



- (51) International Patent Classification:
F16D 1/08 (2006.01)
- (21) International Application Number:
PCT/EP2017/052216
- (22) International Filing Date:
2 February 2017 (02.02.2017)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
EP16156219.4 18 February 2016 (18.02.2016) EP
- (71) Applicant: VOITH PATENT GMBH [DE/DE]; St.
Pöltener Str. 43, 89522 Heidenheim (DE).
- (72) Inventors: MEHLICH, Andreas; Jägerstrasse 110a,
48429 Rheine (DE). BOHLER, Axel; Bergatan 10, 82532
Iggesund (SE). BERGSTRÖM, David; Bro 233, 82494
Hudiksvall (SE). WEISBJERG, Sigvard; Urövägen 14B,
82491 Hudiksvall (SE).
- (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, 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.

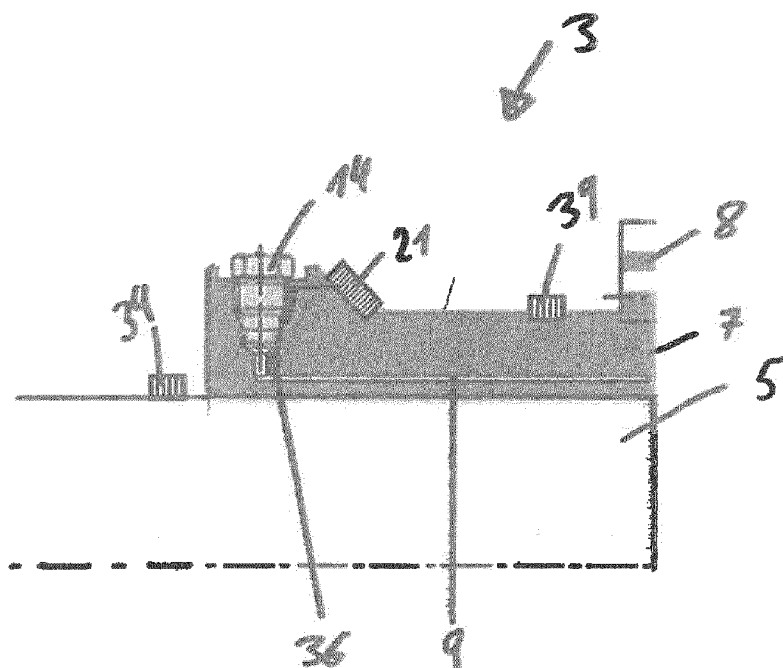
- (84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, 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: METHOD AND SYSTEM FOR DIGITAL OPTIMIZATION OF TORQUE LIMITERS AND CONNECTION COUPLINGS

Fig.:3



(57) Abstract: A coupling connection comprises a memory device. For establishing a connection a hydraulic chamber of the coupling connection is pressurized with a predetermined pressure. Information of the predetermined pressure is stored in the memory device. A system uses information stored on the memory device for pressurization of the coupling connection. The method for pressurization of the hydraulic chamber of the coupling connection comprises the step of reading information stored on the memory device.

Method and system for digital optimization of torque limiters and connection couplings

5

Connection couplings and safety connection couplings comprising an outer sleeve and an inner sleeve, wherein the inner sleeve and the outer sleeve are connected by friction force are well known. For providing the friction connection a hydraulic chamber is pressurized. The transferrable torque is predetermined by the chosen pressure in the hydraulic chamber. To fill the hydraulic chamber with hydraulic fluid the connection coupling comprises a fluid inlet connected to the hydraulic chamber and connectable to a pump for pressurization.

For example, Voith Turbo Safeset AB delivers connection couplings, for example HyGrip. These connection couplings are backlash-free, frictional, quick setting/releasing shaft-hub connections. The setting or releasing occurs hydraulically. Depending on the application, various operating principles are available, all of which offer the advantage of a backlash-free pressure connection. A description of the HyGrip Coupling is published in the company flyer "Connection Couplings HyCon, HyLoc and HyGrip", G1578 published in 2010. The connection is provided by pressurization of the coupling connection.

Voith Turbo Safeset AB delivers torque transmitting connection couplings with an overload protection under the name SafeSet, SmartSet and SlipSet.

25

The SafeSet principle is simple: friction and flexibility. No material fatigue, a constant torque transmission and adaptability. These safety connection couplings comprise a release mechanism at a preset torque. So an immediately release is realized for over-torque situations. The SafeSet coupling includes a twin-walled hollow sleeve. A friction connection is provided by surface pressure. Therefore the twin wallet hollow sleeve is expanded by pressurized hydraulic oil. The integrated shear tube holds pressure to ensure a constant, but easily adaptable torque transmission. In an overload situation the coupling slips and the shear tube shears off. Oil pressure drops

30

- 2 -

and the frictional surfaces separate. The coupling rotates on bearings without transmitting any torque.

After a pressure release, a connection is re-established by pressurization of the connection with a predetermined pressure. The pressure has to be looked up in documentation. It is very important to look up the correct value; otherwise there is the risk that the connection does not work in the predicted way. If a coupling connections or safety coupling does not transfer the predicted torque then operation time decreases.

It is the object of the invention to provide a more comfortable coupling connection and system for pressurization and re-pressurization of the coupling connection and method of pressurization and re-pressurization. Further it is an object of the invention to make the pressurization and re-pressurization more secure. Further it is an object of the invention to document the history of pressurization. The predetermined pressure can differ between the same types of safety couplings because of manufactory reasons, especially fabrication tolerances. Further safety couplings can be adapted to the use case by choosing different predetermined pressures.

The object of the invention is solved by the features of the independent claims.

The coupling connection comprises a memory device containing information about the predetermined pressure. The information about the predetermined pressure is also mentioned as predetermined pressure value. It is easy to look up the correct predetermined pressure value for the use case and the coupling connection. It is possible that tables are stored in the memory device, so that the predetermined pressure value can be extracted from the stored table.

A coupling connection is a device for connecting an input shaft with an output shaft wherein a hydraulic chamber of the coupling connection is pressurized.

- 3 -

The coupling connection can be used as safety coupling slipping when a predetermined torque is exceeded. The coupling connection can further be used to provide a connection of two sleeves which can be engaged and disengaged like HyGrip.

5

Especially if different connection couplings are used in one environment, it is comfortable to look up the correct predetermined pressure value after release by reading the information on the memory device. The risk to use wrong information is avoided. It is preferred to arranged the memory device on or
10 near by the coupling.

So pressurization and re-pressurization are more secure, because the predetermined pressure value is linked to the connection coupling. So using a wrong manual is avoided.

15

In a preferred embodiment the connection coupling comprises a memory device containing a ROM and an RAM. In the ROM a connection coupling identification and predetermined pressure values in relation to transferrable torque can be stored. The RAM can be used to store information about the
20 history of pressurization of the connection coupling or the usage and the service intervals. Further it is possible to adapt the connection coupling to the real use case and safe adaption values in the RAM.

25

In a further embodiment the system for re-pressurization comprises a control device, preferable handheld device. For example Smartphones, Tablets and portable computers and further portable electronic devices comprising the possibility to establish a data connection to further devices or modules are handheld device. Examples of the further modules or devices are a memory element and/or a controllable or programmable valve. The weight of such
30 handheld devices are usually no more than two kilograms.

- 4 -

The control device comprises an interface. The memory device and the control device are able to establish a data connection. Using a wireless connection, for example Bluetooth or W-Lan or NFC, is very comfortable because no wire connection and no interface openings are needed. The control device can be used to read the information stored in the memory device. In a preferred embodiment the handheld device is used to display information from the memory device.

In a further embodiment of the system the handheld device is connectable to the memory device and/or pump. In a preferred system the handheld device is connectable wireless to the memory device and the pump. So only the pressure line has to be linked to the coupling connection for pressurization by hardware.

In a further embodiment of the coupling connection the memory device is integrated into the coupling connection. Especially the memory device is integrated into the outer sleeve of the coupling connection. The coupling connections are usually made of metal. To provide the possibility of wireless connection, a shielding by the coupling connection should be avoided. In a very preferred embodiment the memory device is arranged in a recess of the surface of the outer sleeve of the connection coupling. In a preferred embodiment an RFID tag is used as memory device wherein the RFID Tag comprises at least the information of the predetermined pressure value.

In a preferred embodiment of the coupling connection the memory device is permanently fixed to the coupling connection.

In a preferred embodiment the memory device comprises a communication interface for establishing a connection to control device or handheld device or display device. The interface can be a connector for a wired connection to the handheld device. Then the risk of connection problems is reduced. Further the interface can be a protocol used for establishing a wireless connection, for

- 5 -

example Bluetooth, NFC, Zigbee. A wireless connection has the advantage that there are no opening needed and the memory device can be totally sealed. By the connection of the handheld device and the memory device, it is possible to update or to adept the information stored in the memory device.

5 So the stored information can be adjusted to the use case and the individual coupling connection.

In a preferred embodiment of the system the handheld device can be connected to the pump. The pump is used for pressurization of the hydraulic chamber. It is possible to regulate the pressurization of the hydraulic chamber by the handheld device. Further it is possible to store the values of the pressure in the hydraulic chamber after the pressurization is finished.

10 In a preferred embodiment the control device is an integrated part of the pump. The pressurization of the hydraulic chamber is controlled by the control device. A display device can be assigned to the control device to display the progress controlled by the control device. Further the display device can be used for input of data into the control device.

20 In a preferred embodiment the handheld device is linked to the memory device and the pump. So it is possible to store the information about at least of the last pressurization on the memory device. Further it is possible to store a history of pressurizations on the memory device of that coupling connection.

25 In the case the applied and transferred torque is measured, it is possible to analyze the behavior of the coupling connection in dependence to the pressurization. It is possible to adapt the predetermined pressure in dependence of the measurements, especially to adapt the pressure to ensure a slipping at a predetermined torque.

30

The Coupling connection of the invention comprises a hydraulic chamber for establishing a coupling connection between an outer sleeve and an inner

- 6 -

sleeve. Further the coupling connection comprises a memory device. In the memory device at least the value of the predetermined pressure value is stored. In a preferred embodiment in the memory device at least the value of the last pressurization is also stored.

5

In a preferred embodiment of the system comprises a torque measurement sensor for generating measurements of the torque transferred by the coupling connection.

10 In a preferred embodiment of the coupling connection the torque applied and/or transferred to the coupling connection is measured by a torque sensor of the coupling connection. In a further embodiment the torque measurement values are measured by torque sensors not part of the coupling connection, but the measurement results are transferred to the memory device of the
15 coupling connection.

In a preferred embodiment the coupling connection comprises a pressure sensor for providing pressure values of the pressure in the hydraulic chamber.

20 The invention is directed on a method for establishing a connection of an input sleeve with an output sleeve of a coupling connection. The input sleeve and the output sleeve are arranged coaxial. The input sleeve is interacting with the output sleeve by friction. The input sleeve can be arranged as an inner sleeve radial inside of the outer sleeve and the output sleeve can be arranged radial
25 outside as an outer sleeve or vice versa. The coupling is established by pressurization of a hydraulic chamber providing a friction force between the inner sleeve and the outer sleeve comprising the steps of:

- reading out a predetermined pressure value from a memory device of the coupling connection
- 30 • pressurization of the hydraulic chamber by a pump
- displaying the information of the predetermined pressure value and the pressure information of the hydraulic chamber on a display.

- 7 -

In a preferred method the value of pressurization is transferred to the memory device after finalization of pressurization. The transferred value of pressurization is stored in the memory device.

- 5 In a preferred method the pressurization of the hydraulic chamber is controlled by the handheld device. Therefor the handheld device is interacting with the pump used for pressurization.

In a preferred method the method comprises the steps of :

- 10
- using the handheld device to read out an individual identification of the coupling connection fixed on the coupling connection and
 - the handheld device provides the predetermined pressure value
 - the handheld device controls the pressurization of the hydraulic chamber and preferable displays the progress of pressurization.

15

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the present preferred embodiments together with the accompanying drawings.

20

Fig. 1: System comprising a coupling connection during the pressurization process;

Fig. 2: handheld device connected to the memory device

Fig. 3: coupling connection comprising an inner sleeve and an outer sleeve

25

In figure 1 a system 1 comprising a coupling connection 3 is disclosed. The coupling connection 3 connects an input shaft 15 with an output shaft 17. The input shaft 15 is connected with an inner sleeve 5, shown in figure 3. The output shaft 17 is connected to an outer sleeve 7, also shown in figure 3. In figure 3 the output shaft 17 is connectable to the outer sleeve 7 by a flange 8. The coupling connection 3 comprises a memory device 21. The memory device 21 is connected to or comprises an interface 27. In the embodiment of figure 1 the memory device 21 is connected by wire with the interface 27. A control device 31 in form of handheld device 33 is

30

- 8 -

connectable to the interface 27. In this case the control device 31 is connected to the interface 27 by wire 28. The control device 31 is a handheld device 33. The handheld device 33 comprises a display 35. Further the handheld device 33 is connected to a pump 19 by a wireless connection 29. The pump 19 is hydraulically connected by a pump line 12 with the hydraulic chamber 9 of the coupling connection 3. The pump 19 can be controlled by the handheld device 33. Further the coupling connection comprises a valve 13 or a screw plug for closing an opening of the hydraulic chamber 9.

The coupling connection 3 establishes a connection between the input shaft 15 and the output shaft 17 by frictional engagement. The frictional engagement is realized by pressurization of a hydraulic chamber 9 of the coupling connection 3. For pressurization of the hydraulic chamber 9 the pump 19 is connected to the hydraulic chamber 9. The handheld device is connected to the memory device of the coupling connection 3. The handheld device 33 reads out the predetermined pressure value stored in the memory device 21. The memory device 33 establishes a wireless connection to the pump. The pressurization of the hydraulic chamber is controlled by the handheld device 33. A pressure sensor 36, 38 detects the pressure in the hydraulic chamber 9. The pressure sensor 38 can be part of the pump. The measurements of the pressure sensor 38 are transferred to the handheld device 33. The handheld device 33 controls a pressurization of the hydraulic chamber 9 up to the predetermined pressure value. After pressurization the hydraulic chamber 9 is closed by a valve 13 or a screw plug. The pump 19 can be disconnected from the coupling connection 3. The pressure value of the pressurization is transferred to the memory device 21 and stored in the memory device 21. Especially in the case of a damage of the coupling connection 3 it is possible to read out the value of the last pressurization. If also information of the applied torque and the transferred torque is available, it is possible to determinate at which torque values the damage occurs. Further it is possible to read out the value of the last pressurization for analyzation.

Figure 2 discloses a handheld device 33 in more detail. The handheld device 33 comprises a display 35. The display comprises a pressure display panel 43 for

- 9 -

displaying the pressure ranges of low pressure 55, predetermined pressure range 57 and overload pressure range 59. The actual pressure information is indicated by a line 41. The display comprises a pressure history panel 45, a predetermined pressure value panel 47 and a pump pressure panel 49. Further an ID of the coupling connection 3 is displayed in a coupling connection ID panel 51. Further there is a field for process selection 53. There the user can choose different options, for example, display of the pressurization history, service history, and event history or pressurization of the coupling connection 3. In the case of a safety coupling as the coupling connection 3 the event history comprises events of slipping or disengagement. The handheld device comprises an communication interface 37. The handheld device 33 is connected to a memory device 21 by a wireless connection 29. The memory device 21 comprises a ROM 23 and a RAM 25.

Figure 3 discloses a coupling connection 3 detailed. The coupling connection 3 comprises an inner sleeve 5 and an outer sleeve 7. The outer sleeve 7 comprises a hydraulic chamber 9. The hydraulic chamber 9 is closed by plug screw 14. The outer sleeve 7 comprises a flange 8 for connection to the output shaft 17. Torque sensors 39 are arranged for determining torque transferred by the coupling connection 3. A pressure sensor 36 is integrated into the outer sleeve 7 for pressure measurements. The memory device 21 is arranged at the outer surface of the outer sleeve 7.

The terms and expressions employed herein are used as terms of the description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

Reference list

- 1 system
- 3 coupling connection
- 5 inner sleeve
- 5 7 outer sleeve
- 8 flange
- 9 hydraulic chamber
- 12 pump line
- 13 valve
- 10 14 plug screw
- 15 input shaft
- 17 output shaft
- 19 pump
- 21 memory device
- 15 23 ROM
- 25 RAM
- 27 interface
- 29 wireless connection
- 31 control device
- 20 33 handheld device
- 35 display device, display
- 37 communication interface of handheld device
- 36 pressure sensor (coupling device)
- 38 pressure sensor (pump)
- 25 39 torque sensor
- 41 pressure information
- 43 pressure display panel
- 45 pressure history panel
- 47 predetermined pressure value panel
- 30 49 pump pressure panel
- 51 coupling connection ID panel
- 53 field for process selection

Claims

1. Coupling connection (3) with a hydraulic chamber (9), a fluid inlet (13)
5 connectable to a pump (19) for pressurization of the hydraulic chamber (9), characterized in that,
the coupling connection (3) comprises a memory device (21).
2. Coupling connection (3) of claim 1, wherein for providing a connection
10 between an input shaft (15) and an output shaft (17) the hydraulic chamber (9) is pressurized with a predetermined pressure,
characterized in that,
the hydraulic chamber (9) is pressurized with a predetermined pressure
and wherein the memory device contains information about the
15 predetermined pressure .
3. Coupling connection (3) of claim 1,
characterized in that
the memory device (21) comprises a ROM (23) wherein the
20 predetermined pressure information is stored and a RAM (25) wherein
measured pressure values are stored.
4. Coupling connection (3) of one of the previous claims,
characterized in that
25 the memory device (21) is integrated into the coupling connection (3),
especially is integrated into an outer sleeve (7) of the coupling
connection (3), or is permanently fixed to the coupling connection (3).
5. Coupling connection (3) of one of the previous claims,
30 characterized in that
the memory device (21) comprises an interface (27) for establishing a
connection to the handheld device (33).

- 12 -

6. Coupling connection (3) of claim 5,
characterized in that
the coupling connection (3) comprises a torque measurement sensor
(39) for generating measurements of the torque transferred by the
coupling connection (3) and a pressure sensor (38) for providing
pressure values of the pressure in the hydraulic chamber (9).

7. System (1) for pressurization of a coupling connection of one of the
previous claims, wherein a pump (19) is connectable to the coupling
connection,
characterized in that
a control device (31), preferable a handheld device (33), is connectable
to the memory device (21).

8. System (1) of one of the previous claims,
characterized in that
the control device (31) is connectable to the pump (19).

9. System (1) of one of the claims 7 or 8,
characterized in that
the control device (31) comprises a display for displaying information
stored in the memory device (21).

10. System (1) of one of the claims 7 to 9,
characterized in that
the control device (31) is connectable to the memory device (21) and
/or pump (19) wireless.

11. System (1) of one of the claims 1 to 6,
wherein a control device (31) is an integrated part of the pump (19).

- 13 -

12. Method for establishing a connection of an inner sleeve (5) with an outer sleeve (7) of a coupling connection (3) of one of the previous claims, wherein the coupling is established by pressurization of the hydraulic chamber (9) providing a friction force between the inner sleeve (5) and the outer sleeve (7), comprising the steps of:

- reading out a predetermined pressure value from a memory device (21) of the coupling connection (3)
- displaying the information of the predetermined pressure value and the transferred pressure information on a display
- pressurization of the hydraulic chamber (9) by a pump (19).

13. Method of claim 12,

wherein after finalization of the pressurization final pressure value is transferred and stored in the memory device (21).

14. Method of claim 12 or 13,

wherein the predetermined pressure value is transferred to a handheld device (33) and the data of pressurization are transferred to the handheld device (33) and both information are displayed by the handheld device.

15. Method of one of the claims 12 to 14 characterized by the steps of:

- using the handheld (33) device to read out an individual identification of the coupling connection (3) fixed on the coupling connection (3) and
- the handheld device (33) provides the predetermined pressure value
the handheld device (33) controls the pressurization of the hydraulic chamber (9) and preferable displays the progress of pressurization.

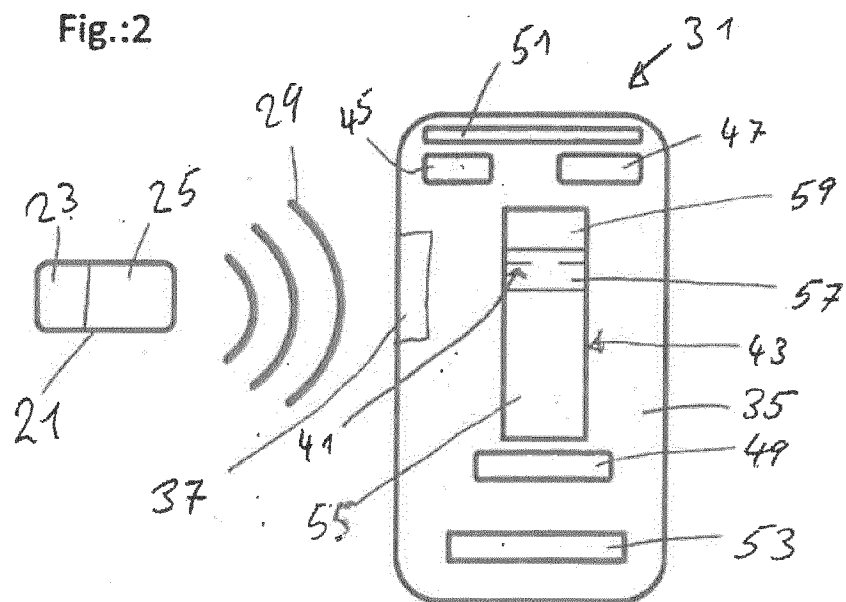
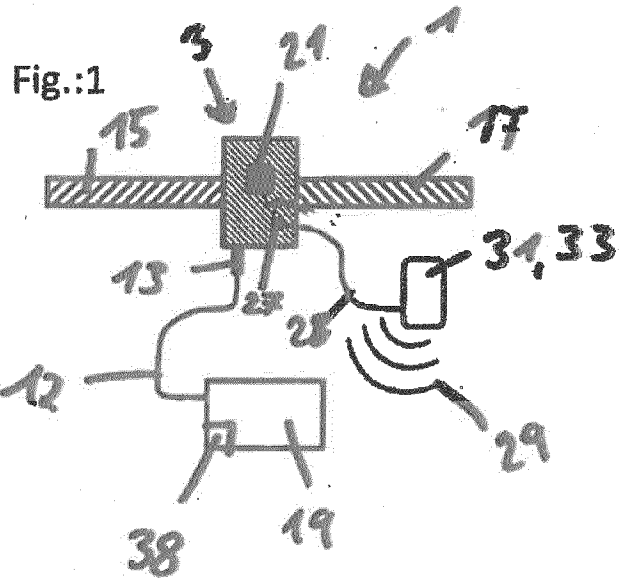
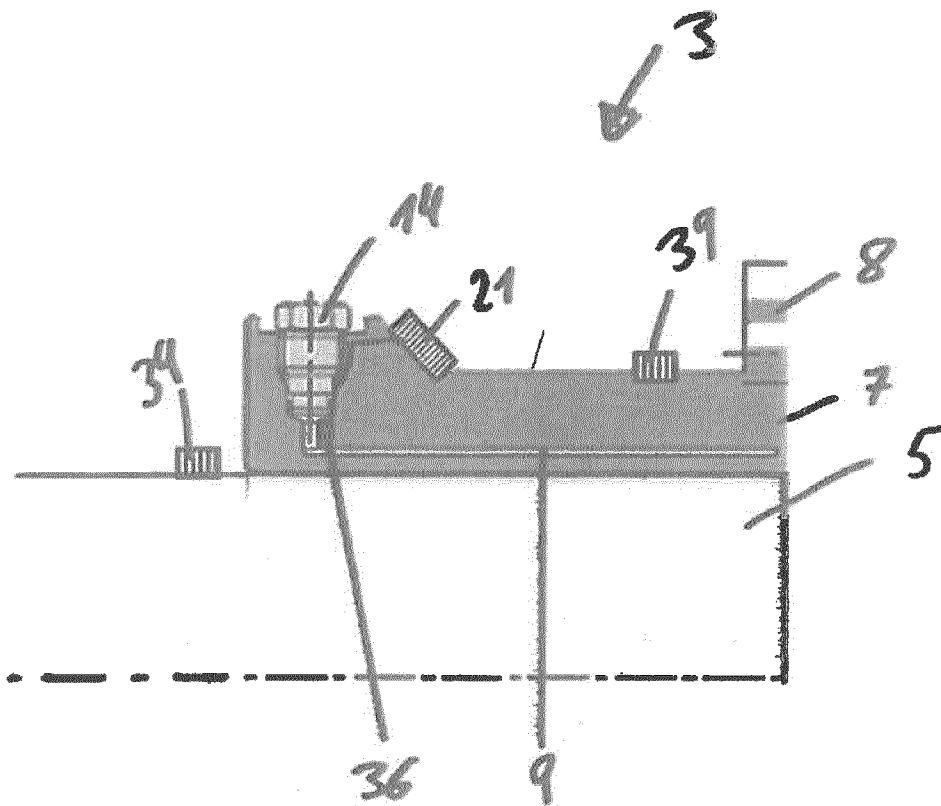


Fig.:3



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/052216

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16D1/08
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)
F16D

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 98/15751 A1 (VOITH TURBO KG [DE]; LINDENTHAL HANS [DE]) 16 April 1998 (1998-04-16) page 15, line 11 - line 18 -----	1-4,7,8, 12-15
Y	FR 2 341 778 A1 (FOERENADE FABRIKSVERKEN [SE]) 16 September 1977 (1977-09-16) figures 3,4 -----	1-5,7-9, 12-15
Y	US 5 839 883 A (SCHMIDT LAWRENCE P [US] ET AL) 24 November 1998 (1998-11-24) figures 1-5 -----	1-5,7-9, 12-15



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

13 April 2017

Date of mailing of the international search report

26/04/2017

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

García y Garmendia

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/052216

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9815751	A1	16-04-1998	EP 0929753 A1 21-07-1999 US 6170627 B1 09-01-2001 WO 9815751 A1 16-04-1998
FR 2341778	A1	16-09-1977	BR 7700996 A 06-12-1977 CA 1049278 A 27-02-1979 CH 606853 A5 15-11-1978 DE 2707530 A1 25-08-1977 DE 7705310 U1 07-06-1979 ES 456151 A1 16-01-1978 FI 770328 A 24-08-1977 FR 2341778 A1 16-09-1977 GB 1546699 A 31-05-1979 IT 1064344 B 18-02-1985 JP S6240567 B2 28-08-1987 JP S52102956 A 29-08-1977 NL 7701906 A 25-08-1977 NO 770565 A 24-08-1977 SE 422232 B 22-02-1982
US 5839883	A	24-11-1998	CA 2202961 A1 22-11-1997 US 5839883 A 24-11-1998