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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 July 2022 (21.07.2022)

WIPO | PCT

(10) International Publication Number
WO 2022/152811 A1

(51) International Patent Classification:
F16J 15/12 (2006.01) *F16L 23/18* (2006.01)
F16J 15/10 (2006.01) *F16L 23/22* (2006.01)
F16J 15/02 (2006.01)

(21) International Application Number:
PCT/EP2022/050679

(22) International Filing Date:
13 January 2022 (13.01.2022)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
21151873.3 15 January 2021 (15.01.2021) EP

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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, IT, 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, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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: IMPROVED COMPRESSION SEALING GASKET AND SEALING SYSTEM

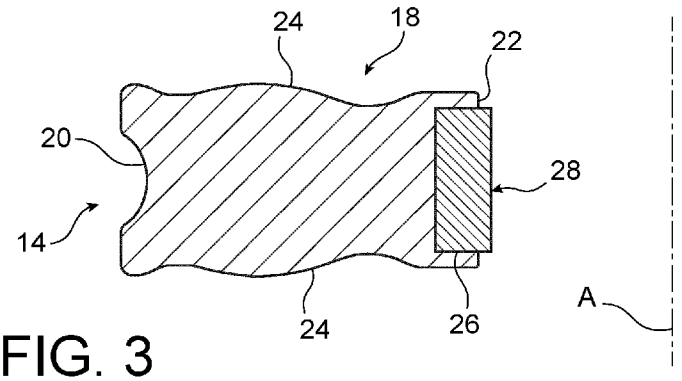


FIG. 3

(57) **Abstract:** The invention concerns a compression sealing gasket (14) comprising an annular main body (18) made of an elastomer material and having a main axis A, the main body (18) comprising an annular radially outer face (20) and an annular radially inner face (22) parallel and coaxial to each other, wherein the gasket comprises an insert (28) mounted on the inner face (22). The invention also concerns a sealing system comprising the sealing gasket (14).

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IMPROVED COMPRESSION SEALING GASKET AND SEALING SYSTEM

TECHNICAL FIELD

The invention concerns a compression sealing gasket designed to reduce its permeability to gas.

The sealing gasket is intended to be implemented on gas insulated apparatuses, at the connection between two parts.

PRIOR ART

Some high voltage apparatuses comprise hollow components in which conductors are arranged.

An insulating gas fills these components, to isolate the conductors carrying current at a high voltage from the hollow components which are at ground potential.

The insulating gas is also able to withstand the dielectric field in short distances between conductors arranged in the component.

The connection between two components comprises a tubular part from each component and a sealing gasket placed between the tubular parts.

According to a known embodiment, the sealing gasket is made of an elastomer and is compressed between the two tubular parts.

The compression of the tubular parts produces an elastic deformation of the gasket, improving the tightness of the connection.

However, the gasket is generally made of an elastomer that shows a permeability to the insulating gas.

The object of the invention is to provide a sealing gasket having a significantly lower permeability, in order to reduce the leakage rate for a complete apparatus.

The aim is to reach for the overall arrangement a leakage rate in the range of than 0.5% vol/year as describes in the relevant IEC standards for switchgear, for example IEC 62271-203 for gas insulated switchgear.

This improvement is of particular interest since the industry moves towards insulating gasses, consisting of different mixtures and different gasses, that show other impact of leaks due to the different characteristics of those new molecules used compared to the prevailing SF6 gas that has been used for decades.

BRIEF DESCRIPTION OF THE INVENTION

The invention concerns a compression sealing gasket comprising an annular main body made of an elastomer material and having a main axis A, the main body comprising an annular radially inner face and an annular radially outer face parallel and coaxial to each other,

wherein the gasket comprises an insert mounted on the inner face.

The insertion of an insert in the main body reduces the section through which the gas can migrate. The insert may be made of any material that has a significant lower permeability than the main sealing material made of elastomer.

Also, the insert locally increases the axial compression of the elastomer main body.

As an alternative solution also a surface treatment on part of the gasket or covering the full gasket may be used to act as a barrier to decrease the permeability of the overall sealing system drastically.

Preferably, the inner face comprises a throat extending coaxially to main axis A and in which the insert is fitted.

Preferably, both the throat and the insert extend along the entire periphery of the inner face.

Preferably, the inner face comprises a plurality of throats each of the throats extending along a segment of the periphery of the inner face and receiving an associated insert.

Preferably, the axial height of the throat is at least 80 % of the axial dimension of the main body.

Preferably, the shape of a cross section of the insert through an axial plane is a rectangle.

Preferably, the shape of a cross section of the insert through an axial plane or is convex oriented radially towards or away from main axis A.

Preferably, the gasket further comprises a coating covering the outer face of main body and the insert.

Preferably, the axial dimension of the insert equals the axial dimension of the main body.

Preferably, the insert is made of a material having a lower gas permeability than the material of the main body.

Preferably, the insert is metallic, made of a thermoplastic material or an elastomer.

The invention also concerns a sealing system comprising two cylindrical components arranged coaxially to each other and to a main axis A, in which each of the components comprises an end face extending in a plane perpendicular to main axis A, that faces the assembling face of the other component and

wherein a compression sealing gasket according to any preceding claim is arranged and is compressed axially between the assembling faces of the cylindrical components.

Preferably, at least one of the assembling faces comprises an annular recess in which the compression sealing gasket is fitted.

Preferably, the insert is axially compressed by the assembling faces.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a schematic diagram of a high voltage apparatus comprising two components assembled together using a gasket according to the invention.

Figure 2A and 2B are details of the assembly of the components showing how the gasket is received between the two components.

Figure 3 is a diagram showing a first embodiment of the gasket.

Figure 4 shows diagrams representing various other embodiments of the insert in the gasket.

Figure 5 is a diagram of a variant embodiment of the casket comprising a layer of coating.

Figure 6 is a diagram of a variant embodiment of the casket comprising an insert extending axially over the whole length of the gasket.

DETAILED DESCRIPTION OF PARTICULAR EMBODIMENTS

FIG. 1 illustrates a portion of a high voltage apparatus comprising components 10 assembled one to the other. Here, each component 10 is represented as a cylindrical and tubular component.

It will be understood that the components may be of any other shape that comprises a tubular part as represented on the drawings.

In the following description, the tubular elements represented will be designated as the components 10.

The components 10 extend coaxial to a main axis A of the high voltage apparatus.

As can be seen in more details in figs 2A and 2B, each component 10 comprises an end face 12 which faces, and is connected, to the end face 12 of the other component 10.

A sealing system for connecting the components 10 comprises a compression sealing gasket 14 of annular general shape that is arranged axially between the end faces 12 of the two components 10.

The sealing system comprises tightening means 30, such as bolting means that press axially one component 10 towards the other.

The tightening means 30 also compress axially the sealing gasket 14 to provide a gastight connection between the two components 10.

According to a first embodiment represented on fig. 2A, the end face 12 of each component 10 comprises an annular recess 16 in which part of the sealing gasket 14 is received.

The axial depth of the recesses 16 is inferior to half of the axial height of the gasket 14 before the two components 10 are assembled. As a consequence, before the definitive assembling of the components 10, the gasket 14 protrudes axially from the end face 12 of each component 10.

According to another embodiment shown on fig. 2B, the gasket 14 is in contact with the end faces 12 of both

components 10 and maintains the end faces 12 distant one from the other.

The compression of the gasket 14 by the tightening means 30 produces an axial deformation of the gasket 14 and maintains an efficient pressure of the gasket 14 on the end faces 12 and against the walls and bottom of the recess 16.

The gasket 14 comprises a main body 18 made of an elastomer like, as a non-limiting example, the one known as "Butyl".

The permeability of this elastomer with respect to the gas intended to fill the components 10 results in a loss of gas during time.

As can be seen on figures 3 and 4, a section of the main body 18 of the gasket 14, along an axial plane containing main axis A, is of general rectangular shape.

The main body 18 of the gasket 14 then comprises an annular radially outer face 20, an annular radially inner face 22 and two planar annular end faces 24 that axially delimit the gasket 14 and connect the inner face 22 to the outer face 20.

According to a preferred embodiment, the faces 20, 22, 24 of the main body 18 are wave shaped to enhance the sealing. The faces 20, 22, 24 can have a different shape, or be rectilinear without going beyond the scope of the invention.

In order to reduce the permeability of the gasket 14, the inner face 22 comprises an annular throat 26 extending coaxially to main axis A and in which an insert 28 is arranged. The throat 26 is open radially towards main axis A.

According to a preferred embodiment, the insert 28 is designed to be impermeable to the gas. Accordingly, it reduces the overall permeability of the gasket 14.

As non-limiting examples, the insert 28 is made from various materials; it can be metallic, made of a thermoplastic material or another elastomer.

According to other embodiment, the insert 28 can be made of any material that has a lower permeability that the material of the gasket 14.

Also, in the vicinity of the insert 28, more particularly between the insert 28 and each end face 24, the main body 18 of the gasket 14 is more compressed than at other places, this also reduces the permeability of the gasket 14 to the gas.

According to a first embodiment, both the throat 26 and the insert 28 extend along the entire periphery of the inner face 22, that is to say they are both circular.

According to another embodiment, the inner face 22 comprises a plurality of throats 26 and inserts 28 distributed along the circumference of the inner face 22.

Each pair of throats 26 and inserts 28 extend along a ring sector of the circumference of the inner face 22, this ring sector being centered on main axis A.

The axial height of the insert 28 is inferior to the axial height of the main body 18 of the gasket 14, that is to say inferior to the axial distance between the end faces 24.

Preferably, the axial height of the insert 28 and of the associated throat 26 is at least of 80 % of the axial height of the main body 18 of the gasket 14.

The insert 28 can have various shapes.

Non limiting examples of the section of the insert 28 are represented on figures 3 and 4.

This section can be rectangular, in the shape of a U, a V or can be curved, with the opening of the section oriented radially towards or away from the main axis A.

It will be understood that the shapes of the section represented are only given as examples and the shape of the section can be different.

As represented on figure 5, in order to further reduce the permeability of the gasket 14, a coating 32 covers the radially inner face of the insert 28 and the inner face 22 of the main body 18.

The coating 32 functions as an additional barrier to the gas.

The coating 32 is preferably made by chemical vapor deposition or by atomic layer deposition.

As represented on figure 6, the gasket 14 comprises an insert 28 that extends axially over the entire axial dimension of the gasket 14.

This insert 28 is mounted on the inner face 22 of the main body 18 and covers it completely.

Here, the section of this insert is of rectangular shape and comprises axial end faces 34 that come in contact with the assembling faces 12 of the components 10.

Claims

1. A compression sealing gasket (14) comprising an annular main body (18) made of an elastomer material and having a main axis A, the main body (18) comprising an annular radially outer face (20) and an annular radially inner face (22) parallel and coaxial to each other,

wherein the gasket comprises an insert (28) mounted on the inner face (22)),

characterized in that the main body (18) comprises annular end faces (24) that are wave shaped.

2. A gasket (14) according to claim 1 wherein the inner face (22) comprises a throat (26) extending coaxially to main axis A and in which an insert (28) is fitted.

3. A gasket (14) according to claim 2, wherein both the throat (26) and the insert (28) extend along the entire periphery of the inner face (22).

4. A gasket (14) according to claim 2, wherein the inner face (22) comprises a plurality of throats (26) each of the throats (26) extending along a segment of the periphery of the inner face (22) and receiving an associated insert (28).

5. A gasket (14) according to claim 2, wherein the axial height of the throat (26) is at least 80% of the axial dimension of the main body (18).

6. A gasket (14) according to claim 2, wherein the shape of a cross section of the insert (28) through an axial plane is a rectangle.

7. A gasket (14) according to claim 2, wherein the shape of a cross section of the insert (28) through an axial plane or is convex oriented radially towards or away from main axis A.

8. A gasket (14) according to any preceding claim, further comprising a coating (32) covering the inner face (22) of main body (18) and the insert (28).

9. A gasket (14) according to claim 1, wherein the axial dimension of the insert (28) equals the axial dimension of the main body(18).

10. A gasket (14) according to any preceding claim, wherein the insert is made of a material having a lower gas permeability than the material of the main body (18).

11. A gasket (14) according to claim 10, wherein the insert (28) is metallic, made of a thermoplastic material or an elastomer.

12. A sealing system comprising two cylindrical components (10) arranged coaxially to each other and to a main axis A, in which each of the components (10) comprises an end face (12) extending in a plane perpendicular to main axis A, that faces the assembling face (12) of the other component (10) and

wherein a compression sealing gasket (14) according to any preceding claim is arranged and is compressed axially between the assembling faces (12) of the cylindrical components (10).

13. A sealing system according to claim 9, wherein at least one of the assembling faces (12) comprises an annular recess (16) in which the compression sealing gasket (14) is fitted.

14. A sealing system according to claim 12 or 13, in combination with claim 9, wherein the insert (28) is axially compressed by the assembling faces (12).

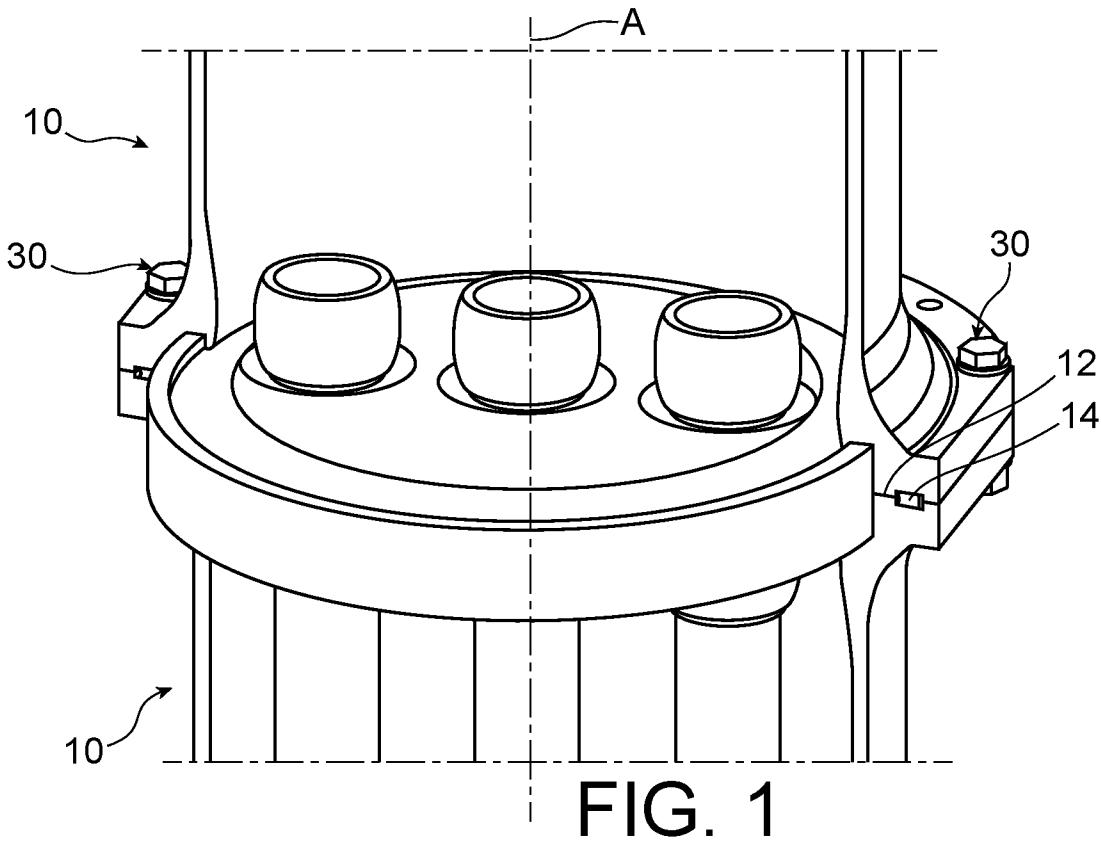


FIG. 1

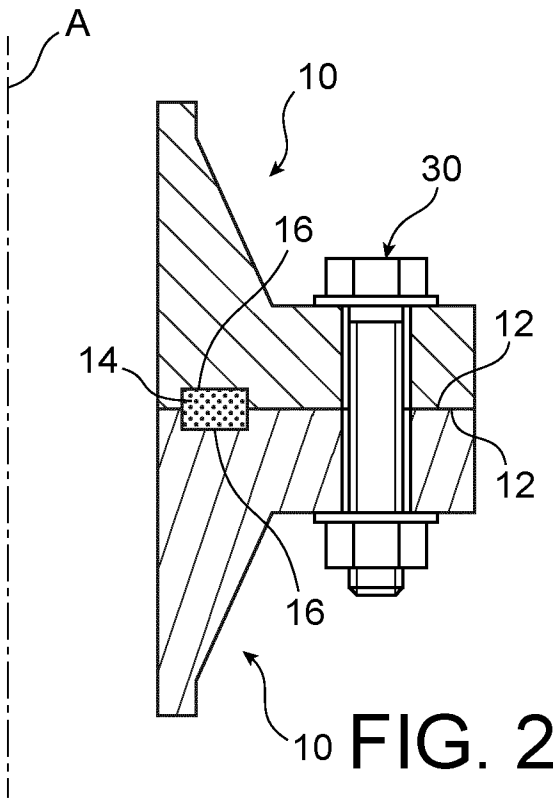


FIG. 2A

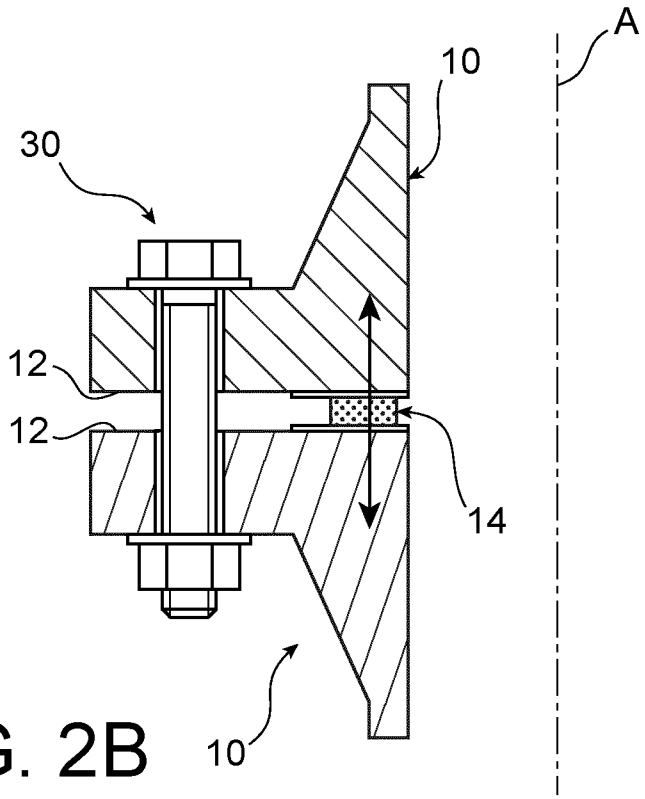


FIG. 2B

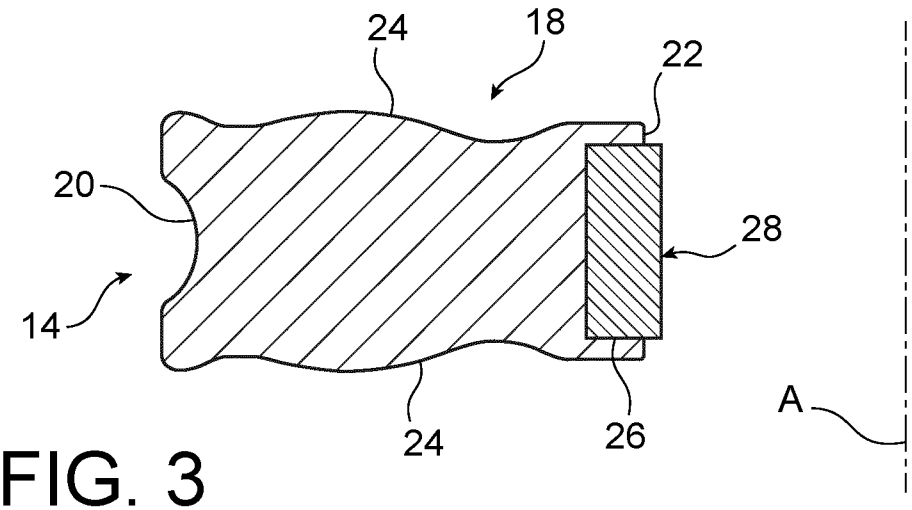


FIG. 3

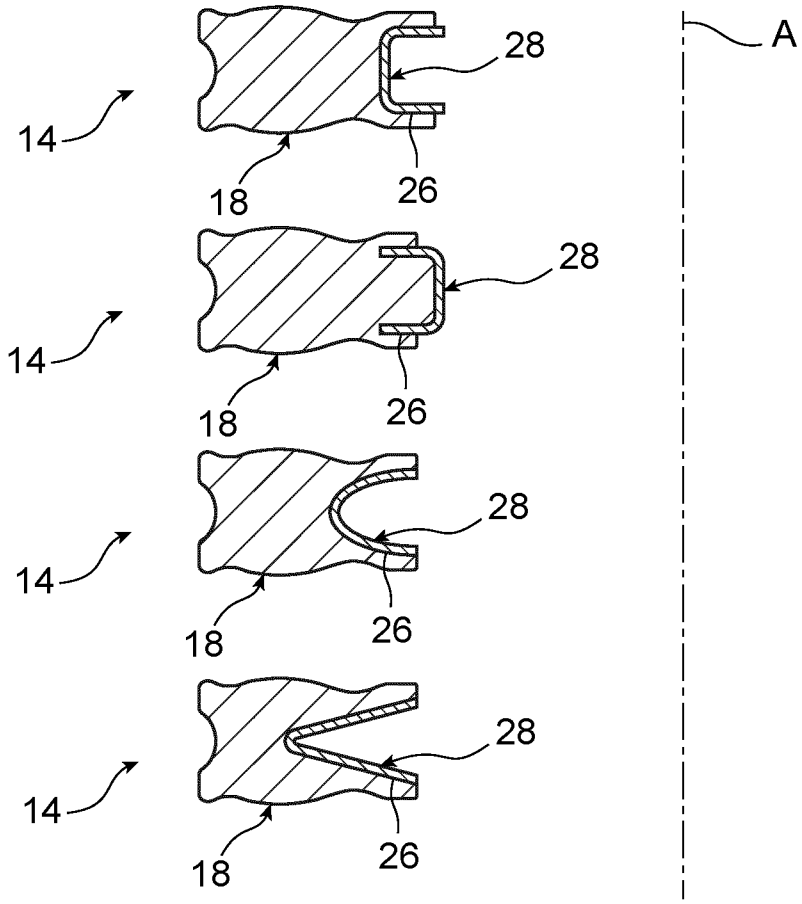


FIG. 4

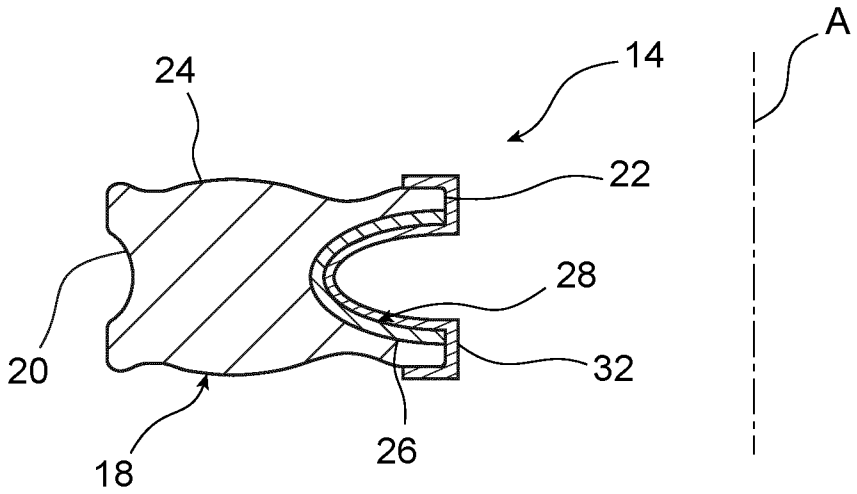


FIG. 5

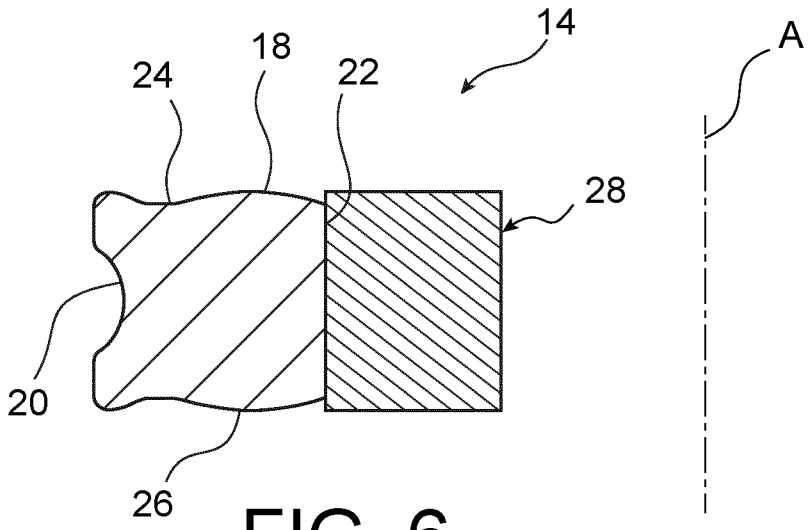


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/050679

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16J15/12 F16J15/10 F16J15/02 F16L23/18 F16L23/22
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)
F16J F16L

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.
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X A	EP 0 915 273 A2 (PENBERTHY INC [US]) 12 May 1999 (1999-05-12) paragraphs [0020], [0032], [0033], [0037]; figures 6, 7, 12, 14, 17	1-5,7, 10-12,14 6,8,9,13
X A	US 2010/019455 A1 (KENT JR EDWIN J [US] ET AL) 28 January 2010 (2010-01-28) paragraphs [0002], [0032], [0038], [0049], [0051] - [0053]; figures 2, 3, 5, 6, 7	1,8, 10-12 2-7,9, 13,14

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

[x] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
10 February 2022	18/02/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Regaud, Christian

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	column 3, lines 61-67; figures 1-3, 6	2-8,14
X	US 5 518 257 A (BREAKER JOHN V [US]) 21 May 1996 (1996-05-21)	1-5, 7-12,14
A	column 9, lines 16-18; figures 5, 9-10, 25	6,13

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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