



(51) International Patent Classification:

G01D 11/24 (2006.01) F16L 41/00 (2006.01)

(21) International Application Number:

PCT/EP2019/080719

(22) International Filing Date:

08 November 2019 (08.11.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10 2018 128 385.7

13 November 2018 (13.11.2018) DE

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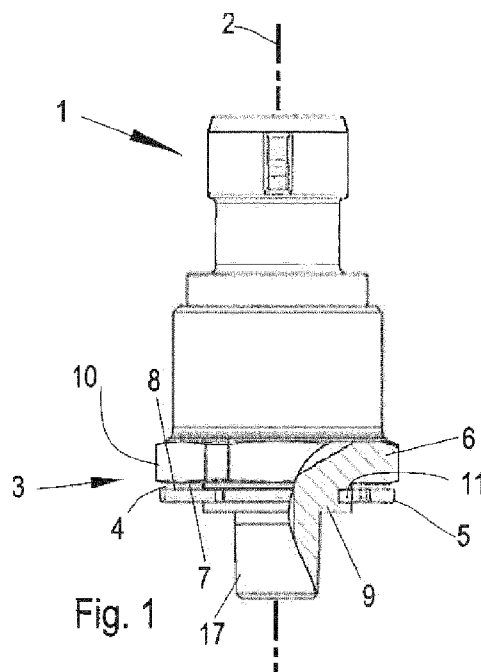
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, 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, 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))

(54) Title: SENSOR HOUSING



(57) Abstract: A sensor housing (1) comprising a longitudinal axis (2), a clamping area (3) surrounding the longitudinal axis (2) and a recess (4) in the clamping area (3) is described, the recess (4) running in circumferential direction. In such a sensor housing a recess in the clamping area (3) should be provided with low production costs. To this end the recess (4) is formed between a part 6 of the housing (1) and a locking element (5) fixed to the housing (1).

Sensor housing

The present invention relates to a sensor housing comprising a longitudinal axis, a clamping area surrounding the longitudinal axis, and a recess in the clamping area, the recess running in circumferential direction.

- 5 The sensor housing can be used as part of a pressure sensor or a temperature sensor which can be mounted on fluid systems, for example refrigeration systems, hydraulic systems or engines.

10 A sensor which is arranged in a fluid system may be subjected to vibrations and/or shock.

In order to overcome or at least reduce problems which are caused by such vibrations and/or shock, it has been proposed not only to mount the sensor housing to the fluid system, but to secure the sensor housing to a rigid
15 structure or a vibration damping element by use of screws, threaded bolts and nuts.

Such elements are, however, difficult to mount in systems or remote locations, where there is only limited space to handle the parts and the
20 necessary tools.

The more sophisticated solution is the use of a kind of hose clamp surrounding the clamping area. In order to reduce the possibility of axial movements of the sensor housing, the hose clamp is provided with a radially
25 inwardly extending protrusion which, however, requires a corresponding recess in the clamping area of the sensor housing. The recess can be in form of a circumferentially running groove. When the protrusion of the hose clamp or a similar clamping ring has been inserted into the recess, the sensor housing is locked against a movement in axial direction.

30

However, the manufacturing of such a recess or groove in the clamping area is difficult and expensive, in particular in case the clamping area is in a

massive flange portion of the housing which often has a polygon shape outer surface for a mounting tool. Further, the longitudinal extension of the massive flange may be too limited to accommodate such recess or groove, while still being used as a surface for mounting tools and/or for product marking.

5

The object underlying the invention is to provide a recess in the clamping area of the sensor housing with low production costs.

10 This object is solved with a sensor housing as described at the outset in that the recess is formed between the part of the housing and a locking element fixed to the housing.

15 Such a solution has the advantage that it is no longer necessary to form the recess or a corresponding groove by machining of the housing. It is only necessary to fix the locking element to the housing so that a gap is formed between the locking element and a part of the housing in the clamping area. The width of the gap can be determined by the mounting position of the locking element. The protrusion of the hose clamp or any other clamping ring can then be inserted into the gap between the locking element and the
20 housing so that the sensor housing is protected against an axial movement, i. e. a movement parallel to the longitudinal axis.

25 In an embodiment of the invention the housing comprises an extension having a cross section area smaller than a cross section area of the clamping area, wherein the locking element is fixed to the extension. The locking element can then be fixed to the circumference of the extension and the axial position of the extension, i. e. a position in a direction parallel to the longitudinal axis of the sensor housing, defines the width of the gap or recess between the locking element and the part of the housing mentioned above.

30

In an embodiment of the invention the extension is arranged coaxially to the longitudinal axis. This has the advantage that the locking element can as well be arranged coaxially to the longitudinal axis so that mounting is facilitated.

- 5 In an embodiment of the invention the locking element at least partly surrounds the extension. This means that the recess or gap formed between the locking element and the above-mentioned part of the housing in the clamping area is formed at least over the same circumferential part of the extension on which the locking element is arranged.

10

In an embodiment of the invention the extension is of cylindrical form. The cylindrical form is simple to produce, for example by turning. The locking element can be mounted on the cylindrical extension without taking care of the angular position of the locking element. The extension may have a tapered section at the end facing away from the housing.

15

In an embodiment of the invention the extension extends perpendicularly from a face of the housing. This face of the housing which can be termed "permanent clamping surface" defines one side of the groove or recess which accommodates the projection of the clamping ring.

20

In an embodiment of the invention a groove is formed in the extension and the locking element is in form of a clip element which is snapped into the groove. A groove in a cylindrical part can easily be produced. Since the extension is of smaller cross section the groove is shorter in circumferential direction than a corresponding groove on the outer circumference of the clamping area. The groove needs only a relatively small depth since it is provided for holding the locking element only.

25

- 30 In an embodiment of the invention the clip element is E-shaped. In other words, it is in form of a ring (which needs not necessarily be of circular form)

having a number of protrusions pointing radially inwardly, wherein the protrusions are inserted into the groove. An angular distance between the outer most protrusions is more than 180° so that the clip element can be pushed into the groove on the extension by elastically deforming the clip until
5 it snaps around the bottom surface of the groove in the extension. An axial surface of the clip element facing the permanent clamping surface can be termed "temporary clamping surface". The permanent clamping surface and the temporary clamping surface together limit the recess in axial direction which is intended to receive the projection of the clamping ring.

10

In another embodiment the locking element is in form of a locking washer which is mounted on the extension. The locking washer comprises an outer ring element with several elastically deformable sections protruding in a radially inwardly direction from the ring. The inside diameter of the washer is
15 slightly smaller than the outer diameter of the extension. The locking washer can be mounted on the cylindrical extension and pushed towards the permanent clamping surface until the distance between the outer ring of the washer and the permanent clamping surface corresponds to the predetermined distance or width of the recess. The inner end surfaces of the
20 deformable sections will engage with the surface of the extension and be deformed in an axial direction opposite to the mounting direction. Hereby, the washer will be locked against a movement in this direction. The washer will be able to withstand the axial loads from the clamping element occurring under normal operation of the fluid system.

25

In an embodiment of the invention a working section of the sensor extends from the extension. The working section can comprise a sensor itself and/or determine a physical property of the fluid in the system. Alternatively, the working section can form a channel to guide the fluid into other parts of the
30 sensor housing.

In an embodiment of the invention the working section has a cross section smaller than that of the extension. When mounting the locking element, the working section is not disturbing.

- 5 In an embodiment of the invention the working section comprises a threaded portion. The threaded portion can comprise an outer thread or an inner thread. It can be used to connect the sensor housing to the fluid system.

Preferred embodiments of the invention will now be described in more detail
10 with reference to the drawing, wherein:

Fig. 1 shows a first embodiment of a sensor housing partly broken away,

15 Fig. 2 shows a perspective view of the first embodiment of the sensor housing,

Fig. 3 shows a second embodiment of a sensor housing, partly broken away, and

20

Fig. 4 shows a perspective view of the second embodiment of the sensor housing.

In the following description the same elements are referred to with the same
25 reference numerals throughout all figures.

A sensor housing 1 comprises a longitudinal axis 2 and a clamping area 3 surrounding the longitudinal axis 2. A recess 4 is provided in the clamping area 3. The recess 4 runs in circumferential direction, which does not
30 necessarily mean that it is through going in circumferential direction.

The recess 4 is formed between a locking element 5 and a part 6 of the housing 1. The part 6 of the housing comprises a permanent clamping surface 7. The locking element 5 comprises a temporary clamping surface 8.

- 5 An extension 9 extends perpendicularly from the permanent clamping surface 7, i. e. from the part 6 of the housing. As can be seen, the part 6 of the housing can be provided with a polygonal outer surface 10, for example a hexagon, which can be used for a mounting tool.
- 10 The extension 9 has a cross section which is smaller than the cross-section area of the clamping area 3, more precisely smaller than the cross section area of the housing part 6. The extension 9 is of cylindrical outer form. The extension 9 extends coaxially with the longitudinal axis 2.
- 15 The extension 9 is provided with a groove 11 running in circumferential direction. The locking element 5 is in form of a spring ring having radially inwardly projecting protrusions 12, 13, 14. The outermost protrusions 12, 14 have an angular distance of more than 180°. Accordingly, the locking element 5 is in form of a E-shaped clip element which can be pushed into the
- 20 groove 11 by pressing it in radial direction (related to the longitudinal axis 2) into the groove 11. During such mounting the locking element 5 is elastically deformed and the protrusions 12, 13, 14 snap around the bottom surface of the groove 11.
- 25 The temporary clamping surface 8 is an axial surface of the locking element facing the permanent clamping surface 7 of the housing part 6. Accordingly, along the largest part of the circumference of the sensor housing 1 the locking element forms together with the axial surface of the housing part 6 the recess 4. The distance of the radial groove 11 from the permanent
- 30 clamping surface 7 defines the width of the recess 4.

The connection of the locking element 4 and the extension 9 can withstand high axial loads. The locking element 5 is a cheap standard part and it is removable from the sensor housing 1, if no special vibration damping is required.

5

Fig. 3 and 4 show a second embodiment of a sensor housing 1 in which the locking element 5 is in form of a locking washer. The locking element 5 comprises an outer ring element 15 with several elastically deformable sections 16 protruding in a radially inwardly direction from the ring 15. The inside diameter of the locking element 5 is slightly smaller than the outer diameter of the cylindrical extension 9 of the sensor housing 1. The locking element 5 can be pushed onto the cylindrical extension 9 and pushed towards the permanent clamping surface 7, until the distance between the temporary clamping surface 8 of the locking element 5 and the permanent clamping surface 7 of the housing section 6 corresponds to the predetermined or desired width of the recess 4. The inner end surfaces of the deformable sections 16 will engage with the surface of the cylindrical extension 9 and be deformed in an axial direction opposite to the mounting direction. Hereby, the locking element 5 will be locked against the movement in this direction.

20

The locking element 5 will be able to withstand the axial loads from the clamping element. The radially inwardly projecting parts of a hose clamp are inserted into the recess 4, under normal operation of the fluid system.

25

Such a sensor housing 1 allows the use of relatively cheap components for the locking element 5 to enable a remote and fast installation of a sensor arrangement in an opening of a fluid system.

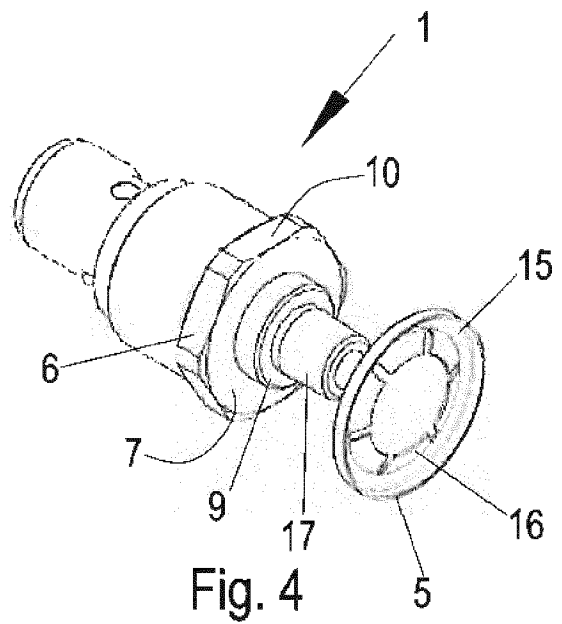
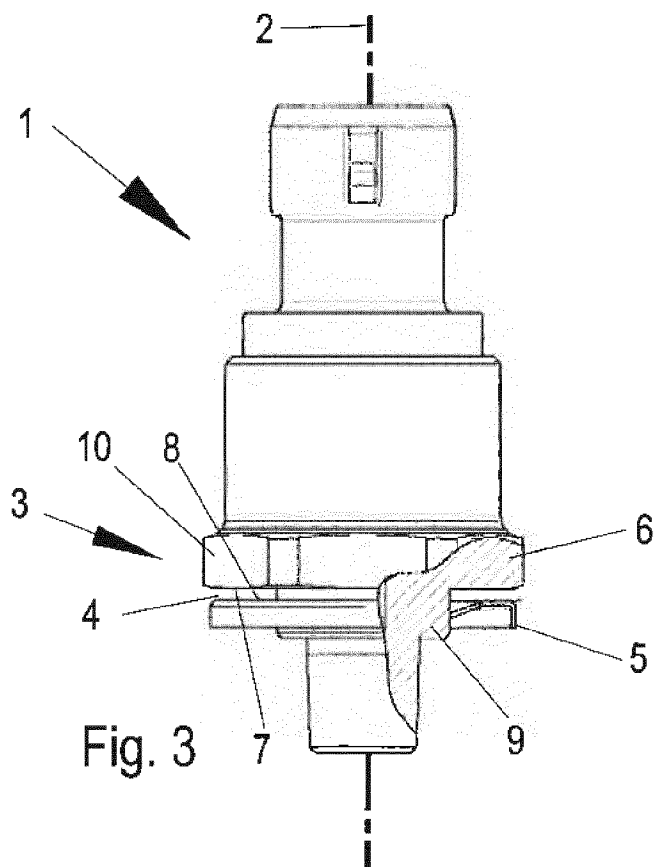
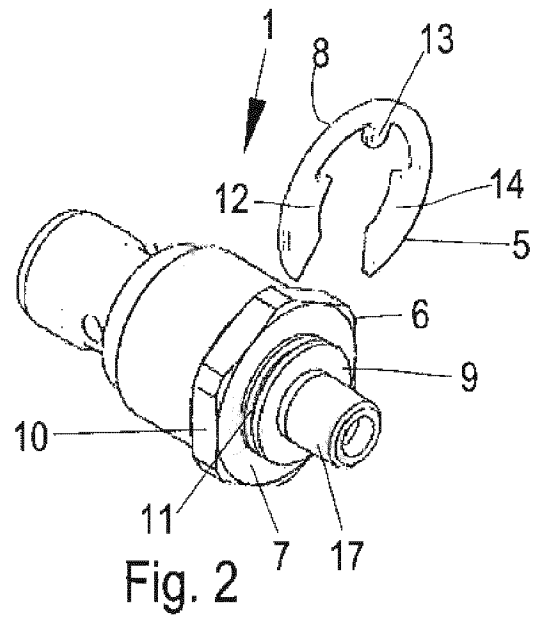
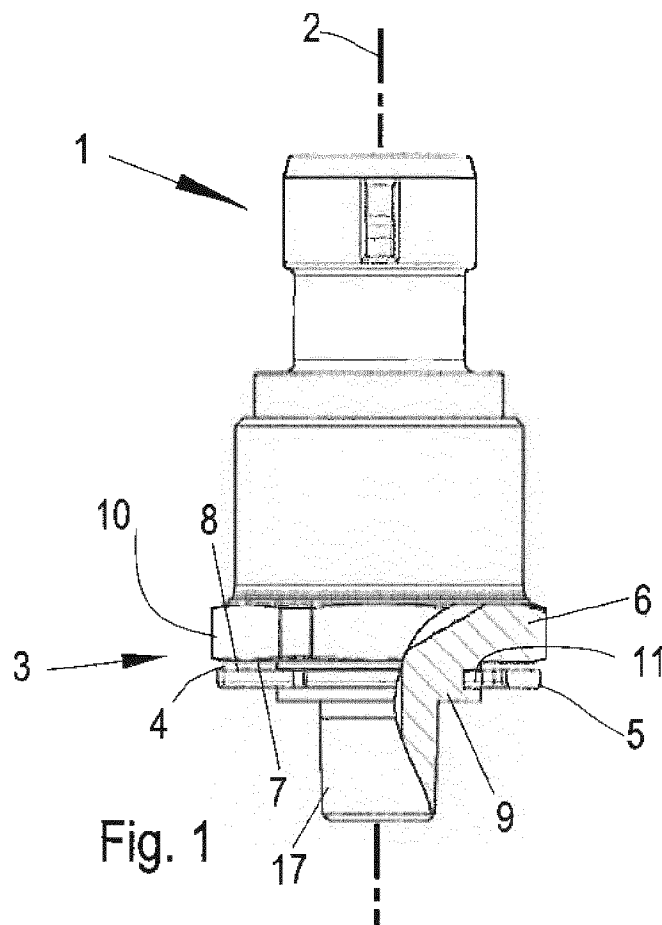
The sensor housing 1 can comprise at least one sensor to determine a physical property of the fluid in the system, e. g. a pressure sensor or a temperature sensor, arranged within the sensor housing 1.

- 5 To this end the sensor housing 1 is provided with a working section 17 which extends from the extension 9 and has a smaller cross-section area than the extension 9. The working section 17 can likewise be of cylindrical outer form. It forms a step to the extension 9.
- 10 The working section 17 can be used to accommodate the sensor mentioned above. Additionally or alternatively the working section 17 can be provided with a channel guiding the fluid from the system into other parts of the sensor housing 1. Furthermore, the working section 17 can be provided with an inner thread or with an outer thread to enable mounting of the sensor housing 1 to
- 15 the fluid system.

Claims

1. Sensor housing (1) comprising a longitudinal axis (2), a clamping area (3) surrounding the longitudinal axis (2), and a recess (4) in the clamping area (3), the recess (4) running in circumferential direction, characterized in that the recess (4) is formed between a part (6) of the housing (1) and a locking element (5) fixed to the housing (1).
2. Sensor housing according to claim 1, characterized in that the housing (1) comprises an extension (9) having a cross section area smaller than a cross section area of the clamping area (3), wherein the locking element (5) is fixed to the extension (9).
3. Sensor housing according to claim 2, characterized in that the extension (9) is arranged coaxially to the longitudinal axis (2).
4. Sensor housing according to claim 3, characterized in that the locking element (5) at least partly surrounds the extension (9).
5. Sensor housing according to any of claims 2 to 4, characterized in that the extension (9) is of cylindrical form.
6. Sensor housing according to any of claims 2 to 5, characterized in that the extension (9) extends perpendicularly from a face (7) of the housing (1).
7. Sensor housing according to any of claims 2 to 6, characterized in that a groove (11) is formed in the extension (9) and the locking element (5) is in form of a clip element which is snapped into the groove (11).
8. Sensor housing according to claim 7, characterized in that the clip element is E-shaped.

9. Sensor housing according to any of claims 2 to 6, characterized in that the locking element (5) is in form of a locking washer which is mounted on the extension (9).
- 5 10. Sensor housing according to any of claims 2 to 9, characterized in that a working section (17) of the sensor housing (1) extends from the extension (9).
11. Sensor housing according to claim 10, characterized in that the working section (17) has a cross section smaller than that of the extension (9).
- 10 12. Sensor housing according to claim 10 or 11, characterized in that the working section (17) comprises a threaded portion.



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/080719

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01D11/24 F16L41/00
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)
G01D F16L 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	US 2007/280780 A1 (BRUEHL MANFRED [DE] ET AL) 6 December 2007 (2007-12-06) paragraph [0091]; figures paragraph [0101] -----	1-6,9-11
X	US 2012/248763 A1 (NAKAMURA HIROSHI [JP]) 4 October 2012 (2012-10-04) paragraph [0032]; figures -----	1-8, 10-12
X	US 2018/187811 A1 (SCHOLZ JOCHEN [DE] ET AL) 5 July 2018 (2018-07-05) paragraph [0087] - paragraph [0088]; figures -----	1-8, 10-12
X	WO 2007/063390 A1 (SGL ITALIA SRL [IT]; CORTESE VIRGINIO [IT]) 7 June 2007 (2007-06-07) figures -----	1-8, 10-12
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

10 January 2020

Date of mailing of the international search report

24/01/2020

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2019/080719

C(Continuation). 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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Information on patent family members

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