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(54) Title: DEVICE FOR PROTECTING PARTS OF A SYSTEM OF A SPINNING ROTOR WITH A MAGNETIC BEARING

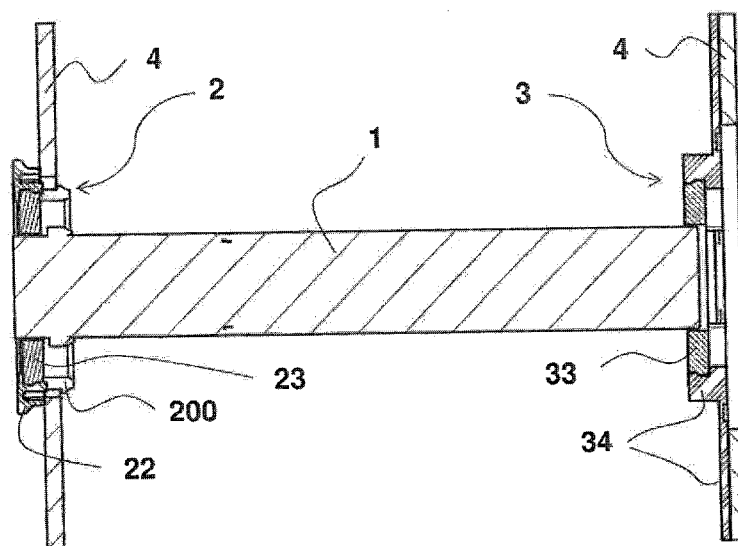


Fig. 2

(57) Abstract: The invention relates to a device for protecting parts of a system of a spinning rotor with a magnetic bearing by preventing contact between a shaft (1) of the spinning rotor and parts of the magnetic bearing or a drive mechanism in the event of loss of the shaft (1) levitation and/or in the event of excessive lateral deflection of the shaft (1) from the axis of the magnetic bearing. The device comprises at least; two safety rings (2, 3) mounted in holders (4) arranged in the front and rear parts of the shaft (1), through which the shaft (1) in the levitation state passes without contact with them. At least the front safety ring (2) is secured in the holder (4) detachably, for example by means of a bayonet connection or by means of a clip connection or a threaded coupling.



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Device for protecting parts of a system of a spinning rotor with a magnetic bearing

5

Technical field

The invention relates to a device for protecting parts of a system of a spinning rotor with a magnetic bearing by preventing contact between a shaft of the spinning rotor and parts of the magnetic bearing or a drive mechanism in the event of loss of the shaft levitation and/or in the event of excessive lateral deflection of the shaft from the axis of the magnetic bearing, comprising at least two safety rings mounted in holders arranged in the front and rear parts of the shaft, through which the shaft passes in the levitation state without contact with them.

15

Background art

For mounting working means which rotate very fast, such as spinning rotors of open-end spinning machines, there are special active magnetic bearings. In shaftless systems, a cup of a spinning rotor rotates in the magnetic field, while in shaft systems it is the shaft that rotates in the magnetic field, whereby at the end of the shaft a spinning rotor is mounted. The system controls the rotation and position of the rotating shaft of the rotor. In the event of a failure of the control system of the bearing, for example, when the shaft vibrates at a critical frequency or in the event of a power failure or at increased rotor unbalance, the magnetic bearing stops keeping the shaft in the axis of the system and it is necessary to make sure that the shaft does not come into contact with parts of the magnetic bearing or parts of the drive and does not damage those parts or itself. For this purpose, two safety rings are used through which the shaft passes in the front and rear parts. In some embodiments, the rear safety ring is provided with a bottom to withstand the axial forces when the shaft is moved backwards upon loss of levitation.

A magnetic bearing for mounting a shaft of a spinning rotor is disclosed, for example, in DE 100 22 736 A1 or DE 198 27 606 A1, in which are shown two annular-shaped safety rings which are pressed into holders in the front and rear parts of the shaft, whereby the shaft passes through the safety rings and, when deflected out of the working position, for example, in the event of vibration at a critical frequency, a failure or power cut, the safety rings withstand the forces from the rotating shaft until the shaft stops. This protects the magnetic bearing and its components from mechanical damage caused by the impact of the shaft and from subsequent damage caused by the friction and the rolling motion of the shaft rotating at more than 50,000 revolutions per minute, with operating speeds reaching as many as about 200,000 revolutions per minute. The magnetic bearing area is closed close from both sides by holders with safety rings. The disadvantage of these safety rings is the fact that they are fixedly mounted to the holder because the entire safety ring holder must be dismounted in case of need for any intervention on the inside of the magnetic bearing and when the safety ring is damaged or worn out, it is necessary to replace the entire safety ring holder. Moreover, the safety ring is rigid and, in the event of the shaft impact, it must withstand all the forces, and so in most cases the safety ring and/or its mounting in the holder is damaged and the safety ring must be replaced together with the respective holder.

When replacing the shaft, the front safety ring or when cleaning the workspace, the front safety ring located together with the holder immediately behind the rotor cup must be temporarily removed and after performing the particular operation, the front safety ring must be mounted again precisely coaxially with the system components.

The aim of the invention is to simplify and reduce the costs of the mounting and dismounting of the safety ring and the holder without having to re-center them to accommodate the shaft. In addition, it is the aim of the invention to maximize the service life of the safety ring.

Principle of the invention

The goal of the invention is achieved by a device for protecting parts of a system of a spinning rotor with a magnetic bearing by preventing contact

between a shaft of the spinning rotor and parts of the magnetic bearing or a drive mechanism in the event of loss of the shaft levitation and/or in the event of excessive lateral deflection of the shaft from the axis of the magnetic bearing, comprising at least two safety rings mounted in the holders arranged in the front and rear parts of the shaft, through which the shaft in the levitation state passes without contact with them, whereby the principle of the invention consists in that at least the front safety ring is mounted detachably in the holder, preferably by a bayonet connection, or is attached by means of a clip or threaded coupling. The detachable mounting significantly facilitates the mounting and dismounting of the ring without having to dismount the holders in which they are mounted.

In a preferred embodiment, the bayonet connection consists of an opening with shaped recesses in the holder for the passage of a bayonet cap of the safety ring. Formed on the inner side of the holder are bayonet recesses extending in the direction of rotation of the shaft away from the shaped recesses and terminating in stops to receive in case of need bayonet protrusions of the bayonet cap of the safety ring. The safety ring is rotated only in some cases of the shaft impact on the safety ring after loss of levitation, and therefore the final position of the safety ring mounted in the holder is defined by the stops.

To achieve a firmer connection, the depth of the bayonet recesses decreases in the direction of the shaft rotation and therefore the clamping force between the bottom of the recess and the bearing surface of the bayonet protrusions and the bearing surface of the head of the safety ring increases due to the rotation of the safety ring in the direction of the shaft rotation.

To increase the service life of the safety ring and to improve the protection of the shaft when in contact with the safety ring after loss of levitation, at least the inner part of the safety ring is formed by a ceramic ring.

The advantage of the ceramic ring is high mechanical strength, which is important because very high energy is dissipated during the impact. Another advantage is excellent wear resistance, which also increases the service life of the ring. The ceramic material allows to choose a suitable surface roughness, whereby a relatively rough surface greater than Ra 1.6 is preferred for the given application, and/or the inner surface of the opening in the ceramic ring is

preferably provided with at least one groove extending from one face to the other, which prevents "the backup wheel effect", that is to say, the effect of reversing the shaft rotation after the impact on the ring, which may damage the safety ring the most. Another advantageous property of the ceramic material is

5 high fracture toughness, which also increases the service life of the ring.

The ceramic ring can be accommodated in a dampening ring made of a material more elastic than that of the ceramic ring, which above all reduces the risk of brittle fracture of the ceramic ring.

10 **Description of drawings**

An exemplary embodiment of the invention is schematically represented in the enclosed drawings, wherein Fig. 1a is an axonometric view and sectional view of a front safety ring detachably mounted in a holder by means of a bayonet connection, Fig. 1b is an axonometric view and sectional view of a rear safety ring detachably mounted in the holder by a bayonet connection, Fig. 2 is

15 a view of a shaft of the spinning rotor with safety rings mounted in the holders, Fig. 3 shows a safety ring with a bayonet connection and a spacing member, Fig. 4a shows a front safety ring with a ceramic ring and a damping ring, Fig. 4b shows a rear safety ring with a ceramic ring and a damping ring, Fig. 5a is a

20 view of a holder with a detachable safety ring, Fig. 5b is a cross-section of the holder and the safety ring of Fig. 5a, Fig. 6a shows a safety ring consisting of a ceramic ring and a damping ring having a clip connection, Fig. 6b shows the safety ring of Fig. 6a mounted in the holder by means of a clip connection, Fig. 7a shows a front safety ring with a ceramic ring and a split

25 damping ring in the holder, Fig. 7b shows a rear safety ring with a ceramic ring and a split damping ring mounted in the holder.

Examples of embodiment

The aim of the invention is a device for protecting parts of a system of a

30 spinning rotor with a magnetic bearing by preventing contact between a shaft 1 of the spinning rotor and parts of the magnetic bearing or a drive mechanism in the event of loss of the shaft levitation and/or in the event of excessive lateral

deflection of the shaft from the axis of the magnetic bearing, for example, as a result of critical frequency shaft vibration, increased rotor unbalance or a power failure. The device comprises at least two safety rings 2, 3, easily replaceable, detachably mounted in holders 4, which are arranged in a known manner in an unillustrated body of the magnetic bearing. The holders 4 are arranged in the front and rear parts of the shaft 1, as shown in Fig. 2. In the levitation state, the shaft 1 passes through the safety rings 2, 3 without contact with them. In the embodiment of Fig. 2, both the front safety ring 2 and the rear safety ring 3 are straight-through. In other embodiments, the rear safety ring 3 is provided with a bottom 35, and so it is only partially straight-through for the shaft 1, as shown in Figs. 1b, 4b and 7b. In the levitation state there is a gap between the bottom 35 of the rear ring 3 and the rear face of the shaft 1. In the embodiment of Fig. 2, the rear safety ring 3 is straight-through, and the rear face of the shaft 1 is secured by other means. At least the front safety ring 2 is mounted detachably in the holder 4, preferably by a bayonet connection, or it is attached by means of a clip or a threaded coupling. The invention will be further explained in detail with reference to the bayonet connection of the front safety ring 2.

For bayonet fastening, a bayonet cap 20 is formed on the first safety ring 2 fitted with bayonet protrusions 21 and in the holder 4 is formed an opening with shaped recesses 41 for the passage of the protrusions 21 of the bayonet connection 20 of the safety ring 2. In the illustrated example of embodiment, fastening bayonet recesses 42 are provided on the inside of the holder 4 and are located in the direction of the shaft 1 rotation away from the shaped recesses 41 and terminate in stops 43 to define the possible end position of the safety ring 2 so that the bayonet protrusions 21 of the bayonet cap 20 of the safety ring 2 can abut on the stops 43. The front safety ring 2 is for the bayonet fastening provided with a head 22 which abuts in the connected position on the front side of the holder 4. In a simplified embodiment, it is not necessary to use the bayonet recesses 42 in the holder 4, as the inner wall of the holder 4 serves the same purpose.

In an alternative embodiment, the depth of the bayonet recesses 42 decreases in the direction of the shaft 1 rotation to achieve a firmer connection, since during the rotation of the safety ring 2 in the original direction of the shaft

1 after the impact of the shaft 1 after the loss of levitation, the clamping force acting between the bottom of the recess and the bearing surface of the bayonet protrusions 21 and the bearing surface of the head 22 of the safety ring 2 increases and hence the resistance against the rotation of the safety ring also increases.

In order to increase the strength of the bayonet connection of the front safety ring 2 and the holder 4, a spacing member 5 is inserted between its head 22 and the holder 4, which, in the illustrated embodiment, is formed by a resilient metal pad, but in an unillustrated embodiment may be formed by an elastic element, for example, by a rubber pad, which at the same time seals the gap in the bayonet connection to protect it from dust.

The rear safety ring 3 may be mounted in the rear holder 4 also by means of a bayonet connection, but since it is not manipulated during normal repairs or maintenance, it is more frequently rigidly connected to the holder 4 by any known method.

If the rear safety ring 3 is mounted by means of a bayonet connection, a bayonet cap 30 having bayonet protrusions 31 is provided on the rear safety ring 3 and the head 32 of the rear safety ring 3 abuts on the inner side of the rear holder 4. The actual connection of the rear safety ring 3 and the holder 4 is then created in the same manner as in the case of the front safety ring 2.

The safety ring 2, 3 for the bayonet connection with the holder 4 is inserted into an opening 40 in a pre-centered holder 4, and by turning slightly the safety ring 2, 3, all the surfaces which abut on each other are pressed together. In the final position after mounting the safety ring 2, 3, the bayonet protrusions 21, 31 of the safety ring 2, 3 do not rest on the stops 43 of the holder 4. In the event of loss of the shaft levitation 1 and its deviation from the axis of the magnetic bearing, the shaft 1 surface may come into contact with the inner surface of the safety ring 2, 3. If this contact occurs, the safety ring 2, 3 can be rotated until its bayonet protrusions 21, 31 abut on the stops 43 terminating the bayonet recesses 42 in the holder 4, reducing the impact energy, thereby reducing the risk of damage to the safety ring 2, 3. The rotation of the safety ring 2, 3 need not take place after each impact of the shaft 1 on the

safety ring 2, 3, it depends especially on the distribution of the shaft 1 energy in the event of the impact.

When replacing the shaft 1 and/or the safety ring 2, 3 and/or when cleaning the inner space of the magnetic bearing, the respective safety ring is
5 turned against the direction of the shaft 1 rotation to a position in which the bayonet protrusions 21, 31 of the safety ring 2, 3 are situated opposite the shaped recesses 41 of the holder 4 and the safety ring 2, 3 is removed.

The front safety ring 2 is usually removed together with the shaft 1, whereby the rear safety ring 3 remains and, after performing the respective
10 reverse operation, with the shaft 1, the front safety ring 2 returns to the holder 4 and is tightened by turning in the direction of the shaft 1 rotation. If the safety ring 2, 3 is damaged, the defective ring 2, 3 is replaced in this manner with a new one.

In another embodiment of the safety rings 2, 3 the bayonet connection is
15 replaced with a clip connection, as shown in Fig. 2 and in Figs. 6a, b of the front safety ring 2. In the illustrated embodiment, the front safety ring 2 is provided with a clip closure 200, which is part of the damping ring 24, and its hook is snapped around the circumference of the opening in the holder 4.

In an unillustrated embodiment, a thread is formed in the opening of the
20 holder 4 and the respective part of the safety ring 2 is provided with the same thread. The thread tightening direction is the same as the direction of the shaft 1 rotation.

To increase the service life of the safety ring 2, 3 and to improve the protection of the shaft 1 of the spinning rotor when the shaft 1 is in contact with
25 the safety ring 2, 3 after loss of the shaft 1 levitation, the inner part of the safety ring 2, 3 is formed by a ceramic ring 23, 33 which is mounted in the body of the safety ring 2, 3 which constitutes a damping ring 24, 34 and may be made of plastic or another material, ensures short-term partial deformation of the safety ring after the possible shaft 1 impact, i.e., it may be made of a material with a
30 greater reversible deformation than that of the ceramic ring 23, 33, which partially removes the disadvantage of the brittleness of the ceramic material. In this embodiment, for a bayonet connection with the holder 4, a bayonet cap, or

a clip connection with the holder 4, or a thread for a threaded coupling to the holder 4 is formed on the outer circumference of the damping ring 24, 34. The damping ring 24, 34 is connected to the ceramic ring 23, 33 by any suitable type of connection, such as a clip connection, as shown in Figs. 2, 4 and 6, by pressing, see Fig. 1, or by a threaded coupling.

Another option is to create the entire safety ring 2, 3 from ceramic material, including the bayonet cap 20, 30, as shown in Fig. 5. In this case it is advantageous if at least the part of the holder 4, 30 with an opening 40 with shaped recesses 41 for the passage of the bayonet cap 20, 30 of the safety ring 2, 3, is made of a material having a reversible shape deformation greater than that of a ceramic ring, for example it is made of plastic, which ensures short-term partial deformation of the safety ring in the event of the shaft 1 impact and constitutes a damping ring 24, 34. In an alternative embodiment, the entire holder 4 is made of such a material.

To reduce the energy transmission of the shaft 1 impact on the safety ring 2, 3 and on its mounting in the holder 4 the ceramic ring 23, 33 constituting the safety ring 2, 3 in another alternative embodiment is mounted in a damping ring 24, 34 made of a material whose reversible deformation is greater than that of the ceramic ring 23, 33. In this embodiment, the damping ring 24, 34 is rigidly mounted in the body of the safety ring 2, 3, or it even constitutes this body.

Further reduction in the energy transmission of the shaft 1 impact on the safety ring 2, 3 and on its mounting in the holder 4 is achieved, for example, by splitting the damping ring 24, 34 of the front safety ring 24, 34 into the inner damping ring 241, 341 and the outer damping ring 242, 342 made of a material with different deformation, whereby the outer ring 242, 342 is detachably mounted in the holder 4. In the embodiment shown in Figs. 7a, 7b, the inner damping ring 241, 341 is made of rubber.

Another alternative embodiment of a rear safety ring 3 is shown in Fig. 2, wherein the damping ring 34 is rigidly connected to the holder 4 and the ceramic ring 33 is mounted in the damping ring 34 by a clip connection.

Shapes, dimensions, suitable materials and their strength, hardness, the size of reversible deformation (flexibility) and other properties and combinations

of the individual parts of the safety rings 2, 3 and the holder 4 are selected according to the specific technological conditions.

To prevent "the backup wheel effect", which damages the safety ring the most, that is to say, the effect of reversing the shaft 1 rotation after the impact
5 on the ring 2, 3, the inner opening of the ceramic ring 23, 33 has an increased surface roughness, preferably greater than or equal to Ra 1.6

The same or similar result is achieved by interrupting the surface of the inner opening of the ceramic ring 23, 33 by at least one groove extending from one face to the other.

10 According to another variant shown in Figs. 8 to 11, the safety ring 2, 3 on the holder 4 is screwed by at least two bolts 6.

The front safety ring 2 is configured as a ring 26 which comprises a flange portion 261 and a shoulder 262 to be inserted into the opening in the holder 4. In the flange portion 261, which is intended to abut on the holder 4,
15 three evenly spaced openings 263 for the bolts 6 are arranged around the circumference. In the illustrated embodiment, a groove 264 for a resilient sealing member is formed in the bearing surface of the flange portion 261 to prevent dust penetration. The front safety ring 2 can consist of more rings, as described above.

20 The rear safety ring 3 consists of an annular portion provided with a bottom 35 which is arranged at the end of the opening for inserting the rear portion of the shaft 1 of the spinning rotor. In the embodiment shown, two opposing arms 361, in which openings 362 are formed for the bolts 6, protrude from the annular portion. The rear safety ring 3 can also be formed by a multi-
25 ring assembly as described above.

List of references

- 1 shaft of the spinning rotor
- 2 front safety ring
- 5 20 bayonet cap of the front safety ring
- 200 clip closure
- 21 bayonet protrusions of the front safety ring
- 22 head of the front safety ring
- 23 ceramic ring
- 10 24 damping ring
- 241 inner damping ring
- 242 outer damping ring
- 25 clip
- 3 rear safety ring
- 15 30 bayonet cap of the rear safety ring
- 31 bayonet protrusions of the rear safety ring
- 32 head of the rear safety ring
- 33 ceramic ring
- 34 damping ring
- 20 341 inner damping ring
- 342 outer damping ring
- 35 bottom of the rear safety ring
- 4 holder
- 41 shaped recesses in the holder
- 25 42 bayonet recesses in the holder
- 43 stop
- 5 spacing member

PATENT CLAIMS

1. A device for protecting parts of a system of a spinning rotor with a magnetic bearing by preventing contact between a shaft (1) of the spinning rotor and parts of the magnetic bearing or a drive mechanism in the event of loss of the shaft (1) levitation and/or in the event of excessive lateral deflection of the shaft (1) from the axis of the magnetic bearing, comprising at least two safety rings (2, 3) mounted in holders (4) arranged in the front and rear parts of the shaft (1) through which the shaft (1) in the state of levitation passes without contact with them, **characterized in that** at least the front safety ring is detachably secured in the holder (4).

2. The device according to claim 1, **characterized in that** the safety ring (2 or 3) is mounted in the holder (4) by means of a bayonet connection or by means of a clip connection or a threaded coupling.

3. The device according to claim 2, **characterized in that** a bayonet cap (20) fitted with bayonet protrusions (21) is provided on the safety ring (2, 3) for the bayonet connection and in the holder (4) is formed an opening (40) with shaped recesses (41) around the circumference of the opening (4) for the passage of the bayonet protrusions (21) of the bayonet cap (20) of the safety ring (2).

4. The device according to claim 3, **characterized in that** in the inner wall of the holder (4) are formed fastening bayonet recesses (42) extending in the direction of the shaft (1) rotation away from the shaped recesses (41) and terminating in stops (43) to allow the bayonet protrusions (21) of the bayonet cap (20) of the safety ring (2) to abut on the stops (43).

5. The device according to claim 4, **characterized in that** the bayonet recesses (42) have a decreasing depth in the direction of the shaft (1) rotation.

6. The device according to claim 2, **characterized in that** clip closures (200) are provided on the safety ring (2 or 3) for the clip connection.

7. The device according to claim 2, **characterized in that** for the threaded coupling, the safety ring (2 or 3) and the holder (4) are provided with a

thread whose direction of tightening is the same direction as that of the shaft (1) rotation.

8. The device according to claim 1, **characterized in that** the safety ring (2, 3) is mounted on the holder (4) by means of at least two bolts (6).

5 9. The device according to claim 8, **characterized in that** the front safety ring (2) is formed as a ring comprising a flange portion (261) and a shoulder (262), whereby three openings (263) for the bolts (6) are arranged around the circumference of the flange portion, the openings (263) being spaced evenly from each other.

10 10. The device according to claim 9, **characterized in that** the flange portion (261) has a groove (264) for a resilient sealing member in the bearing surface.

11. The device according to claim 8, **characterized in that** the rear safety ring (3) comprises an annular portion provided with a bottom (35) from which protrude two arms (361), opposed to each other, in which bolt openings (362) for the bolts (6) are formed.

12. The device according to any of the preceding claims, **characterized in that** the safety ring (2, 3) has an inner part formed by a ceramic ring (23, 33).

13. The device according to claim 12, **characterized in that** the entire safety ring (2, 3) is made of ceramic material.

14. The device according to claim 13, **characterized in that** at least part of the holder (4) around the opening for the mounting of the safety ring (2, 3) is made of a material having a greater reversible deformation than the ceramic material of which the safety ring (2, 3) is made.

25 15. The device according to claim 12, **characterized in that** the ceramic ring (23) is surrounded by a damping ring (24) made of a material having a greater reversible deformation than the ceramic ring (23).

16. The device according to claim 15, **characterized in that** the damping ring (23) consists of an inner damping ring (241) and an outer damping ring (242), which are made of a material having a different reversible deformation, which is greater than that of the ceramic ring (23).

17. The device according to claim 16, **characterized in that** the inner damping ring (241) is made of rubber.

18. The device according to any of claims 12 to 16, **characterized in that** the inner opening of the ceramic ring (23) has a surface roughness greater
5 than or equal to Ra 1.6.

19. The device according to any of claims 12 to 16, **characterized in that** the inner opening of the ceramic ring (23) has a surface interrupted by at least one groove formed between the faces of the ceramic ring (23).

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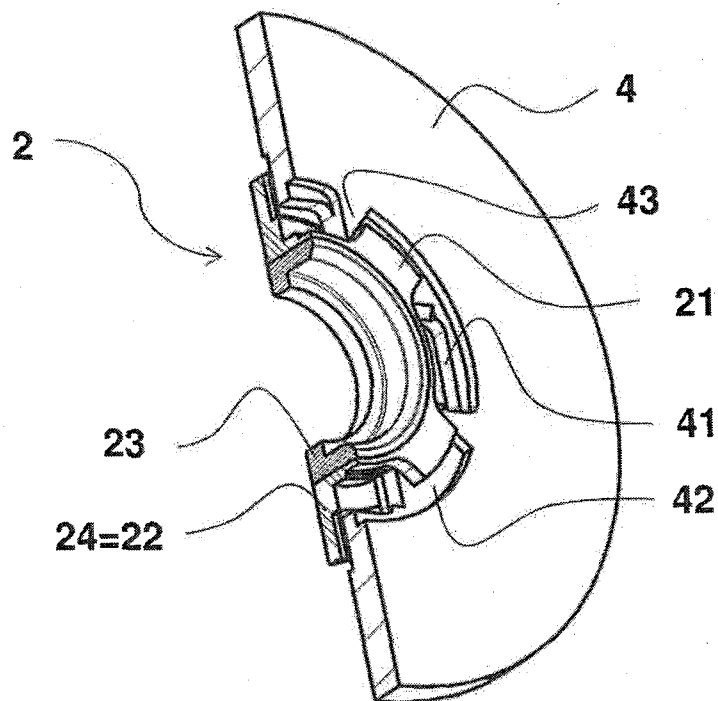


Fig. 1a

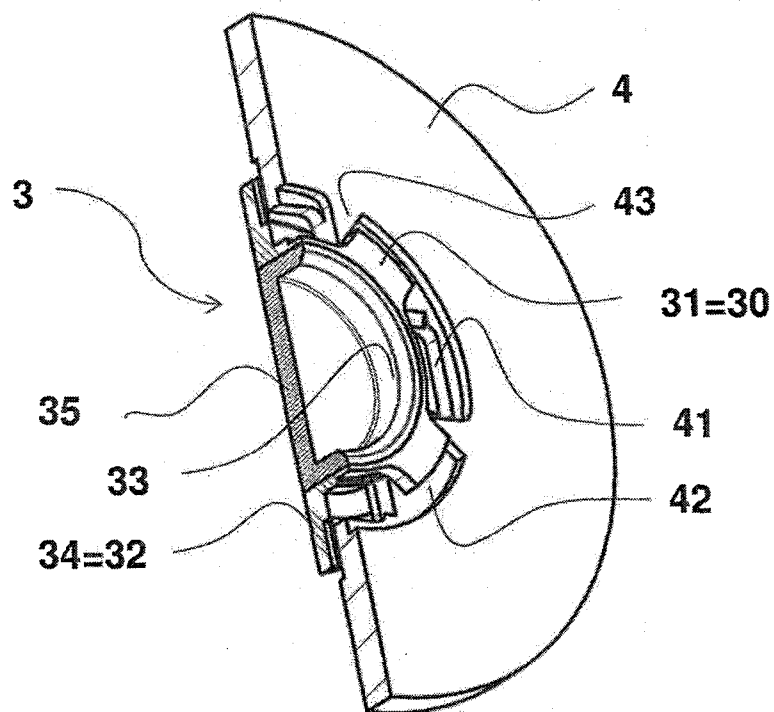


Fig. 1b

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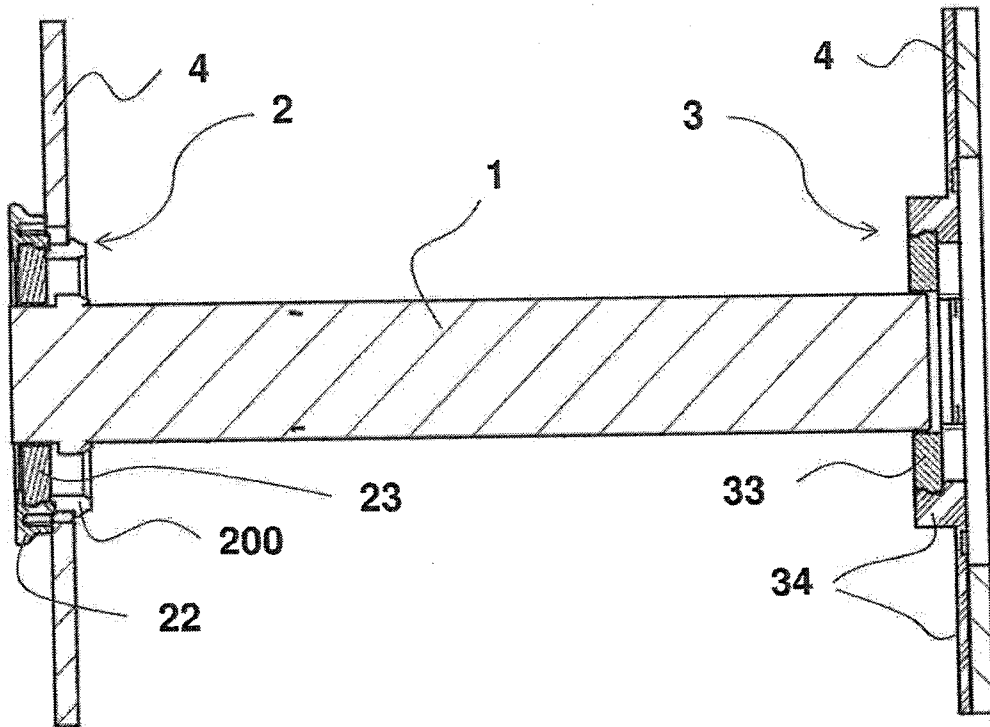


Fig. 2

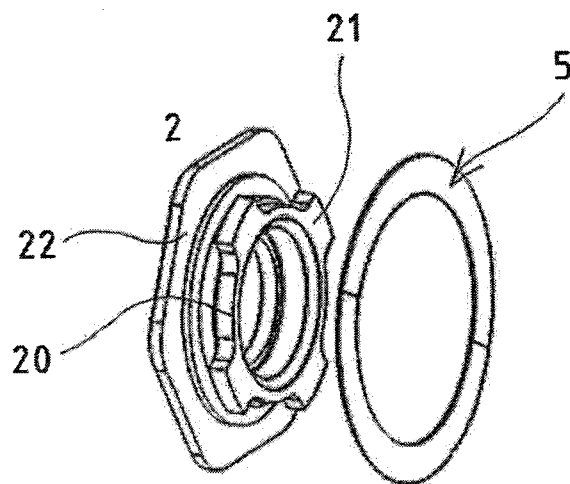


Fig. 3

3/6

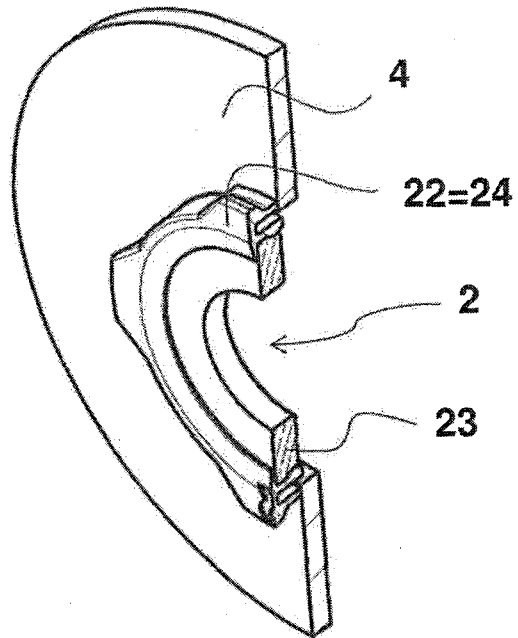


Fig. 4a

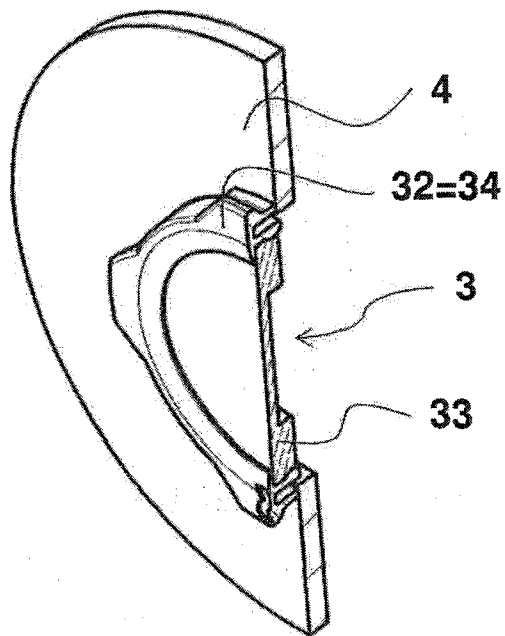


Fig. 4b

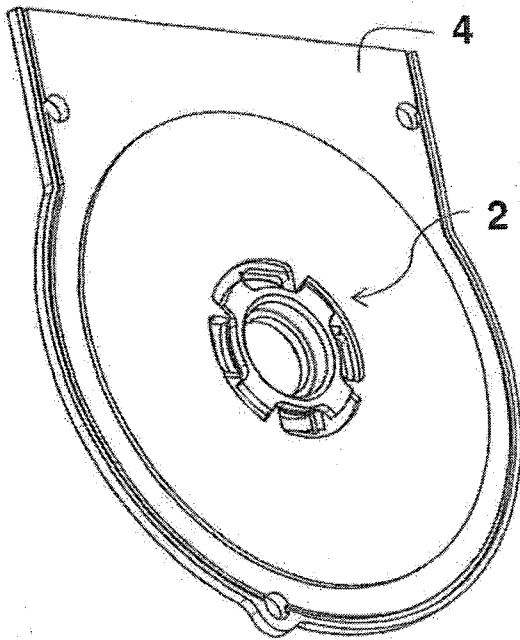


Fig. 5a

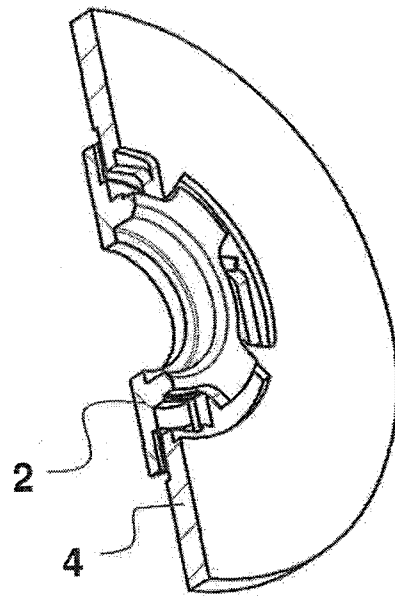


Fig. 5b

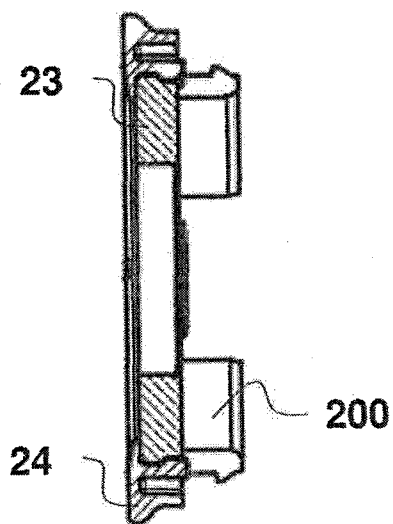


Fig. 6a

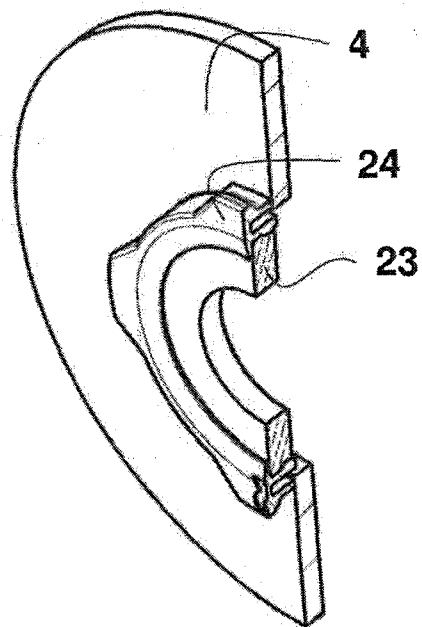


Fig. 6b

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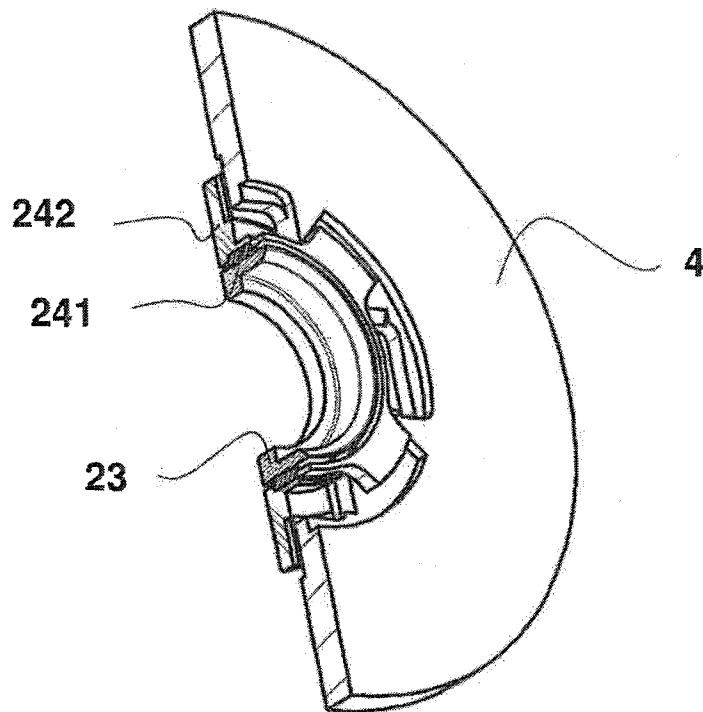


Fig. 7a

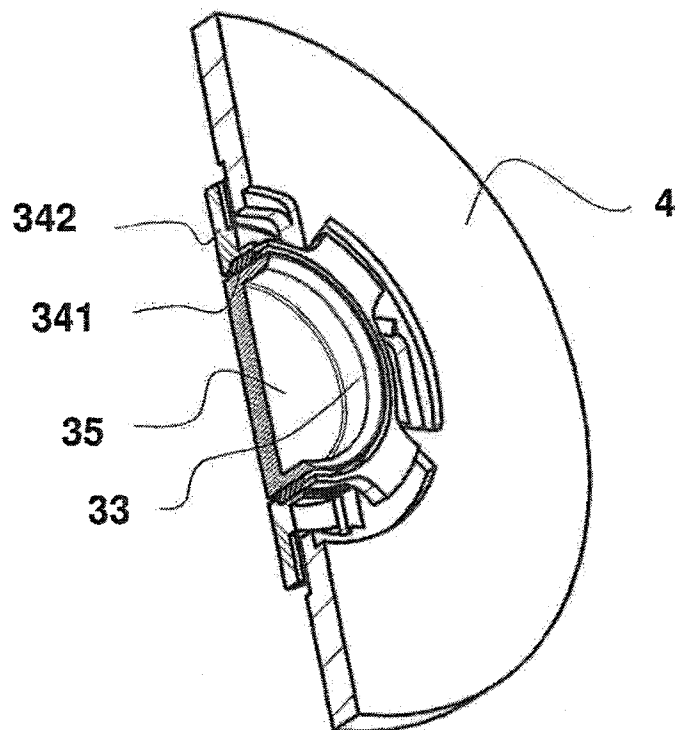


Fig. 7b

6 / 6

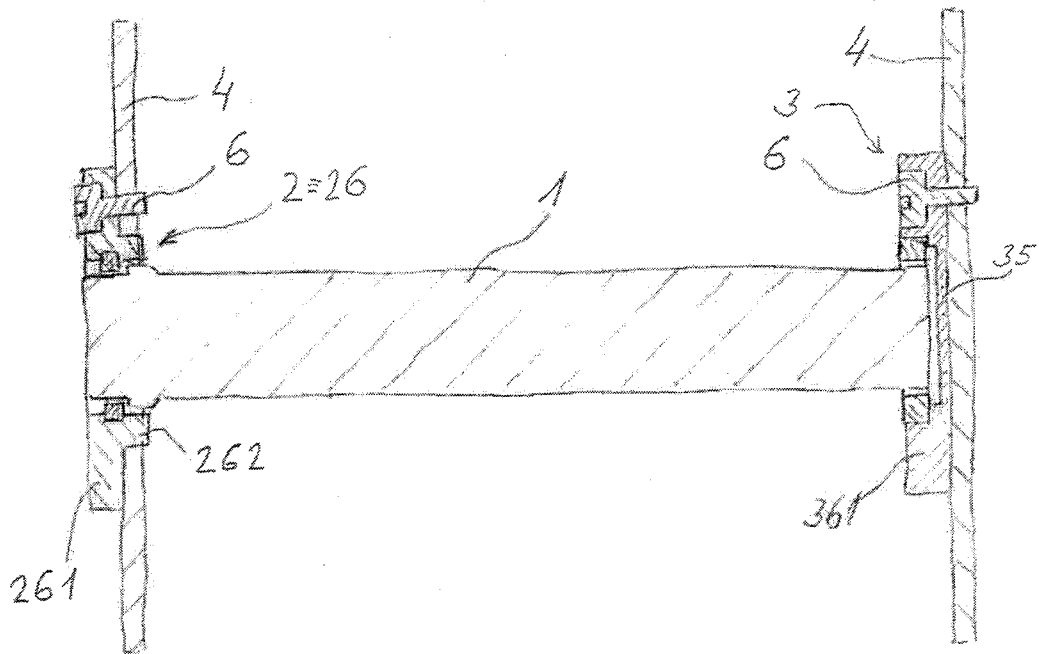


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2018/050042

A. CLASSIFICATION OF SUBJECT MATTER

INV. D01H4/12 F16C27/02 F16C32/04
ADD. F16C17/02 F16C17/10 F16C33/04

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)

D01H F16C

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	DE 10 2008 016745 A1 (OERLIKON TEXTILE GMBH & CO KG [DE]) 8 October 2009 (2009-10-08) paragraph [0011] paragraph [0043] - paragraph [0045]; figure 1 paragraph [0058] - paragraph [0066]; figure 2	1,2
X	US 5 739 609 A (UEYAMA HIROCHIKA [JP] ET AL) 14 April 1998 (1998-04-14) column 1, line 11 - column 1, line 23 column 3, line 54 - column 4, line 38; figure 1 ----- -/-	1



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

29 January 2019

Date of mailing of the international search report

08/02/2019

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

Todarello, Giovanni

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CZ2018/050042

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2018/050042

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 100 22 736 A1 (SCHLAFHORST & CO W [DE]) 15 November 2001 (2001-11-15) cited in the application	1
Y	paragraph [0054] - paragraph [0055]; figure 2	2-4,6-11
X	DE 198 27 606 A1 (SCHLAFHORST & CO W [DE]) 23 December 1999 (1999-12-23) cited in the application	1
Y	column 4, line 30 - column 4, line 35; figure 1	2-4,6-11
Y	DE 37 10 962 A1 (SKF TEXTILMASCH KOM) 15 October 1987 (1987-10-15) column 2, line 18 - column 2, line 60 column 3, line 36 - column 4, line 9; figures 1-3	2-4,6-11
X	JP H04 203523 A (NAT AEROSPACE LAB) 24 July 1992 (1992-07-24)	1,12-14, 18,19
Y	page 1, lower left column - page 1, lower right column page 2, upper right column - page 2, lower left column; figures 1-3	15-17
Y	JP S60 40816 A (HITACHI LTD) 4 March 1985 (1985-03-04) the whole document	15-17
A	DE 299 20 395 U1 (SCHLAFHORST & CO W [DE]) 24 February 2000 (2000-02-24) page 9, paragraph 2; figure 2	12-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/CZ2018/050042

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102008016745 A1	08-10-2009	NONE	
US 5739609 A	14-04-1998	NONE	
DE 10022736 A1	15-11-2001	CN 1322866 A CZ 20011591 A3 DE 10022736 A1 EP 1154340 A1 US 2002002816 A1	21-11-2001 12-12-2001 15-11-2001 14-11-2001 10-01-2002
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JP H04203523 A	24-07-1992	NONE	
JP S6040816 A	04-03-1985	NONE	
DE 29920395 U1	24-02-2000	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 2-11(completely); 1(partially)

A device for protecting parts of a system of a spinning rotor comprising at least two safety rings mounted in holders, wherein the front safety ring is connected to the holder by means of a bayonet connection, clip connection, threaded coupling or at least two bolts.

2. claims: 12-19(completely); 1(partially)

A device for protecting parts of a system of a spinning rotor comprising at least two safety rings mounted in holders wherein the safety ring has an inner part formed by a ceramic ring.
