a close-up cross sectional view of the pressure gauge connector of Fig. 1 in sealing position;

Fig. 7 schematically shows a close-up cross sectional view of the pressure gauge connector of Fig. 1 during mounting of a pressure gauge; and

Fig. 9 schematically shows a simplified impression of a gate valve in cross section.

Detailed description of the invention

The invention will be further illustrated hereinafter by way of example only, and with reference to the non-limiting drawing. The person skilled in the art will readily understand that, while the invention is illustrated making reference to one or more specific combinations of features and measures, many of those features and measures are functionally independent from other features and measures such that they can be equally or similarly applied independently in other embodiments or combinations.

In the present application, the where the term pressure gauge is employed, this is intended to include any suitable type of pressure sensor, including wired or wireless pressure sensors and traditional gauges.

The presently proposed pressure gauge connector comprises a pressure-equalizing barrier configured in a fluid communication port between the space of interest and the interior space of the internal chamber of the pressure gauge connector. The pressure-equalizing barrier transmits the pressure of a test fluid inside the space of interest to a work fluid which during operation is present within the internal chamber. A pressure gauge may be mounted on the

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pressure gauge connector, to monitor the pressure of the work fluid inside the internal chamber.

Under pressure monitoring conditions the internal chamber is a pressure-tight volume, and with the pressure-equalizing barrier in place the work fluid in the interior space of the internal chamber is pressurized by the pressure from the space of interest. To this end, the pressure-equalizing barrier may comprise a flexible barrier, which can change the volume available in the internal chamber. No work fluid flows from the interior space into the space of interest, and no test fluid flows from the space of interest into the interior space. The pressure-equalizing barrier stops equalizing pressure when the internal chamber does not hold the required pressure (i.e. the pressure of the test fluid) within the interior space. In that case the pressure-equalizing barrier creates a seal between the space of interest and the internal chamber thereby blocking flow of pressurized test fluid from the space of interest into the leaking internal chamber while allowing for a pressure drop across the pressure-equalizing barrier.

The pressure-equalizing barrier may be embodied in the form of a pressure-equalizing check valve, which opens a flow passage for excess work fluid to flow from the interior chamber into the space of interest when the amount of work fluid in the interior space exceeds the available volume at the pressure-equalized pressure (i.e. the pressure of the test fluid inside the space of interest). In such a case, just enough volume of work fluid will bleed from the interior space into the space of interest to restore equilibrium of pressure-equalization without the need to reduce the amount of work fluid inside the interior space.

Suitably, the housing further comprises a work fluid injection port configured to feed the work fluid into the

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interior space. Suitably, an injection fitting is mounted on the work fluid injection port. With such provisions, the pressure gauge connector can be employed both for gauging of pressure within the space of interest, as well as for
5 injecting of work fluid into the space of interest.

Fig. 1 shows a schematic perspective view of an example pressure gauge connector. A cross sectional view of the same pressure gauge connector features in Fig. 2, combined with some auxiliary elements such as a pressure gauge 7 and
10 injection fittings 6. Numerous types of grease injection fittings are available on the market which may be employed, such as (vented) capped grease fittings. However, any type of pressure fitting equipment can be employed. The injection fittings 6 are merely shown as examples. A housing body 1,
15 which may hereinafter be equally referenced to by the terms housing and/or body, defines an internal chamber providing an interior space 9 within the housing body 1.

The housing 1 is provided with a pressure gauge port 4. The pressure gauge port 4 can accommodate a pressure gauge 7,
20 suitably via a threaded coupling, and it is configured to expose a pressure gauging surface to a pressure within in the interior space 9. The housing 1 is further provided with barrier port 5. A pressure-equalizing barrier 20 is configured between the interior space 9 and the space of
25 interest 30. The space of interest 30 contains a test fluid, of which the pressure is to be gauged.

The barrier port may comprise connector comprising a threaded male nipple which can be screwed into a female counterpart to provide access to a test fluid in the area of
30 interest. Suitably, barrier port 5 is axially aligned with the pressure gauge port 4. The pressure gauge port 4 may be provided with an internal thread for receiving an external thread of the pressure gauge 7. The pressure gauge port 4 may

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accommodate a key profile 2, to facilitate making up the connection of the pressure gauge connector to the area of interest.

Optionally, the housing 1 may further comprise one or
5 more work fluid injection ports 3, configured to feed a work fluid into the interior space 9. Suitably, work fluid injection ports 3 can be configured as side ports relative to the barrier port 5 and the pressure gauge port 4. The injection fittings 6 may be thread-connected into the work
10 fluid injection ports 3.

The pressure-equalizing barrier 20 generally transmits a pressure of a test fluid inside the space of interest 30 to a work fluid present inside the interior space 9 of the internal chamber. This means the test fluid pressurizes the
15 work fluid in the interior space 9. The pressure-equalizing barrier 20 seals the access to the interior space 9 when the internal chamber for some reason does not hold the pressure within the interior space 9. This can for instance be the case if the pressure gauge 7 is removed from the pressure
20 gauge port 4, or if one of the injection fittings is opened without providing sufficient back pressure, or when for some reason there is a leak in the housing 1 to ambient.

On the other hand, the pressure-equalizing barrier 20 opens a flow passage for work fluid to flow from the interior
25 space 9 into the space of interest 30 when the work fluid in the interior space 9 is pressurized to a higher pressure than the pressure of the test fluid inside the space of interest 30.

Pressure-equalizing barriers with the properties
30 described above can be constructed in numerous ways. One non-limiting example is illustrated in Figs. 3-6. In this example, the pressure-equalizing barrier comprises a bore 10. The bore 10 has a cylindrical bore wall section 14, extending

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along a longitudinal direction and defining a cross sectional contour of the bore 10. The cross sectional contour is the contour of an area available for longitudinal flow of fluid through the bore 10. A chamber-side open end 31 forms a fluid
5 passage from the bore 10 to the interior space 9. A connector-side open end 32 forms a fluid passage from the bore 10 to the space of 30 interest outside the housing 1. The connector-side open end 32 thus may be in open fluid communication with the space of interest 30 outside the
10 housing 1. An inward sealing shoulder 18 is configured at the chamber-side open end 31 and terminating the bore 10. The shoulder 18 has a flow opening from the bore 10 into the interior space 9 than the area available for longitudinal flow through the bore 10.

15 A flexible barrier, which in the example is embodied in the form of a traveler 11, is arranged in the bore 10 in sliding engagement with the cylindrical bore wall 14. The traveler 11 in the figures is represented as a floating sphere. However, alternatives are within scope of the present
20 disclosure, including a piston, a bellows, or the like. The traveler 11 has freedom to slide longitudinally through the bore 10 over a stroke range bound on one side by the inward sealing shoulder 18 at the chamber-side open end 31. On the other side, the stroke range is bound by a spring retainer
25 16, the function of which will be explained hereinbelow.

As is best viewed in Fig. 4, the traveler 11 separates a chamber-side section 33 of the bore 10 from a connector-side section 34 of the bore 10. The traveler 11 seals the interior space 9 from the connector-side section 34 of the bore 10,
30 when the traveler 11 engages with the inward sealing shoulder 18, as shown in Fig. 6. The traveler 11 thus functions as a barrier against loss of containment of test fluid from the

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space of interest 30 when the traveler 11 seals against the inward shoulder 18.

The inward sealing shoulder 18 may be shaped in a variety of ways. For example, it may be shaped in the form of a tapered low angle seat, whereby the traveler 11 completes a fluid tight seal as it shoulders into engagement with the inward sealing shoulder 18. The inward sealing shoulder 18 may be formed out of, or comprise, a soft elastomeric and/or soft metallic material.

The stroke range of the traveler 11 can be divided into two distinct subranges: a floating range and a non-floating range.

In the floating range, which is illustrated in Fig. 4, the traveler 11 slidably floats in the bore 10 thereby separating the chamber-side section 31 of the bore 10 from a connector-side section 32 of the bore 10. When the traveler 11 is in the floating range, the test fluid can enter into the connector-side section 34 of the bore 10 and push against the traveler 11. As schematically indicated by arrow 35, the traveler 11 is capable of transmitting the pressure of the test fluid to the work fluid that is present inside the interior space 9.

At an extremity of the floating range, where the traveler 11 is furthest removed from the internal sealing shoulder 18, the floating range transitions into the non-floating range. This is illustrated in Fig. 5. A bypass flow path 37 is open when the traveler is located in the non-floating range. The bypass flow path 37 fluidly connects the chamber-side section 33 of the bore 10 with the space of interest 30. In this case, excess work fluid, which can be additional work fluid and/or be a result of a reduction of volume available in the internal chamber, pushes the traveler into the non-floating range. As stated above, a spring retainer 16 is provided.

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This spring retainer 16 supports a spring-loaded seat 24 configured at the connector side 34 of the bore 10. The traveler 11 engages with the spring-loaded seat 24 when the traveler 11 is in the non-floating range. The spring 15 loads
5 as the traveler 11 moves away from the inward sealing seat 18. The spring 15 unloads as the traveler 11 moves from towards the floating range and the inward sealing seat 18. The traveler 11 is disengaged from spring-loaded seat 24 when the traveler 11 is located in the floating range.

10 As can be best seen in Fig. 3, preferred embodiments of the pressure gauge connector comprise provisions to separate the pressure gauging surface from the work fluid in the interior space 9 of the internal chamber. If fauling of the pressure gauging surface by the work fluid is of no
15 significant concern, such provisions may not be necessary. However, to illustrate the option, the embodiment as shown further comprises an auxiliary traveler 12 arranged between the pressure gauge port 4 and the interior space 9. Herewith, a gauge fluid chamber 38 is defined between the gauging
20 surface of the pressure gauge, and the interior space 9. The gauge fluid chamber 38 is pressure-equalized with the interior space 9. The gauge fluid chamber 38 may be filled with a suitable, clean, gauge fluid such as clean oil. The auxiliary traveler 12 separates work fluid in the interior
25 space 9 from any gauge fluid that may be present in the gauge fluid chamber 38.

The auxiliary traveler 12 is shown in the form of a second floating sphere. However, alternatives including pistons, bellows, and the like are conceived within the scope
30 of the present disclosure. The auxiliary traveler 12 may be kept in position by two, relatively weak, auxiliary springs: gauge-side spring 13 and chamber-side spring 14. Auxiliary spring retainers 17 may be provided as necessary or desired.

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The auxiliary traveler 12 does not need to form a pressure-tight seal. In fact, not fully sealing can be advantageous to ensure accurate pressure read out, regardless of the position of the auxiliary traveler 12.

5 An internal port 8 may be provided to grant fluid communication access from the gauge fluid chamber 38 to the interior space 9 if the auxiliary sphere is pressured into the chamber-side spring 14 in case of excess gauge fluid in the gauge fluid chamber 38. This is illustrated in Fig. 7.

10 Arrows 39 show the flow of gauge fluid from gauge fluid chamber 38 through the ports 8. If this causes excess fluid (work fluid, mixed with some gauge fluid) in the interior space 9, traveler 11 may be pushed into the non-floating range causing the bypass flow path 37 to open as well to

15 bleed excess work fluid into the space of interest.

 Optionally, the chamber-side spring 14 supports an auxiliary spring-loaded seat. When the auxiliary traveler 12 engages with the spring-loaded seat it loads the auxiliary spring 14 and opens the auxiliary bypass flow path 39 between

20 the gauge fluid chamber 38 and the interior space 9.

 It will be understood that the pressure gauge connector can be embodied in various configurations. This includes configurations which comprise only one injection fitting 6 and/or configurations where the injection fitting 6 is

25 aligned on a straight line with the barrier port 5. The pressure gauge port 4 could be directed side-ways. Fig. 8 serves to illustrate such an embodiment by an example wherein the pressure gauge connector is configured in the form of a T-piece. As with the preceding example, a pressure-equalizing

30 barrier 20 is configured between the interior space 9 and the space of interest 30. This configuration can also house provisions to separate the pressure gauging surface of the pressure gauge 7 from the work fluid (grease) in the interior

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space 9 of the internal chamber, if such would be necessary or desired. Fig. 8 shows as an example the auxiliary traveler 12 can still be arranged between the pressure gauge port 4 and the interior space 9.

5 The pressure gauge connector can be connected to any type of pressurized equipment, such as pressure vessels, reactor vessels, pipe lines, or the like. Particularly embodiments that are provided with one or more optional work fluid injection ports can be useful to combine the functionality of
10 pressure gauging with injecting of work fluid into the pressurized equipment. Examples of injectable substances that could be used as work fluid for the pressure gauge connector described herein include: corrosion inhibitors, scavenger fluids, leak tracing fluids, sealants, and lubrication fluids
15 (e.g. grease). The term "grease" as used herein may stand for any suitable lubrication fluid and/or sealant.

One of the possibilities is to connect the pressure gauge connector to a grease injection port of a valve. Various common types of valves, such as gate valves and globe valves,
20 have a grease port to lubricate the mechanism inside. This is illustrated with reference to Fig. 9, which schematically shows a simplified impression of a gate valve 40.

A gate valve 40 typically comprises a body 41 provided with a flow bore 45. A common gate valve is one of floating
25 seat type. It comprises a gate 47 which can be moved in or out of a flow bore 45: when in closed position the pressure differential caused by the fluid in the flow bore presses the gate 47 against a gate seat 42, thereby fully sealing off the flow bore 45. Typically, the gate 47 is moved by sliding
30 transversely to the flow direction 44 in the bore 45. The movement is actuated by an actuator, which may for example be a manual actuator such as a hand wheel 48. Hydraulic

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actuators are also available. The body 41 may comprise connecting flanges 43 to connect the valve to piping.

A grease injection port 46 is provided, on a gate valve typically on the high-pressure side of the gate 47, which
5 allows to lubricate the gate 47, the gate seat 42 and possibly also parts of the actuator. Usually the grease port 46 is accessible via an injection fitting 6. The injection fitting 6 may be replaced by a pressure gauge connector as described herein.

10 Valves provided with grease injection ports may be employed on wellhead equipment. The term "wellhead" is used in this specification to designate the wellhead including an assembly of spools, valves and fittings mounted on top of the wellhead. This may include a so-called Christmas tree. Such
15 valves, in particular gate valves, may be employed on a wellhead in a variety of configurations, including as side outlet valve, a wing valve, and a master valve. Depending on the function of the valve, the pressure gauged on the grease injection port can be representative of, for example, well
20 annulus pressure or well production tube pressure.

If, after installing the pressure gauge connector, the traveler 11 is seated against the inward sealing shoulder 18, the volume available in the internal chamber may be decreased and/or the amount of work fluid in the internal chamber may
25 be increased to push the traveler 11 into the bore 10 against the pressure prevailing in the connector-side section 34 of the bore 10. This may be accomplished for example by screwing a pressure gauge 7 in the pressure gauge port 4 and/or by injecting additional work fluid via one of the work fluid
30 injection ports 3. Eventually, the traveler 11 can end up in the non-floating position as shown in Figs. 5 and 7, in which case some of the work fluid will be injected into the space of interest 30 via the bypass flow path 37.

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As long as the traveler 11 is not seated against the inward sealing shoulder 18, it forms a pressure-equalizing barrier enabling read out of the pressure via the pressure gauge 7. However, in case there is a leak (for instance if the pressure gauge 7 is removed) then the traveler 11 will sealingly seat against the inward sealing shoulder 18 and thus form a full pressure barrier capable of retaining the pressure in the pressure equipment. Assuming no leaks are present, the test fluid pressure in the space of interest 30 can be measured to a maximum pressure increase which is determined by the volume available in the chamber-side section 33 of the bore 10 and the effective (cumulative) compressibility of the fluids contained within the internal chamber of the housing (this may include pockets of trapped air). Pressure readings can be made, as long as the traveler 11 is not seated against the inward seating shoulder 18.

The person skilled in the art will understand that the present invention can be carried out in many various ways without departing from the scope of the appended claims.

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C L A I M S

1. A pressure gauge connector for connecting a pressure gauge to a space of interest, said pressure gauge connector comprising a housing defining an internal chamber having an interior space, said housing comprising:
- a pressure gauge port configured to expose a pressure gauging surface to a pressure within in the interior space; and
 - a barrier port comprising a pressure-equalizing barrier configured between the interior space and the space of interest.
2. The pressure gauge connector of claim 1, wherein the pressure-equalizing barrier comprises a flexible barrier preventing a test fluid to flow from the space of interest into the interior space while transmitting a pressure of the test fluid inside the space of interest to an amount of work fluid present inside the internal chamber, thereby pressurizing the work fluid in the interior space of the internal chamber, which flexible barrier seals when the internal chamber does not hold the pressure within the interior space.
3. The pressure gauge connector of claim 2, wherein said pressure-equalizing barrier opens a flow passage for work fluid to flow into the space of interest when the amount of work fluid in the interior space exceeds the available volume at the pressure-equalized pressure.
4. The pressure gauge connector of any one of claims 1 to 3, wherein said housing further comprises:
- a work fluid injection port configured to feed a work fluid into the interior space.
5. The pressure gauge connector of any one of claims 1 to 4, wherein said pressure-equalizing barrier comprises:

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- a bore having a cylindrical bore wall section defining a cross sectional contour of the bore enclosing an area for longitudinal flow;

- a chamber-side open end forming a fluid passage from
5 the bore to the interior space;

- a connector-side open end forming a fluid passage from the bore to the space of interest;

- an inward sealing shoulder configured at the chamber-side open end and terminating the bore; and

10 - a traveler arranged in sliding engagement with the cylindrical bore wall with freedom to slide longitudinally through the bore over a stroke range bound by the inward sealing shoulder at the chamber-side open end.

6. The pressure gauge connector of claim 5, wherein the
15 traveler separates a chamber-side section of the bore from a connector-side section of the bore.

7. The pressure gauge connector of claim 6, wherein the traveler seals the interior space from the connector-side section of the bore when the traveler engages with the inward
20 sealing shoulder.

8. The pressure gauge connector of any one of claims 5 to 7, wherein the connector-side open end is in open fluid communication with the space of interest outside the housing.

9. The pressure gauge connector of any one of claims 5 to 8,
25 wherein the stroke range comprises a floating range and a non-floating range, in which floating range the traveler slidably floats in the bore separating the chamber-side section of the bore from a connector-side section of the bore, and which floating range transitions into the non-
30 floating range, whereby a bypass flow path is open when the traveler is located in the non-floating range, which fluidly connects the chamber-side section of the bore with the space of interest.

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10. The pressure gauge connector of claim 9, further comprising a spring-loaded seat configured at the connector side of the bore, whereby the traveler engages with the spring-loaded seat when the traveler is in the non-floating
5 range, and whereby the spring loads as the traveler moves away from the inward sealing seat and unloads as the traveler moves towards the inward sealing seat.

11. The pressure gauge connector of claim 10, wherein the traveler is disengaged from spring-loaded seat when the
10 traveler is located in the floating range.

12. The pressure gauge connector of any one of the preceding claims, further comprising an auxiliary traveler arranged between the pressure gauge port and the interior space, thereby defining a gauge fluid chamber between the gauging
15 surface and the interior space which is pressure-equalized with the interior space.

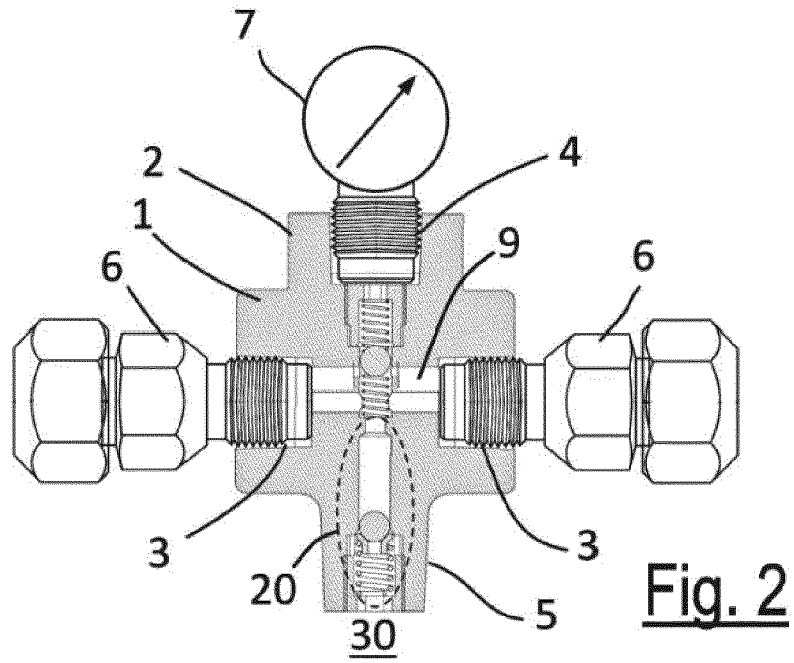
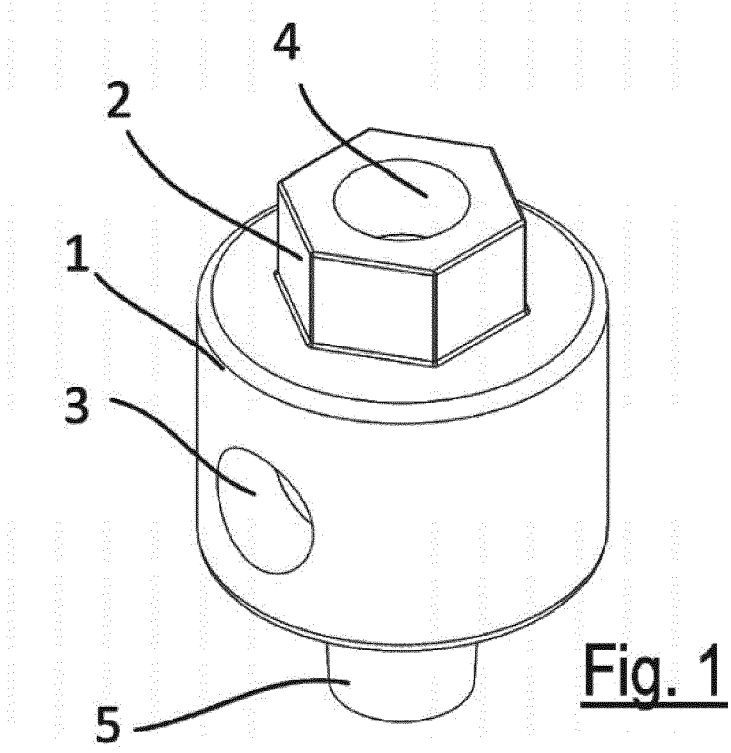
13. The pressure gauge connector of claim 12, wherein access of any work fluid from the interior space into the gauge fluid chamber is obstructed by the auxiliary traveler.

14. The pressure gauge connector of claim 12 or 13, further comprising an auxiliary spring-loaded seat configured at interior space side of the auxiliary traveler side of the bore, whereby when auxiliary traveler engages with the spring-loaded seat it loads the auxiliary spring and opens an
20 auxiliary bypass flow path between the gauge fluid chamber and the interior space to allow gauge fluid to leak away from the gauge fluid chamber into the interior space.

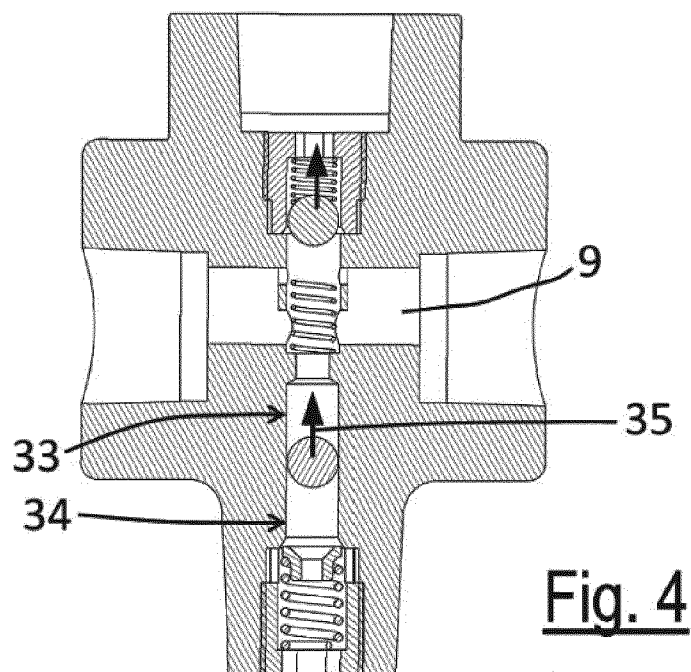
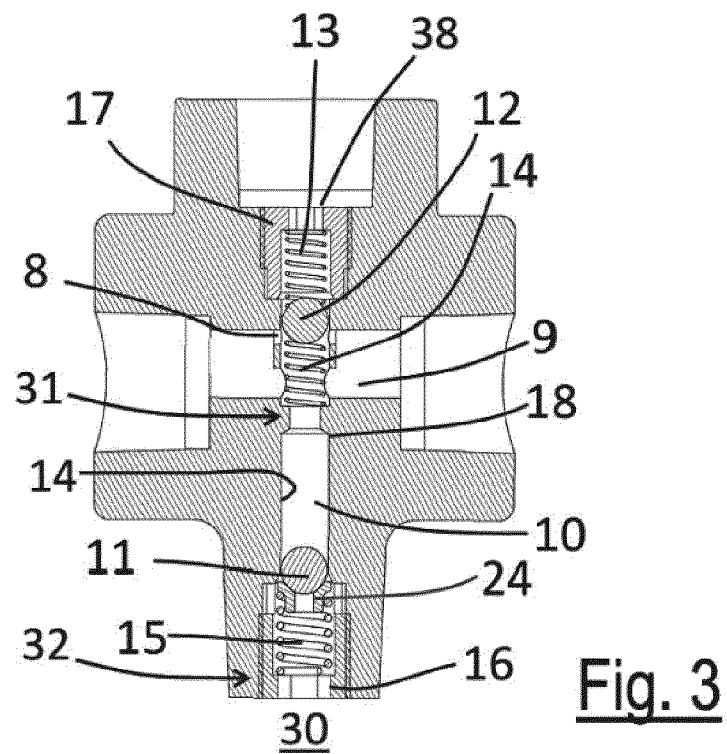
15. A wellhead comprising a pressure gauge connector according to any one of the preceding claims.

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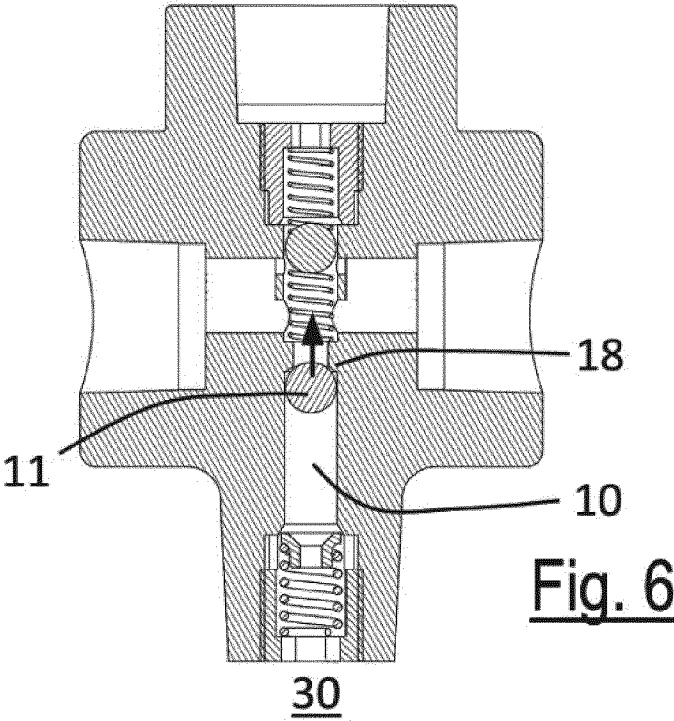
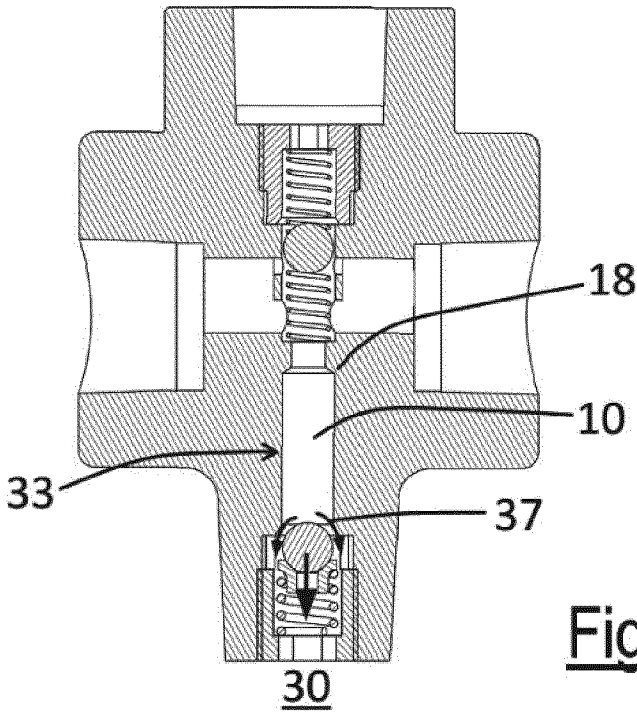
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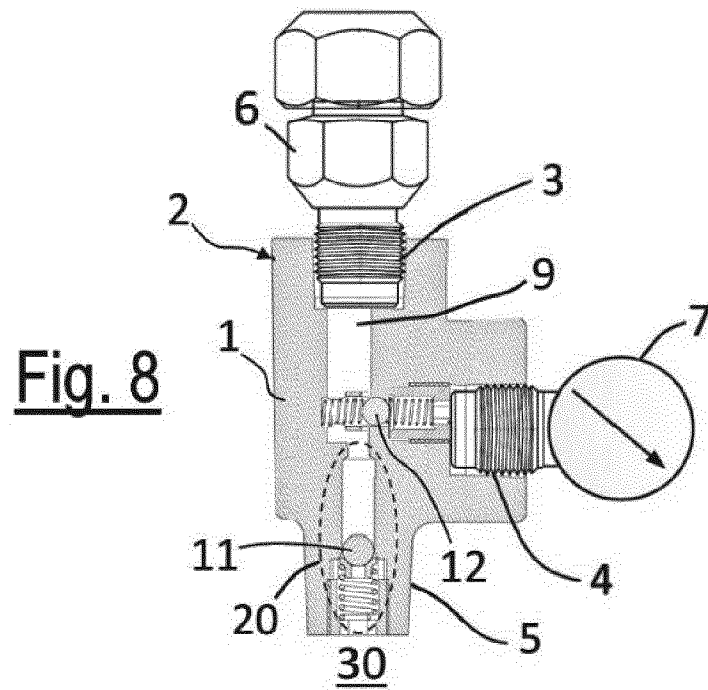
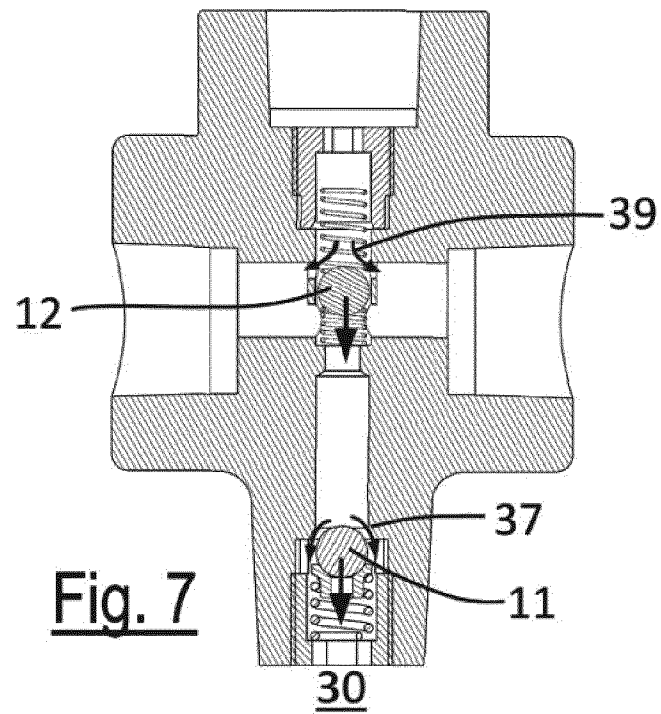
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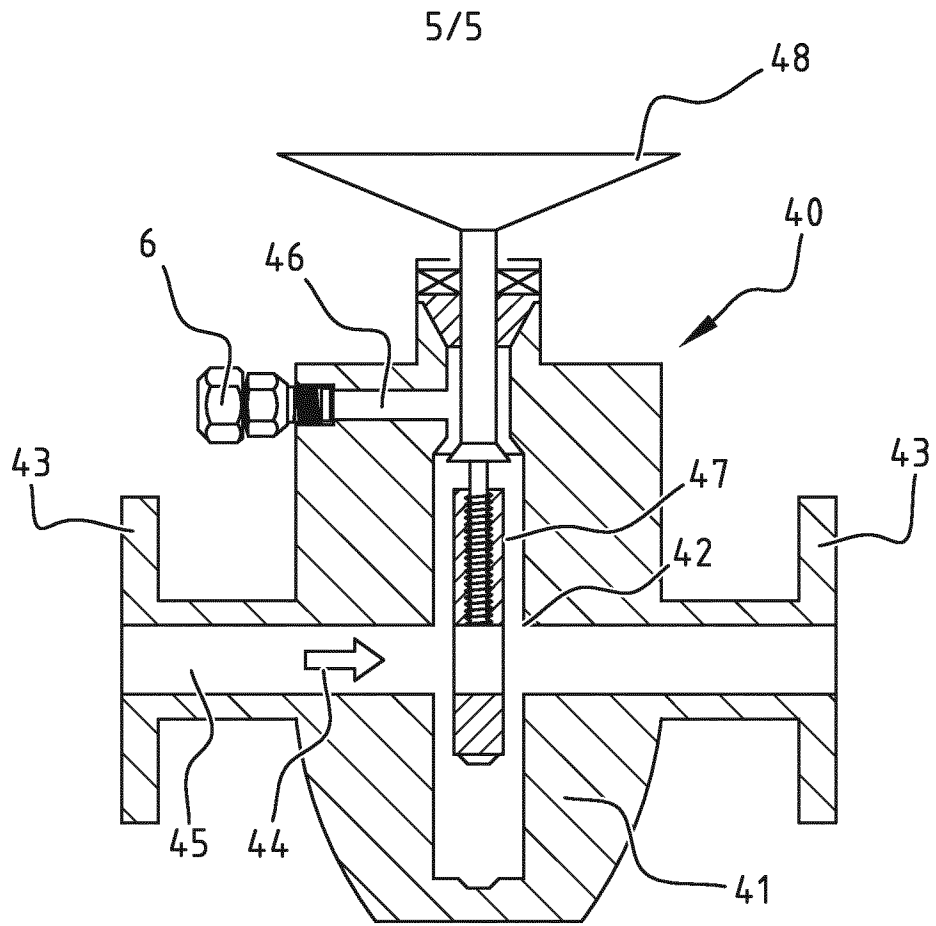


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/076599

A. CLASSIFICATION OF SUBJECT MATTER INV. F16N3/10 G01L7/00 G01L19/00 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) F16N G01L		
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.
X	WO 96/35933 A1 (FURON CO [US]) 14 November 1996 (1996-11-14) abstract figure 1	1-15
A	----- EP 0 270 284 A1 (EIDSMORE PAUL G) 8 June 1988 (1988-06-08) figure 6	5-14
A	----- WO 00/55072 A2 (GLAXO GROUP LTD [GB]; JONES ANTHONY PATRICK [GB]; ANDERSON GREGOR JOHN) 21 September 2000 (2000-09-21) figure 1 -----	5-14
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search	Date of mailing of the international search report	
4 December 2018	12/12/2018	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Kister, Clemens	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2018/076599

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-15

Invention 1 solves the problem to improve the pressure transmissivity of the pressure-equalizing barrier,

1.1. claims: 1-3

Invention 1.1 solves the problem to improve the pressure transmissivity of the pressure-equalizing barrier,

1.2. claim: 4

Invention 1.2 solves the problem to facilitate handling of the connector,

1.3. claims: 5-15

Invention 2 solves the problem of improving the fluid sealing of the connector housing in combination with the pressure equalizing barrier.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/076599

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