(19) DANMARK

(10) DK/EP 3574248 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *F 16 L 37/23 (2006.01)* *F 16 L 37/34 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2022-06-07**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2022-04-27**

(86) Europæisk ansøgning nr.: **18704454.0**

(86) Europæisk indleveringsdag: **2018-01-26**

(87) Den europæiske ansøgnings publiceringsdag: **2019-12-04**

(86) International ansøgning nr.: **EP2018052000**

(87) Internationalt publikationsnr.: **WO2018138286**

(30) Prioritet: **2017-01-27 IN 201711003111**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Danfoss Power Solutions II, Zone Industrielle Reyrieux , Route Départementale 28, 01600 Trevoux, Frankrig**

(72) Opfinder: **LAFOND, Sebastien, 84 chemin du Bert de l'Etraz, 74420 Habere Lullin, Frankrig**
LAD, Pritam Sudhakar, Shankrahi Park, Wing-C Room No. 103 Shivaji Road, New Sangvi, Pune 411027, Indien

(74) Fuldmægtig i Danmark: **Patrade A/S, Ceresbyen 75, 6., 8000 Århus C, Danmark**

(54) Benævnelse: **FLAT-FACE HYDRAULISK HUNKOBLING**

(56) Fremdragne publikationer:
WO-A1-2014/161616
WO-A1-2016/037890
CN-Y- 201 428 887
DE-A1- 10 351 997
US-A- 4 124 228
US-A- 5 179 976
US-A1- 2002 174 904
US-A1- 2013 206 261
US-A1- 2015 377 402
US-A1- 2016 369 923

DESCRIPTION

[0001] The invention relates to a flat face female hydraulic coupling comprising:

- a body with a continuous passage extending in axial direction;
- a valve stem coaxially arranged in the continuous passage of the body;
- a valve guide coaxially arranged in the continuous passage of the body, wherein the valve guide is sealed against the surface of the continuous passage and wherein the valve guide comprises a central passage;
- a valve sleeve arranged slidingly in axial direction between a first and a second position relative to the valve guide, wherein the valve sleeve is guided by the valve guide and wherein the valve sleeve is sealed to the valve guide in both first and second position and is sealed to the valve stem in the first position and a passage is provided between the valve stem and the valve sleeve in the second position;

wherein in the first position of the valve sleeve a fluid chamber is formed by the central passage, the inner surface of the valve sleeve and the valve stem.

[0002] Such a flat face female hydraulic coupling is known from US 2002 0174904. In this prior art coupling the valve sleeve is composed out of two sleeve parts, which both need to be slid to the second position to open the coupling and allowing for fluid to flow through the coupling.

[0003] The valve sleeve has, when seen in a first axial direction, a first frontal axial surface which is in contact with fluid in the coupling. When seen in the opposite second axial direction, the valve sleeve has a second frontal axial surface. Clearly, the size of the first frontal axial surface differs from the size of the second frontal axial surface.

[0004] When the female coupling is closed and a pressure is present in the fluid chamber formed by the central passage, the inner surface of the valve sleeve and the valve stem, the difference between the sizes of the first and second frontal axial surface cause a force onto the valve sleeve, which force needs to be overcome when a flat face male hydraulic coupling is inserted into the female coupling. Generally this force prevents manual coupling of a flat face male hydraulic coupling with a female hydraulic coupling. With the couplings according to the prior art, the hydraulic system needs to be shutdown and to be depressurized before the coupling can be made manually.

[0005] Similar flat face female hydraulic coupling are known from US2013206261 A1, WO2014161906 A1, WO2014161616 A1, DE10351997 A1, CN201428887Y, US2015377402 A1, US2016369923 A1, US5179976 A and WO2016037890 A1.

[0006] Accordingly it is an object of the invention to reduce or even remove the above mentioned disadvantages.

[0007] This object is achieved with a flat face female hydraulic coupling according to the

preamble, which flat face female hydraulic coupling is characterized in that the part of the inner surface of the valve sleeve bordering the fluid chamber has a surface integrated normal vector perpendicular to the axial direction or equal to zero.

[0008] According to the invention, in basis, the frontal axial surface in both opposite axial directions is made equal to cancel the resulting force due to a difference in size of both frontal axial surfaces. By ensuring that the surface integrated normal vector is perpendicular to the axial direction or is equal to zero, it is ensured that the frontal axial surface in both opposite directions is equal and the resulting force in axial direction, therefore is cancelled.

[0009] With the resulting force in axial direction on the valve sleeve being canceled, the flat face female hydraulic coupling can be coupled without effort and therefore manually with a flat face male hydraulic coupling. By having the integrated normal vector perpendicular to the axial direction or equal to zero, the valve sleeve can be slid from the first to the second position, independent of the height of the hydraulic pressure in the fluid chamber.

[0010] In an embodiment of the flat face female hydraulic coupling according to the invention a radially extending flange is arranged to the outer surface of the valve sleeve and spring means are arranged between the radially extending flange and the valve guide to urge the valve sleeve in the first position.

[0011] These spring means ensure that when the flat face female hydraulic coupling is decoupled from a male coupling, the valve sleeve is urged to the first position closing fluid passage in the female coupling.

[0012] In a preferred embodiment of the flat face female hydraulic coupling according to the invention the valve sleeve has a cylindrical inner surface and the inner surface of the valve sleeve is sealed to the valve stem in the first position and the inner surface of the valve sleeve is sealed to the valve guide.

[0013] Using a cylindrical inner surface and sealing both the valve stem and the valve guide to said cylindrical inner surface ensures that the inner surface of the valve sleeve bordering the fluid chamber does not have any axial surface components, which could generate in combination with a fluid pressure in the fluid chamber an axial force .

[0014] In another preferred embodiment of the flat face female hydraulic coupling according to the invention the inner surface of the valve sleeve is stepped with a first diameter and a second diameter, wherein the inner surface with the first diameter is sealed to the valve stem, wherein the outer surface of the valve sleeve is sealed to the valve guide, the outer surface having a diameter equal to the first diameter and wherein the first diameter is larger than the second diameter.

[0015] In this embodiment the valve guide is sealed to the outer surface of the valve sleeve. By ensuring that the diameter of this outer part is equal to the first diameter of the inner surface,

the part of the valve sleeve surface bordering the fluid chamber will have a first frontal axial surface, when seen in a first direction, being equal to a second frontal axial surface when seen in the opposite direction. This ensures that no resulting axial forces are present on the valve sleeve when a hydraulic pressure is present in the fluid chamber.

[0016] Yet another embodiment of the flat face female hydraulic coupling according to the invention, further comprises a locking sleeve slidingly arranged between the body and the valve sleeve, at least one radial channel arranged in the body, at least one locking ball arranged in the at least one radial channel and a locking ring slidingly arranged on the outside of the body over the at least one radial channel.

[0017] When a male coupling is inserted into the female coupling according to the invention, the locking sleeve is pushed inward releasing the at least one locking ball, which can engage into an outer groove on the male coupling. The locking ring will maintain the locking ball in this locking position until the locking ring is shifted and the locking ball is allowed to move back to its original position.

[0018] Preferably, the flat face female hydraulic coupling according to the invention further comprises second spring means arranged between the locking sleeve and the valve guide to urge the locking sleeve to a position covering the at least one radial channel.

[0019] These and other features of the invention will be elucidated in conjunction with the accompanying drawings.

Figure 1 shows a cross-sectional view of a first embodiment of the flat face female hydraulic coupling according to the invention.

Figure 2 shows a cross-sectional view of a second embodiment of the flat face female hydraulic coupling according to the invention.

Figure 3 shows a cross-sectional view of the female coupling according to figure 2 coupled to a flat face male hydraulic coupling.

Figure 1 shows a cross-sectional view of a first embodiment of the flat face female hydraulic coupling 1. This coupling 1 has a body 2 with a continuous passage 3 extending in axial direction 4.

[0020] A valve guide 5 is arranged on and sealed to the surface of the continuous passage 3. The valve guide 5 has a central passage 13. A valve stem 6 is furthermore coaxially arranged in the continuous passage 3.

[0021] A valve sleeve 7 is arranged slidingly in axial direction. This valve sleeve 7 is sealed on one end with the inner surface by a seal 8 to the valve stem 6 and with the other end with the outer surface by a seal 9 to the valve guide 5.

[0022] The valve sleeve 7 has a stepped inner surface with a first diameter d_1 and a second diameter d_2. The diameter d_3 of the outer surface of the valve sleeve 7 is equal to the first diameter d_1. The diameter d_2 is smaller than d_1, such that in one axial direction a frontal axial surface 10 and in the opposite direction a frontal axial surface 11 is formed.

[0023] The respective forces F1 and F2 which are generated by a hydraulic pressure in the fluid chamber 12 formed by the central passage 13, the inner surface of the valve sleeve 7 and the valve stem 6, are with respect to their axial component canceling each other out. This allows for the valve sleeve 7 to be moved from the shown first position towards a position in which a passage is created between the valve sleeve 7 and the valve stem 6. Spring means 14 will urge the valve sleeve 7 towards the first position.

[0024] The body 2 has a radially extending channel 15 in which a locking ball 16 is arranged. On the inside the locking ball 16 is kept in position by a locking sleeve 17, which is urged by a spring 18. On the outside a slidable locking ring 19 is provided which has a cavity 20 in which the locking ball 16 is partially accommodated.

[0025] Figure 2 shows a cross-sectional view of a second embodiment 30 of the flat face female hydraulic coupling according to the invention. This embodiment 30 partially corresponds to the embodiment 1 according to figure 1 and as a result similar components are designated with the same reference signs.

[0026] The valve sleeve 31 is differently shaped and has a cylindrical inner surface 32. The inner surface 32 of the valve sleeve 31 seals with the seal 8 onto the valve stem 6 on one end and seals also on the inner surface 32 with a seal 33 onto the outside surface of the valve guide 5. The valve sleeve 31 is urged to the closed position by a spring 34.

[0027] Because the inner surface 32 of the valve sleeve 31 bordering the fluid chamber Z 12 is fully cylindrical, no axial surface is present and so no axial force can be generated to counteract the sliding movement of the valve sleeve 31.

[0028] Figure 3 shows a cross-sectional view of the female coupling 31 according to figure 2 coupled to a flat face male hydraulic coupling 40. The male coupling 40 has at least a body 41 with a continuous passage 42 and a valve body 43 axially movable in the continuous passage.

[0029] When the body 41 of the coupling 40 is inserted into the female coupling 30, the body 41 will slide the locking sleeve 17 and then the valve sleeve 31 towards the position shown in figure 3. At the same time the valve stem 6 will slide the valve body 43 into the male coupling 40. As a result a continuous flow path for fluid F will be created between both couplings 30, 40.

[0030] By sliding back the locking sleeve 17, the locking ball is free to move into a circumferential groove in the body 41 of the male coupling 40. At that moment, the locking ring 19 can slide such that the cavity 20 is no longer positioned above the channel with the locking

ball 16 causing the locking ball 16 to be locked into the groove of the male coupling 40 and accordingly locking the female coupling 30 and the male coupling 40 together.

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US20020174904A **[0002]**
- US2013206261A1 **[0005]**
- WO2014161906A1 **[0005]**
- WO2014161616A1 **[0005]**
- DE10351997A1 **[0005]**
- CN201428887Y **[0005]**
- US2015377402A1 **[0005]**
- US2016369923A1 **[0005]**
- US5179976A **[0005]**
- WO2016037890A1 **[0005]**

Patentkrav

1. Flat-face hydraulisk hunkobling (1), omfattende:

- et legeme (2) med en kontinuerlig passage (3), der strækker sig i aksial retning (4);
- en ventilspindel (6), der er koaksialt anbragt i den kontinuerlige passage (3) af legemet (2);
- et ventilstyr (5) koaksialt anbragt i den kontinuerlige passage (3) af legemet (2), hvor ventilstyret (5) er tætnet mod overfladen af den kontinuerlige passage (3), og hvori ventilstyret (5) omfatter en central passage (13);
- en ventilbøsning (7) anbragt glidende i aksial retning mellem en første og en anden position i forhold til ventilstyret (5), hvor ventilbøsningen (7) styres af ventilstyret (5), og hvor ventilbøsningen (7) er tætnet til ventilstyret (5) i både første og anden position og er tætnet til ventilspindelen (6) i den første position, og der er tilvejebragt en passage mellem ventilspindelen (6) og ventilbøsningen (7) i den anden position;

hvori der i første position af ventilbøsningen (7) bliver dannet et væskekammer af den centrale passage (13), den indvendige overflade af ventilbøsningen (7) og ventilspindelen (6);

kendetegnet ved, at den del af den indvendige overflade af ventilbøsningen (7), der grænser op til væskekammeret, har en overfladeintegreret normalvektor vinkelret på den aksiale retning eller lig med nul.

2. Flat-face hydraulisk hunkobling (1) ifølge krav 1, hvor en radialt udstrakt flange er anbragt til den ydre overflade af ventilbøsningen (7), og hvori der er anbragt fjedermidler mellem den radialt udstrakte flange og ventilstyret (5) for at presse ventilbøsningen (7) i den første position.

3. Flat-face hydraulisk hunkobling (1) ifølge krav 1 eller 2, hvor ventilbøsningen (7) har en cylindrisk indvendig overflade, og hvor den indvendige overflade af ventilbøsningen (7) er tætnet til ventilspindelen (6) i den første position, og hvor den indvendige overflade af ventilbøsningen (7) er tætnet til ventilstyret (5).

4. Flat-face hydraulisk hunkobling (1) ifølge krav 1 eller 2, hvor den indvendige overflade af ventilbøsningen (7) er trindelt med en første diameter (di) og en anden diameter (d_2), hvor den indvendige overflade med den første diameter (d_1) er

tætnet til ventilspindelen (6), hvor den ydre overflade af ventilbøsningen (7) er tætnet til ventilstyret (5), den ydre overflade har en diameter (d_3) lig med den første diameter (di), og hvor den første diameter (di) er større end den anden diameter (d_2).

5. Flat-face hydraulisk hunkobling (1) ifølge et hvilket som helst af de foregående krav, yderligere omfattende en låsebøsning (17), der er glidende anbragt mellem legemet (2) og ventilbøsningen (7), mindst en radial kanal (15) anbragt i legemet (2), mindst en kuglelås (16) anbragt i mindst den ene radiale kanal (15) og en låsering (19) glidende anbragt på ydersiden af legemet (2) over mindst en radial kanal (15).

6. Flat-face hydraulisk hunkobling (1) ifølge krav 5, yderligere omfattende et andet fjedermiddel, anbragt mellem låsebøsningen (17) og ventilstyret (5) for at presse låsebøsningen (17) til en stilling, der dækker mindst en radial kanal (15).

DRAWINGS

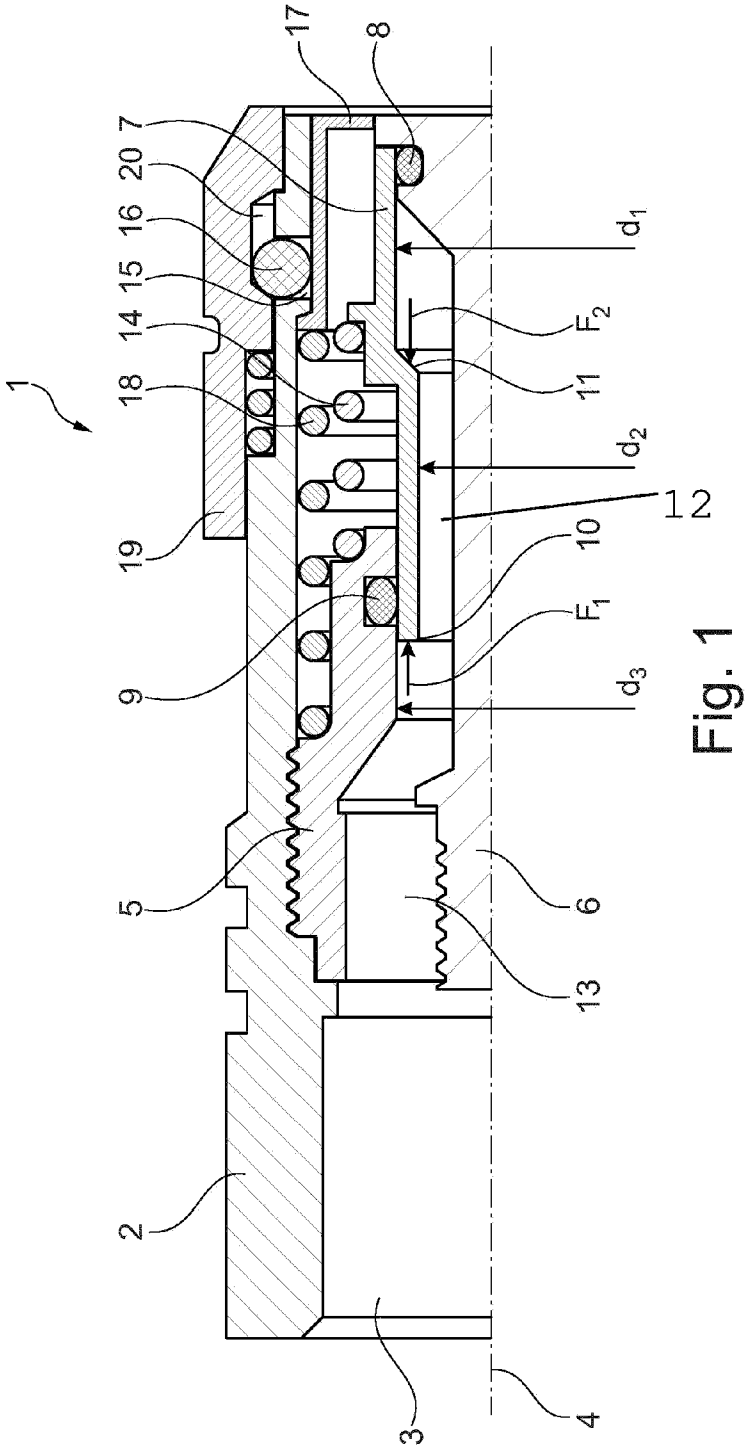

Fig. 1

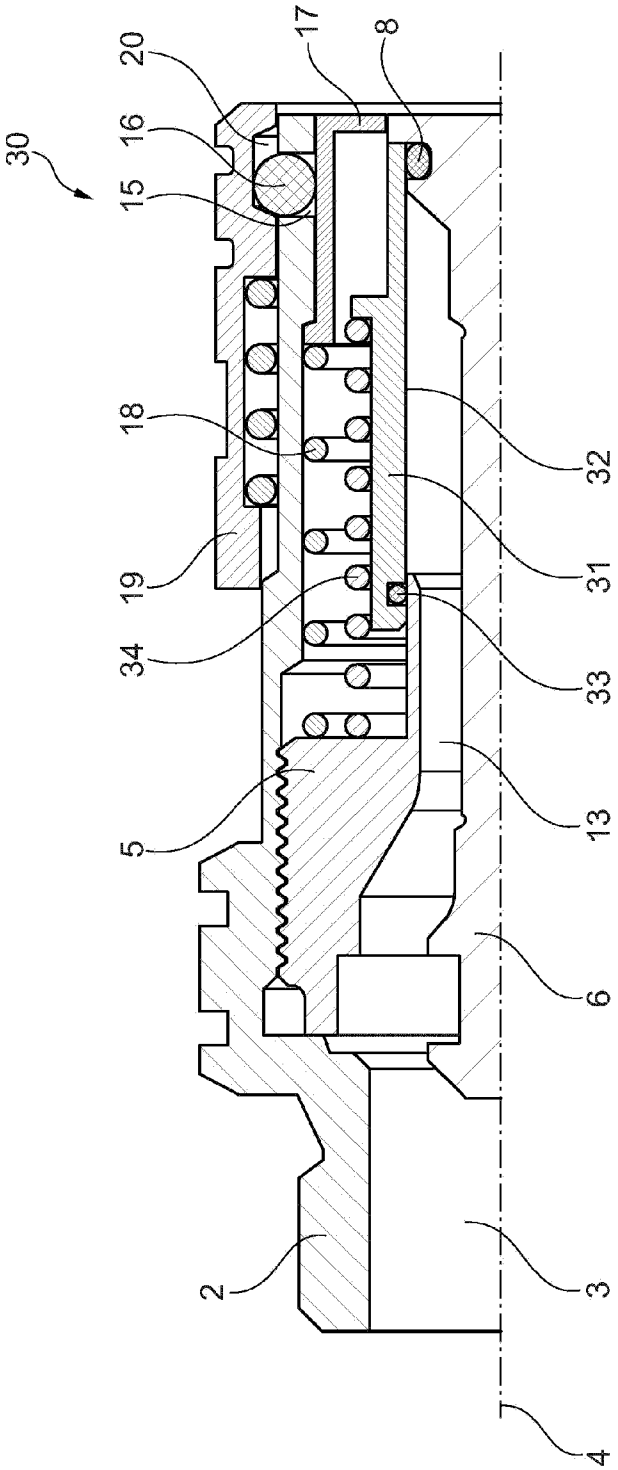

Fig. 2

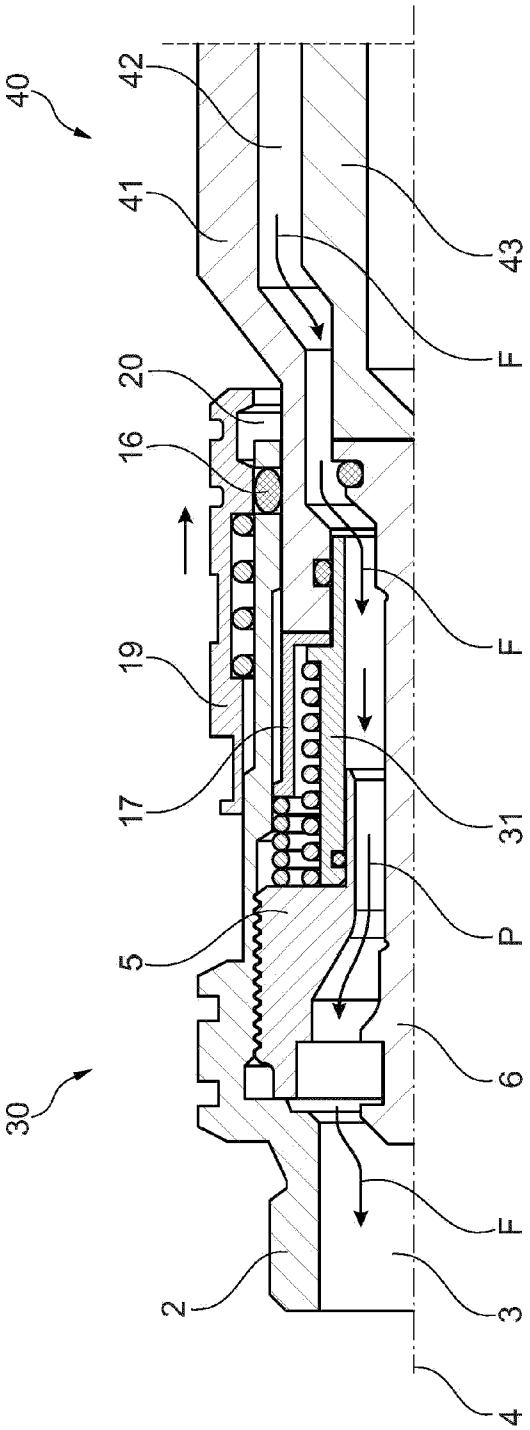

Fig. 3