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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 April 2019 (11.04.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/068292 A1

(51) International Patent Classification:
G01G 21/23 (2006.01)

(21) International Application Number:
PCT/DK2018/000091

(22) International Filing Date:
07 September 2018 (07.09.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PA 2017 00448 02 October 2017 (02.10.2017) DK

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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, 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:** LOAD CELL LIFT-OFF PROTECTION DEVICE

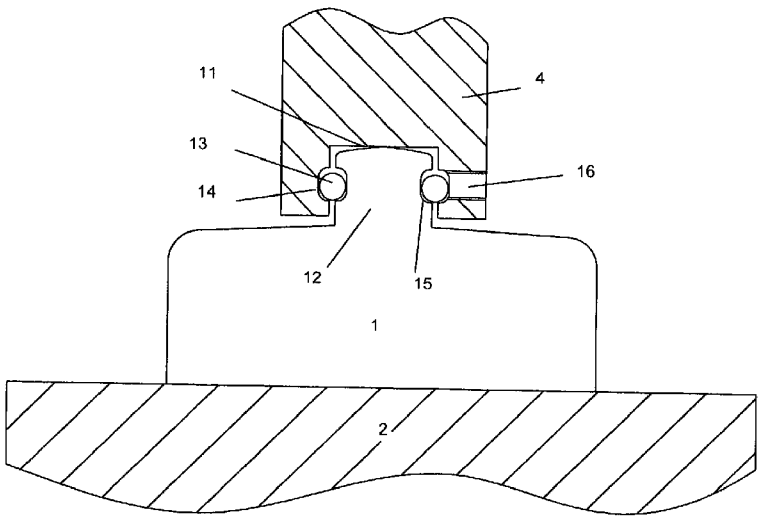

Fig. 3

(57) **Abstract:** Load cell lift-off protection devices with the load to be measured applied directly to the spherical upper surface of the load cell and with locking members which are locking grooves in the load cell force introducing parts to grooves in the structure of the weighed installation.

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Load cell lift-off protection device

The invention relates to a device for securing that the connection between a load and a load cell is ensured even under adverse operational conditions with negative loads on a load cell.

The invention relates more specifically to installations where load cells are used for weighing on silos, mixing machinery etc. and where there is a risk of the weighed installation accidentally being tilted or falling over.

These situations are found when the weighed installation is hit by a vehicle, or because of strong winds or earthquakes.

Apart from the obvious risk to personnel, there is also the risk of high costs when a weighed installation is tilted and falling to the ground.

Figure 1 show a commonly used way of securing a weighing installation against tilting where 1 is the load cell, 2 is a concrete surface, 3 is a load introducing part and 4 is a part of the structure of the weighed installation. The two bolts 5, which are fastened in the concrete surface 2 are passing through two holes 6 in the beam 7, which is welded to the structure member 4. The nuts 8 are securing that the weighed installation cannot be lifted off the load cell 1. The accuracy of this commonly used weighing solution is totally dependent on that the beam 7 is not in contact with the bolts 5 nor the nuts 8. These conditions are often violated in practice by the installation of the weighing system and later in use. Besides this obvious problem, this solution with the rather long bolts, is not stable with strong horizontal forces, which for example are seen during earthquakes.

Another common solution is to secure the weighed installation by one or more bolts mounted in the upper surface of the load cell, but this solution will invariably introduce parasitic forces into the load cell, lowering the accuracy.

It is the object of the invention to provide a weighed installation which can operate with and transfer negative forces to the load cell, and which at the same time guarantees a simple installation with a high accuracy of the weighing.

According to the invention this object is obtained by locking the weighed installation to the load cell with locking members which are ensuring a reliable function and which are not introducing parasitic forces into the load cell.

In the embodiment of the invention shown in figure 2, the load cell 1 is clamped down on the surface 2 by the bolts 9 securing the ring or plate 10. The part 4 of the structure of the weighed installation is resting on the spherical upper surface 11 of the force introduction part 12 of the load cell 1. The locking members 13 are placed in the groove 14 of the part 4 and the groove 15 of the force introduction part 12.

The locking members 13, which are shown as possibly being spherical balls are introduced into the grooves 14 and 15 through the opening 16 in the part 4. The grooves are preferably completely filled with locking members to ensure that the highest possible load can be taken up by the load cell lift-off protection device in critical situations. The opening 16 is preferably closed by a threaded screw and additional openings 16 are preferably provided for a possible later easy removal of the locking members 13 when performing service on the load cell installation. The locking members 13 are preferably magnetic for even more easy removal.

In the embodiment of the invention shown in figure 3, the height of the groove 14 and or possibly the groove 15 are higher than the height or diameter of the locking member 13. This allows the part 4 to tilt to a certain degree without introducing parasitic bending moments into the load cell as the load applied to the load cell is just shifting on the spherical surface 11 of the force introduction part 12.

That the load is applied to the spherical surface 11 without any interference from the lift off protection is a prerequisite for a high accuracy of the weighing.

In the embodiment of the invention shown in figure 4 the locking members 13 are shown as locking members fitting into the essentially rectangular grooves 14 and 15, which may have height which is equal to or preferably higher than the height of the locking members 13.

Figure 5 show locking members in the form of cylindrical rollers with a height fitting into the grooves 14 and 15, and figure 6 show locking members with a height fitting into the grooves 14 and 15 and with an inner and outer radius fitting into respectively the grooves 15 and 14.

These embodiments of the invention can take up much higher loads than the spherical balls.

Fig. 7 shows a sectional view of a load cell assembly, where a first end of the load cell 1 may be attached (not shown) to the base 2, where the load cell is provided with a second end, the force introduction part 12, configured to receive a load from a load transmission member 4. The load transmission member is provided with a recess 17 having a size that is larger than the outer diameter of the second end of the load cell, so that the second end 12 may be introduced into the recess of the load transmission member.

The peripheral edge of the second end 12 may be provided with one or more grooves, that may be adapted to receive an intermediate coupling element 13, where the intermediate coupling element is locked to the side walls of the recess 17. The coupling element 13 may be adapted to move in a radial direction, so that prior to the placement of the load transmission member onto the load cell, the coupling elements are retracted, allowing the side walls of the recess to slip over the second end of the load cell. When the recess has been positioned over the second end, a locking sleeve 18 may be utilized to press the coupling members 13 in a radial inwards direction, allowing the coupling members to engage with the grooves, in order to prevent the load transmission member to be released from the load cell. I.e. the inner diameter of the coupling members, when engaged is smaller than the outer diameter of the grooves, so that the upper edge of the grooves will engage the coupling elements 13 if the load transmission member is pulled in a direction away from the load cell 1.

The grooves are configured to have a vertical dimension that is larger than the vertical dimensions of the coupling element, allowing the coupling element to have a margin of movement (latitude) between the lower edge of the groove and the upper edge of the groove.

By providing a margin of movement, the load transmission member 4 will be capable of tilting away from a vertical axis (central axis of the load cell) without the coupling member to come into engagement with the upper edge of the groove. I.e. that the coupling element may move in a vertical direction within the groove without engaging the groove. This ensures that the angled movement of the load transmission member will not transfer any interfering forces into the load cell, such as forces that are in a direction other than in the vertical direction. Thus, the forces that effect the movement of the load transferring member to tilt, will not affect the second end of the load cell, ensuring that parasitic forces applied to the load transmission member are isolated from the load cell.

The attachment between the load transmission member and the second end of the load cell in a direction towards the load cell is ensured between the contact surface of the load cell and the contact surface of the load transmission member, so that the load applied to the load transmission member to be measured by the load cell is directly transmitted to the load cell. The attachment in the opposite direction is however secured by the coupling element, allowing some leeway of movement between the load cell and load transmission member in an upwards direction (vertical direction away from the load cell, as well as a tilting movement of the load transmission member, relative to the load cell.

Items

1.Load cell lift-off protection devices with the load to be measured applied directly to the spherical upper surface of the load cell, c h a r a c t e r i z e d in that locking members are locking grooves in the load cell force introducing parts to grooves in the structure of the weighed installation.

2. Load cell lift-off protection devices according to item 1, where the grooves are adapted to spherical balls as locking members.

3. Load cell lift-off protection devices according to item 2, where the grooves are higher to allow tilting.

4 Load cell lift-off protection devices according to item 1, where the grooves are essentially rectangular to adapt locking members with a cylindrical cross section.

Claims

1. A load cell assembly configured to measure a axial load in the direction of a central axis of the load cell, the load cell assembly comprising

- a load cell body having a first end and a second end,
- a load transmission member configured to transfer the load of a weighed installation to the load cell body in a direction coaxial with the central axis of the load cell,
- a first connection arrangement configured to securely attach a first end of the load cell body to a base,
- a second connection arrangement configured to attach a second end of the load cell to the load transmission member,
- wherein the load transmission member comprises a first coupling member and the load cell comprises a second coupling member, which are configured to secure the load transmission member to the second end of the load cell,
- characterized in that the first and the second coupling members are configured to provide a margin/latitude between the first and second coupling members allowing the load transmission member to tilt at an angle relative to the central axis of the load cell.

2. A load cell assembly according to claim 1, where the second end of the load cell which may be in contact with the load transmission member is spherical.

3. A load cell assembly according to any of the preceding claims, where a contact surface of the load transmission member, which may be in contact with the load cell may have a spherical surface.

3. A load cell assembly according to any of the preceding claims where the first and second coupling members are opposing grooves that are coupled to each other via a locking member.

4. A load cell assembly according to claim 3 wherein the locking member may be a cam, a bearing ball, a spherical member, a spherical ball, a bolt, that engages the opposing grooves.

5. A load cell assembly according to claims 3 or 4, wherein the height of the grooves is larger than the height of the locking member.

6. A load cell assembly according to claims 3, 4 or 5, the grooves are essentially rectangular in cross section to adapt locking members with a cylindrical cross section.

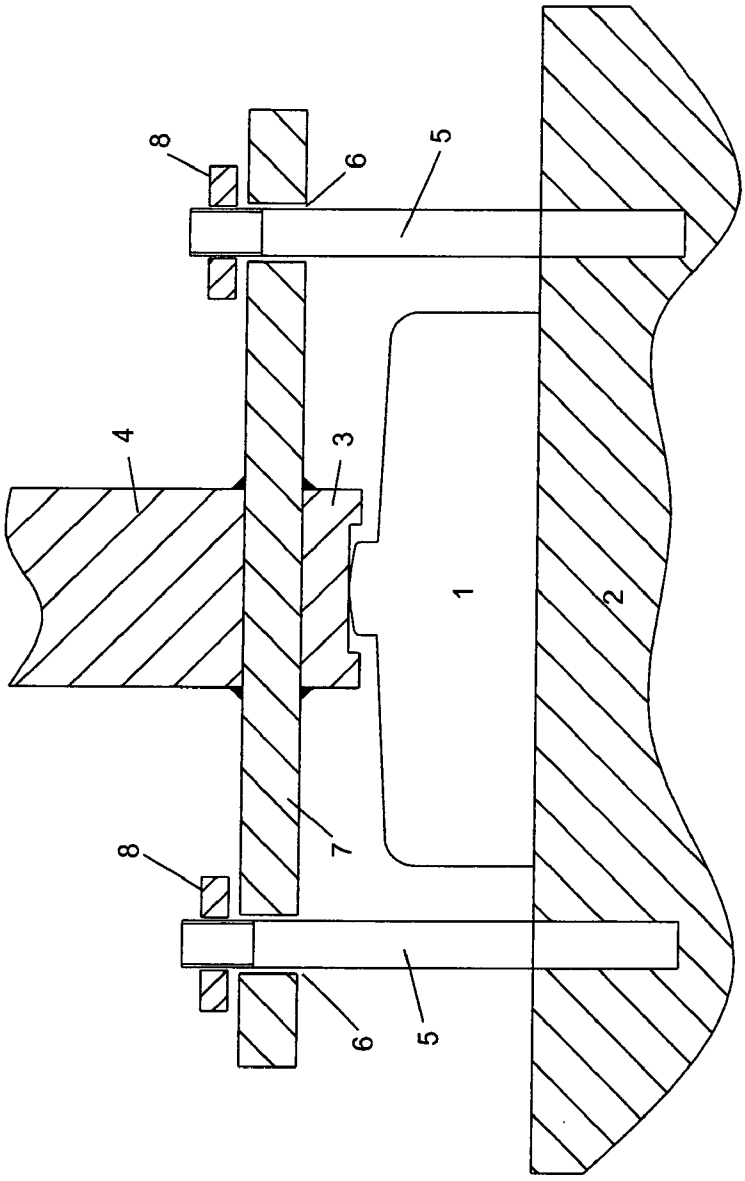

Fig. 1

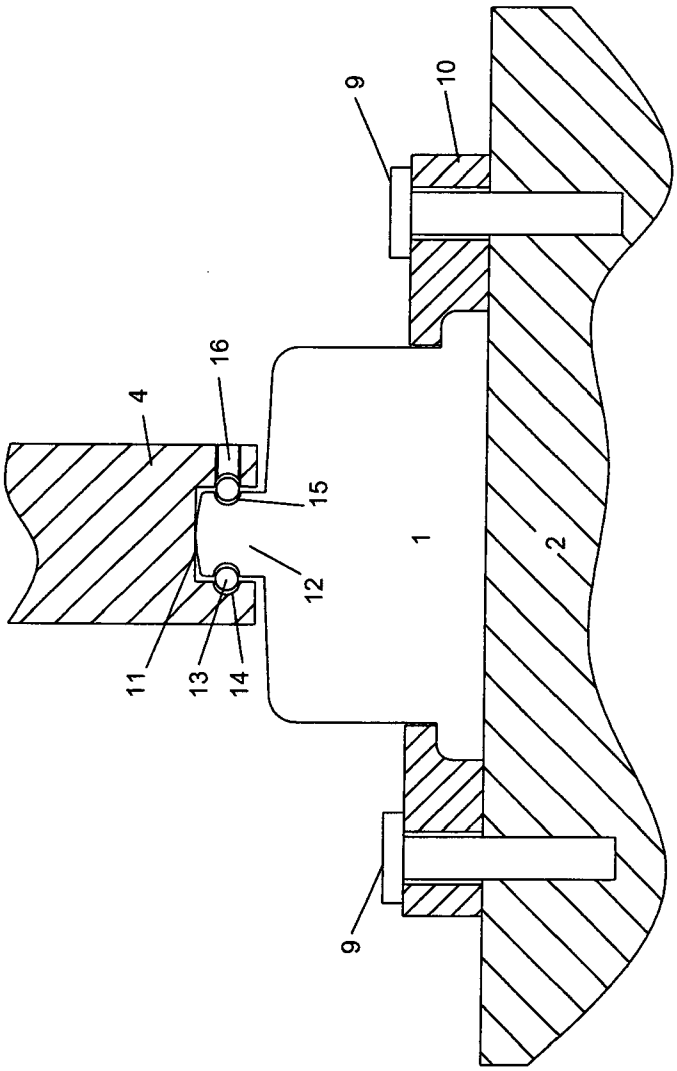

Fig. 2

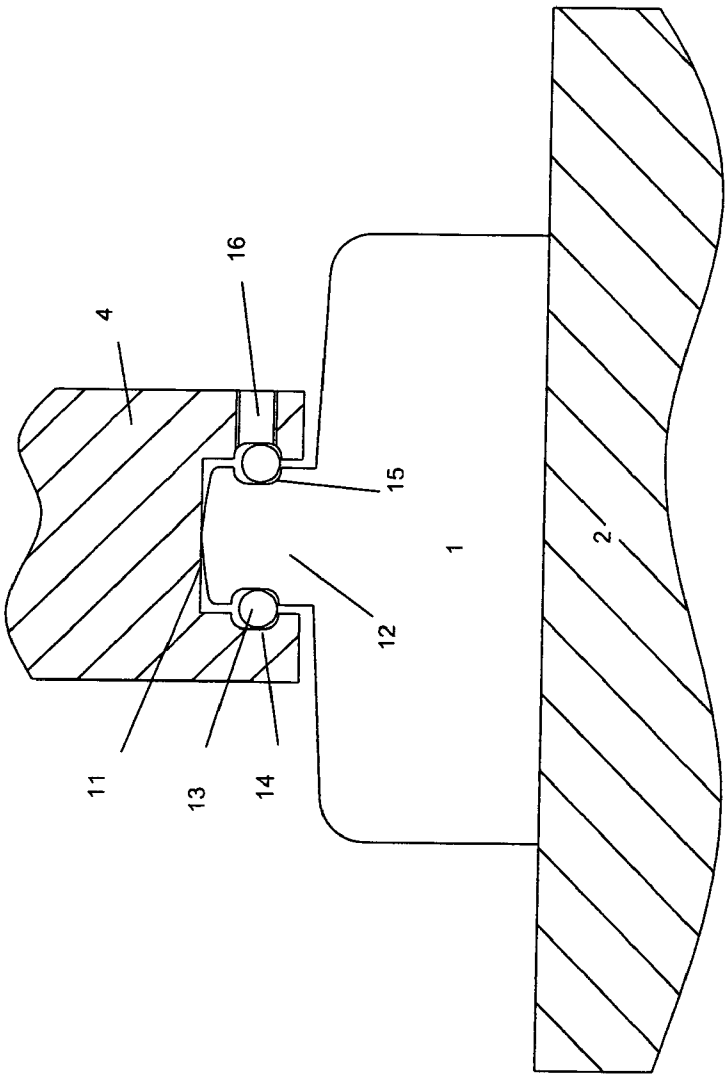

Fig. 3

Fig. 5

Fig. 6

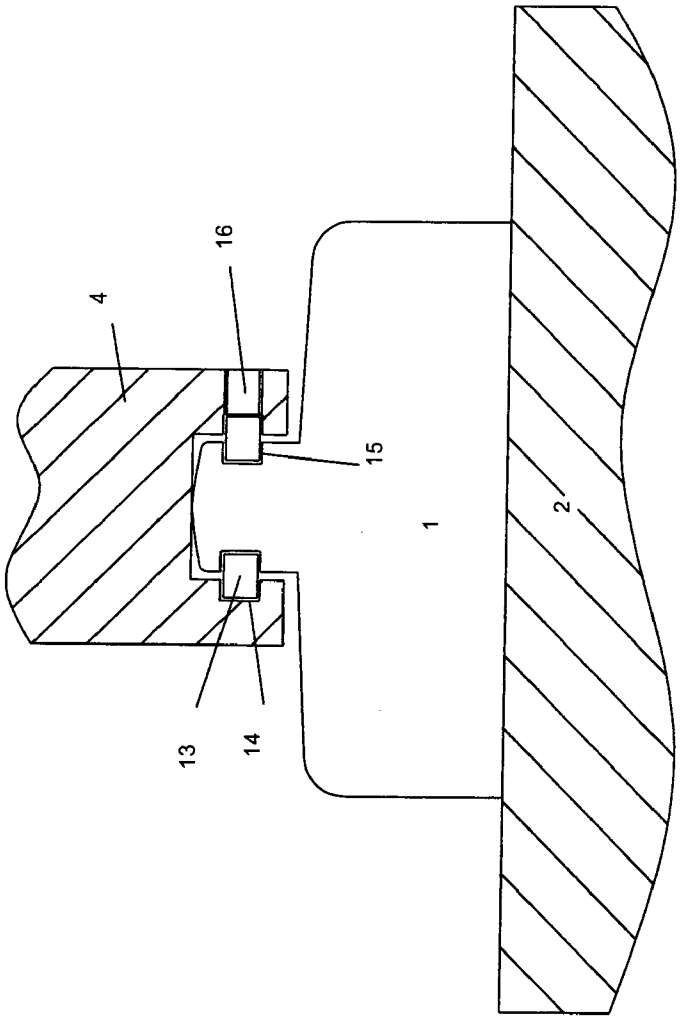

Fig. 4

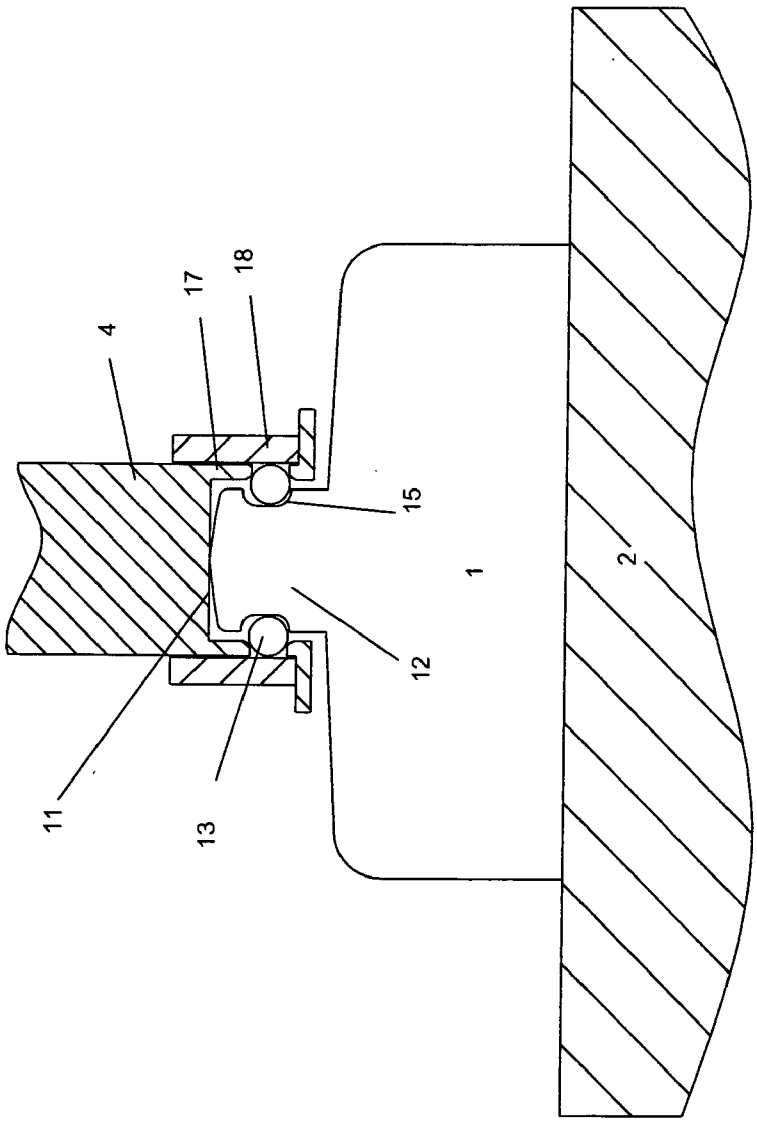

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2018/000091

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01G21/23
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)
G01G

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 Y	EP 1 193 480 A1 (HOTTINGER MESSTECHNIK BALDWIN [DE]) 3 April 2002 (2002-04-03) abstract; claims 1-9; figures 1-2 paragraph [0009] - paragraph [0010] paragraph [0016] - paragraph [0022] -----	1,2 3-6
X	DE 297 18 113 U1 (BORNGAESSER JOHANNES [DE]) 26 February 1998 (1998-02-26) abstract; claim 1; figure 2 paragraph [0034] - paragraph [0036] -----	1-6
Y	DE 83 03 337 U1 (ZELO KONSTRUKTIONS UND VERTRIEBS GMBH) 7 July 1983 (1983-07-07) abstract; claim 1; figure 3 paragraph [0004] - paragraph [0006] paragraph [0010] -----	3-6

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 November 2018	03/12/2018

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2018/000091

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 93 02 752 U1 (HOTTINGER BALDWIN MESSTECHNIK GMBH) 27 May 1993 (1993-05-27) claims 1-6; figure 1 paragraph [0001] - paragraph [0006] paragraph [0010] - paragraph [0011] paragraph [0015] - paragraph [0019] -----	1-6

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/DK2018/000091

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1193480 A1	03-04-2002	DE 10048147 A1	11-04-2002
		EP 1193480 A1	03-04-2002
DE 29718113 U1	26-02-1998	NONE	
DE 8303337 U1	07-07-1983	NONE	
DE 9302752 U1	27-05-1993	NONE	