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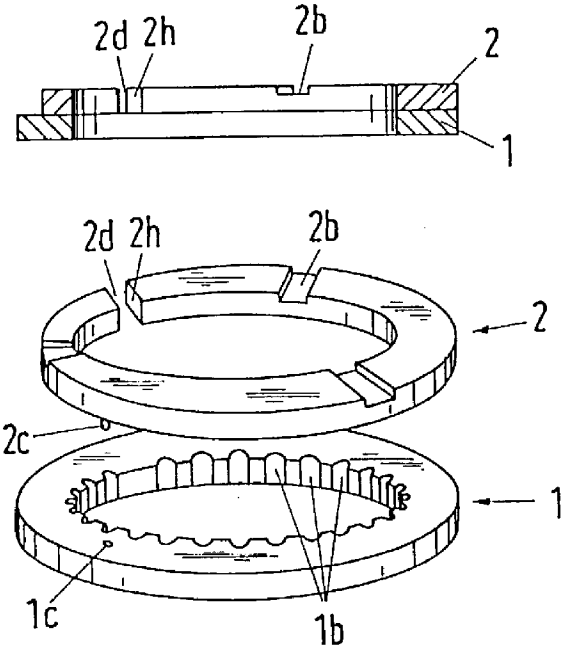
(54) **DISPOSITIF D'ETRANGLEMENT ET MODE DE FONCTIONNEMENT DE CE DISPOSITIF**

(54) **CHOKE ARRANGEMENT AND A METHOD FOR OPERATING SAID CHOKE ARRANGEMENT**



(57) Le dispositif d'étranglement est composé d'un anneau d'étranglement (2) élastique, constitué d'une seule pièce et comportant une interruption (2d) sous forme de fente. Le dispositif d'étranglement comporte également une bague d'appui (1) placée dans le sens radial à proximité immédiate de l'anneau d'étranglement (2). La bague d'appui (1) sert notamment à recouvrir l'interruption (2d) de l'anneau d'étranglement (2). Le dispositif d'étranglement doté d'un anneau d'étranglement flexible est d'une conception avantageuse car l'anneau d'étranglement réagit aux variations dynamiques de pression et modifie, en

(57) The proposed throttle arrangement comprises an elastic throttle ring (2) consisting of a single piece with a discontinuity (2d) in the form of a gap. The throttle arrangement also comprises a support ring (1) immediately adjacent to the throttle ring (2) in the axial direction. The support ring (1) serves among other things to cover the discontinuity (2d) in the throttle ring. An advantage of the proposed throttle arrangement with an elastically resilient throttle ring is that the throttle ring reacts to dynamic pressure fluctuations and thus alters its sealing characteristics. A pressure peak creates a raised pressure differential on the throttle arrangement, forcing

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conséquence, ses propriétés d'étanchéité. Une pointe de pression provoque une augmentation de la différence de pression au niveau du dispositif d'étranglement. L'anneau d'étranglement élastique est donc pressé contre la surface de glissement d'une tige de piston, ce qui augmente l'étanchéité de telle façon que la pointe de pression ne puisse pas se propager sur une bague d'étanchéité située en aval du dispositif d'étranglement. Le dispositif d'étranglement présente un comportement comparable à celui d'un filtre de séparation des fréquences bien connu en électronique, dans la mesure où il assure une étanchéité vis-à-vis des modifications de pression de haute-fréquence mais pas vis-à-vis des composantes de pression statiques ou à modification lente.

the elastic throttle ring against the sliding surface of a piston rod and creating a tighter seal. This ensures that the pressure peak cannot be propagated on to a sealing ring downstream of the throttle arrangement. The throttle arrangement thus behaves like a frequence dividing network known from electrical engineering, which create a seal against high-frequency pressure fluctuations but not against static or slowly changing pressure components.

Abstract of disclosure

The choke arrangement comprises an elastic choke ring (2) which consists of a single piece with a gap formed by a parting joint (2d). The choke arrangement further comprises a support ring (1) which is arranged directly adjacent to the choke ring (2) in the axial direction, with the support ring (1) serving amongst other things to cover over the gap (2d) of the choke ring (2). An advantage of the choke arrangement with an elastically resilient choke ring is to be seen in that the choke ring reacts to dynamic pressure changes and thereupon changes its sealing properties. A peak in pressure produces an increased difference in pressure at the choke arrangement, whereby the elastic choke ring is pressed against the sliding surface of a piston rod and effects an increased sealing action, so that the pressure peak can not propagate to a sealing ring placed after the choke arrangement. The choke arrangement thus behaves analogously to a frequency selective filter known from electrical engineering in that high-frequency pressure changes are sealed off, whereas static or slowly varying pressure components are not sealed off.

(Fig. 1f)

P.6682/Gf/Pa

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Choke arrangement and a method for operating said choke arrangement

The invention relates to a choke arrangement in accordance with the preamble of claim 1. The invention relates further to a method for the operation of the choke arrangement in accordance with the preamble of claim 14.

Sealing rings are usually arranged pairwise one behind the other in series and form in this manner a so-called packing. The pressure difference acting on the individual sealing rings causes their sealing surfaces to be pressed onto the sliding surfaces of the body to be sealed, for instance a piston rod. In addition a choke arrangement comprising at least one choke ring is arranged at one side of the packing. A packing of this kind with a choke ring and sealing rings is known for example from the patent CH 439 897. The choke ring of this known arrangement has the disadvantage that pulsating pressure components are only insufficiently damped. This leads to rapid wear of the sealing rings arranged behind it.

The object of the present invention is to overcome these known disadvantages of choke rings.

This object is satisfied in accordance with the features of claim 1. The subordinate claims 2 to 11 relate to further

advantageous embodiments.

The choke arrangement in accordance with the invention comprises a choke ring which in a preferred embodiment consists of a single piece with a parting joint forming a gap. In addition the choke ring has elastic behaviour. The choke arrangement comprises further a support ring which is placed to lie directly adjacent to the choke ring in the axial direction, with the support ring serving amongst other things to cover over the parting joint of the choke ring so that choke arrangement is impervious in the region of the parting joint. The choke ring requires no further elements such as e.g. a hose spring surrounding the ring. The choke ring is placed directly against the sliding surface of the body to be sealed, e.g. a piston rod. An advantage of the choke arrangement with an elastically resilient choke ring having a parting joint is to be seen in the fact that the choke ring reacts to dynamic changes in pressure and in so doing changes its sealing properties. The choke arrangement in accordance with the invention is suitable in particular for damping pressure peaks such as can arise at the piston rod of a dry running piston compressor. A pressure peak causes an increased pressure difference at the choke arrangement through which the elastic choke ring is pressed against the sliding surface of the piston rod and produces a higher sealing action so that the pressure peak can not propagate to a sealing ring placed after the choke arrangement. The choke ring in accordance with the invention is executed as a highly leaky ring which hardly seals off constant pressure components at all. As a result of its elastic properties the choke arrangement in accordance with the invention, however, has a high adaptability in form with respect to the piston rod for dynamic pressure components so that it lies in contact with the piston rod as a result of a dynamic pressure rise

and seals to an increasing extent. The high adaptability in shape is enabled amongst other things by the choke ring having a parting joint forming a gap in the peripheral direction. The parting joint is made in such a manner that that it does not close even when the choke ring is dynamically pressed against the piston rod in order to thus achieve an adaptability in shape which is as advantageous as possible. The choke arrangement in accordance with the invention has the advantage that it seals off only the dynamically variable pressure components, with the ability of the choke arrangement to respond being variable within a wide range through the geometrical execution of the choke ring, its elastic properties and further parameters such as the choice of material. The choke arrangement thus behaves analogously to a frequency selective filter known from electrical engineering in which high frequency pressure changes are sealed off whereas static or slowly varying pressure components are not sealed off.

The invention will be explained in the following with reference to several exemplary embodiments.

Shown are:

Fig. 1a a plan view of a support ring;

Fig. 1b a plan view of a choke ring;

Fig. 1c a further exemplary embodiment of a support ring;

Fig. 1d a cross-section through a choke ring along the line A-A in Fig. 1b;

Fig. 1e an eccentric embodiment of a choke ring;

Fig. 1f a cross-section as well as a perspective view of a choke arrangement;

Fig. 2 a radial section through a choke arrangement in accordance with the invention in the installed state;

Fig. 2a a view along the section B-B of Fig. 2;

Fig. 2b a further radial section of the choke arrangement in accordance with the invention in the installed state and

Fig. 3 a plot of the pressure as a function of time.

The choke arrangement in accordance with the invention comprises a choke ring 2 as well as a support ring 1 lying in contact in the axial direction. The support ring 1 illustrated in Fig. 1a as well as in Fig. 1f has a ring surface 1a, a cut-out 1c which serves as a guide for a fixing pin 2c, as well as recesses 1b in the surface facing the piston rod 4. The recesses 1b extend over the entire width of the support ring 1. Furthermore, the support ring 1 has a cover region 1d extending in the peripheral direction which comes to lie over the parting joint 2d of the choke ring 2 in order to seal off the parting joint 2d in the axial direction, or in the direction of motion of a piston rod 4. The support ring 1 is executed as a so-called endless ring, which is also designated as an uncut ring. This means that the ring has no parting joint but is made without any interruption in the peripheral direction.

Fig. 1b shows a choke ring 2 with a ring body 2a as well as grooves 2b extending in the radial direction, a fixing pin

2c which protrudes in the form of a cylinder, as well as a parting joint 2d on the side opposite to the fixing pin 2c. The choke ring 2 has elastic, resilient properties. The width of the parting joint or ring gap 2d is dimensioned in such a manner that the choke ring 2 can completely surround a piston rod 4 without a mutual contact of the ring body 2a resulting in the parting joint 2d. It is thereby ensured that the choke ring 2 has an advantageous adaptability in form with respect to the piston rod 4. If a mutual contact of the two parting joint surfaces 2h in the parting joint 2d were to result due to these encountering one another, then this would have the effect that the choke ring 2 does not lie in contact with the piston rod 4 in a partial region.

The support ring 1 and the choke ring 2 can be put together in such a manner that the protruding fixing pin 2c of the choke ring 2 is inserted into the cut-out 1c so that the support ring assumes a definite position with respect to the choke ring 2 and so that it is ensured that the cover region 1d comes to lie over the parting joint 2d.

Fig. 1c shows a further exemplary embodiment of a support ring 1 with ring surface 1a, cut-out 1c and recesses 1b. Fig. 1d shows an exemplary embodiment of a cross-section through the choke ring 2 along the line A-A in Fig. 1b. The ring body 2a can be made rectangular or, as in the present exemplary embodiment, in such a manner that the surface 2i of the ring body 2a facing the piston rod 4 has a sealing surface 2e as well as a part 2g diverging with increasing distance from the surface of the piston rod 4. The ring body 2a has a height H in the axial direction.

Fig. 1e shows a choke ring 2 whose width in the radial direction is greatest in the region of the fixing pin 2c,

with the width continually decreasing towards the gap 2d. A choke ring 2 thus executed has the advantage that it can surround a piston rod very uniformly. A piston rod 4 surrounded by a choke ring 2 extends eccentrically with respect to the outer peripheral line of the choke ring 2. The parting joint 2d or the parting joint surfaces 2h, respectively, extend in radial direction and thus perpendicular to the surface of the piston rod 4. Such a so-called butt joint is suited very well for the choke ring 2 in accordance with the invention since the two parting joint surfaces 2h can be moved relative to one another without restraint, and thus the choke ring 2 can lie in contact with the piston rod 4 without restraint by the parting joint 2d.

Fig. 2 shows a radial section through a choke arrangement arranged in a piston compressor. The choke arrangement is arranged in a chamber ring 5 which is a part of a packing 6 which opens into a cylinder space 15. The choke arrangement with the choke ring 2 and the support ring 1 is arranged in a chamber 14.

Fig. 2a shows a section from the point of view of the line B-B. From this the arrangement of the choke arrangement with the choke ring 2 and the support ring 1 in the chamber 4 can be recognised. Furthermore the path of the radially extending groove 2b of a choke ring 2 can be seen.

Fig. 2b shows the choke arrangement of Fig. 2a in an enlarged view. A pressure peak has the effect that the pressure difference acts on the choke ring 2 as a force acting in the radial direction G1 so that the latter is pressed with its sealing surface 2e against the piston rod 4, from which an increased pressure drop over the sealing surface 2e results. The chamber 14 is sealed in the axial

direction by the support ring 1, which lies on the chamber ring 5, as well as by the choke ring 2 so that the pressure peak does not propagate into the succeeding packing region.

Fig. 3 shows a plot of the pressure as it impacts on the choke arrangement from the direction of the cylinder space 15. The pressure plot has an approximately static pressure Ps on which dynamic pressure peaks with a pressure rise Dp and a peak pressure value Pe are superimposed. The choke arrangement enables sealing off of the dynamic pressure component with a pressure rise Dp so that an approximately constant pressure is present at the following seal arrangement of the packing 6.

Suitable materials for the choke ring 2 or the support ring 1 are plastics such as for example polytetrafluoroethylene (PTFE) modified high temperature polymers such as poly(ether ether ketone) (PEEK), poly(ether ketone) (PEK) polyimide (PI), poly(phenylene sulphide) (PPS), polybenzimidazole (PBI), polyamideimide (PAI) or also a modified epoxy resin.

Patent Claims

1. Choke arrangement comprising a choke ring (2) with a parting joint (2d) as well as a support ring (1) arranged adjacent to and adjoining the choke ring (2) for the covering over of the parting joint (2d).

2. Choke arrangement in accordance with claim 1 characterised in that the support ring (1) has a segment part (1d) which is executed and arranged in such a manner that the parting joint (2d) is completely covered in the radial direction.

3. Choke arrangement in accordance with claim 1 or 2 characterised in that the choke ring (2) consists of a plastic having elastic properties.

4. Choke arrangement in accordance with one of the claims 1 to 3 characterised in that the choke ring (2) has a constant width in the radial direction.

5. Choke arrangement in accordance with one of the claims 1 to 3 characterised in that the width of the choke ring (2) in the radial direction is greatest at the side lying opposite to the gap (2d) and diminishes towards the gap (2d).

6. Choke arrangement in accordance with one of the claims 1 to 5 characterised in that the choke ring (2) has grooves (2b) extending in the radial direction.

7. Choke arrangement in accordance with one of the claims 1 to 6 characterised in that the choke ring (2) as well as the support ring (1) have a common connection

means (1c, 2c) in order to hold the rings (1, 2) in a mutually fixed position.

8. Choke arrangement in accordance with one of the claims 1 to 7 characterised in that the support ring (1) is executed as an endless ring.

9. Choke arrangement in accordance with one of the claims 1 to 8 characterised in that the support ring (1) surrounds an inner circle and has through-going cut-outs (1b) on the side facing the inner circle.

10. Choke arrangement in accordance with one of the claims 1 to 7 characterised in that the support ring (1) has an axial height (H); and in that the surface (2i) facing the centre of the support ring is made to extend cylindrically over a portion (2e) of the height (H) and is made divergent over a further portion (2g).

11. Choke arrangement in accordance with one of the claims 1 to 10 characterised in that the choke ring (2) and/or the support ring (1) consists of a plastic such as polytetrafluoroethylene (PTFE), a modified high-temperature polymer such as poly(ether ether ketone) (PEEK), poly(ether ketone) (PEK), polyimide (PI), poly(phenylene sulphide) (PPS), polybenzimidazole (PBI), polyamideimide (PAI) or a modified epoxy resin.

12. Sealing packing with a choke arrangement in accordance with one of the claims 1 to 11.

13. Piston compressor with a choke arrangement in accordance with one of the claims 1 to 11.

14. Method for damping or sealing dynamic pressure

components with a choke arrangement in accordance with one of the claims 1 to 11 lying in contact with a sliding surface of a body (4) to be sealed, characterised in that a force acting in the radial direction and directed towards the sliding surface is produced on an elastic choke ring (2) by a peak in pressure so that a sealing surface (2e) of the choke ring (2) is pressed against the sliding surface and thereby an increased sealing action of the choke arrangement in the axial direction is achieved.

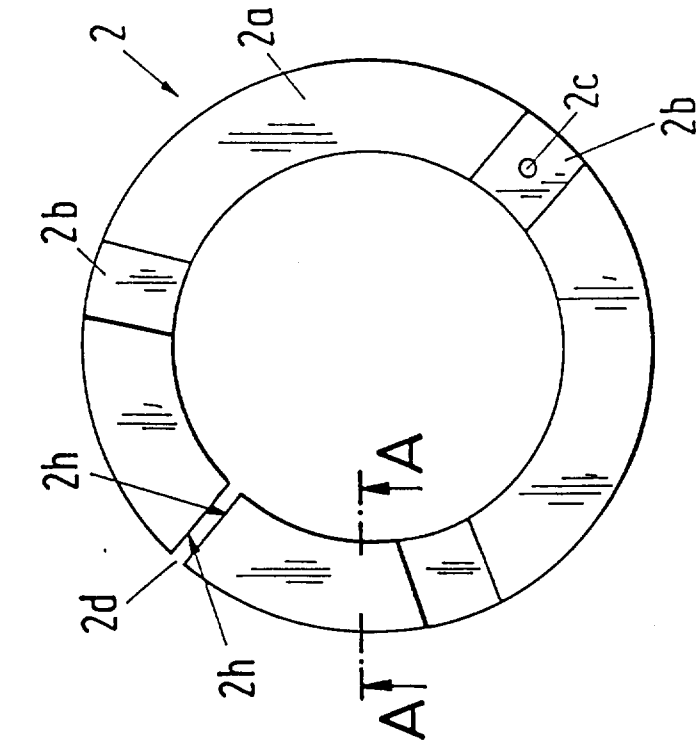


Fig. 1b

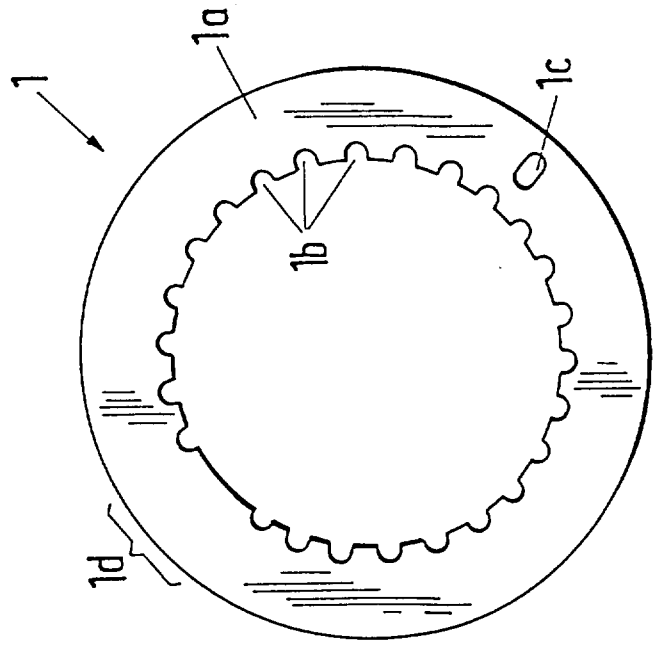


Fig. 1a

Fig. 2b

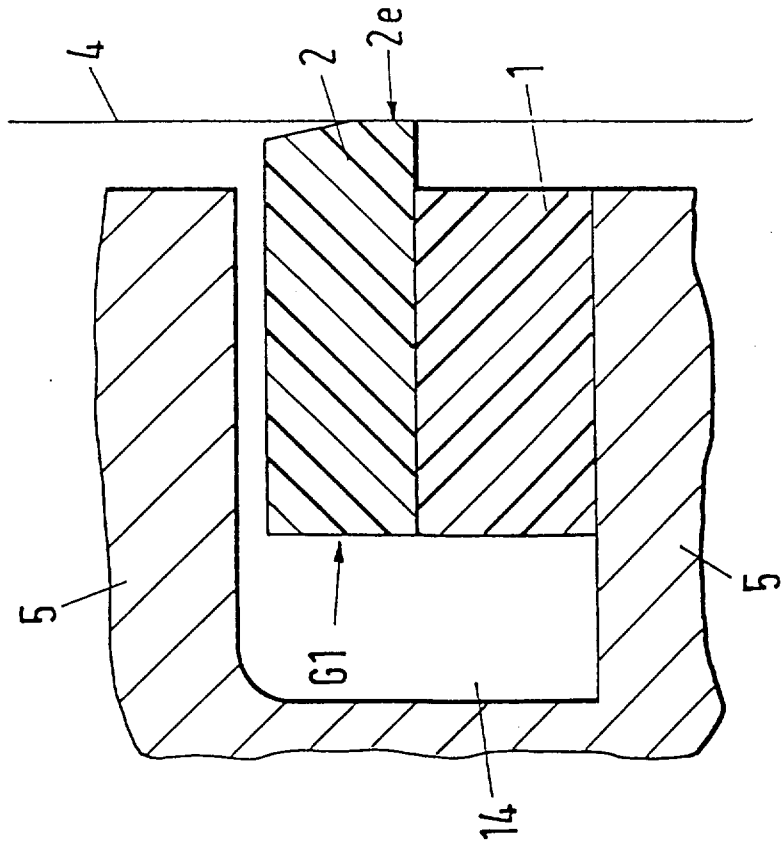


Fig. 1c

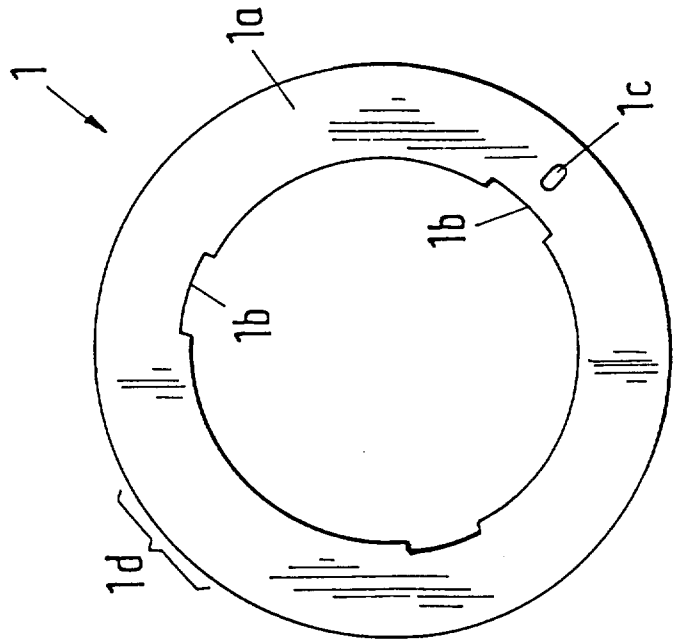


Fig. 1e

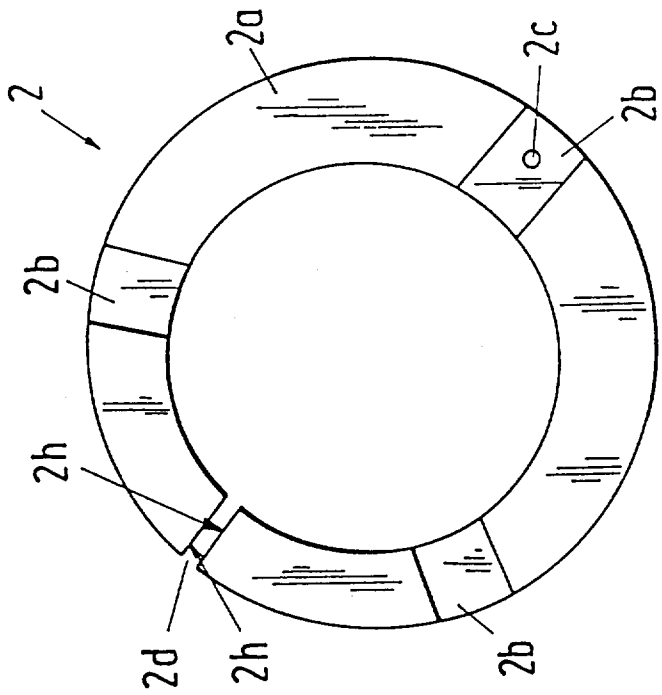
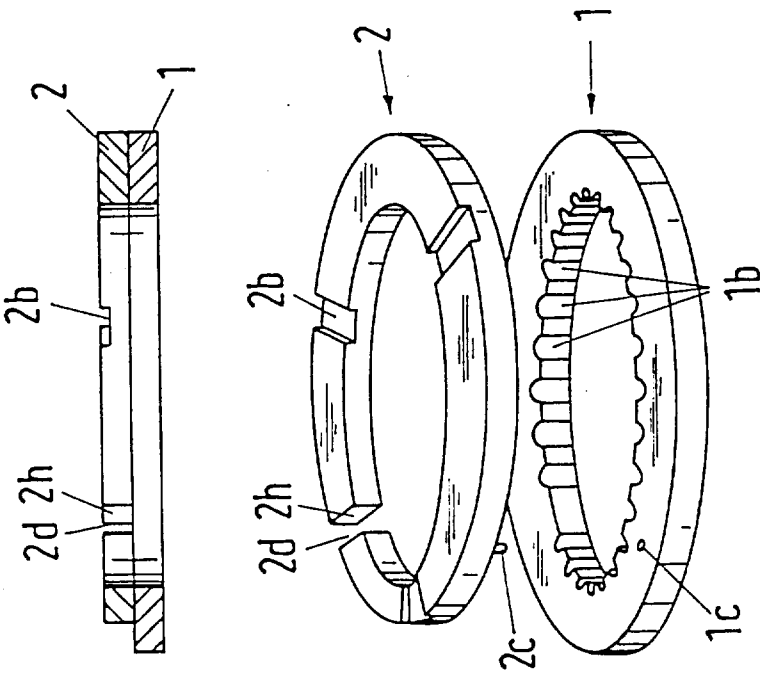


Fig. 1f



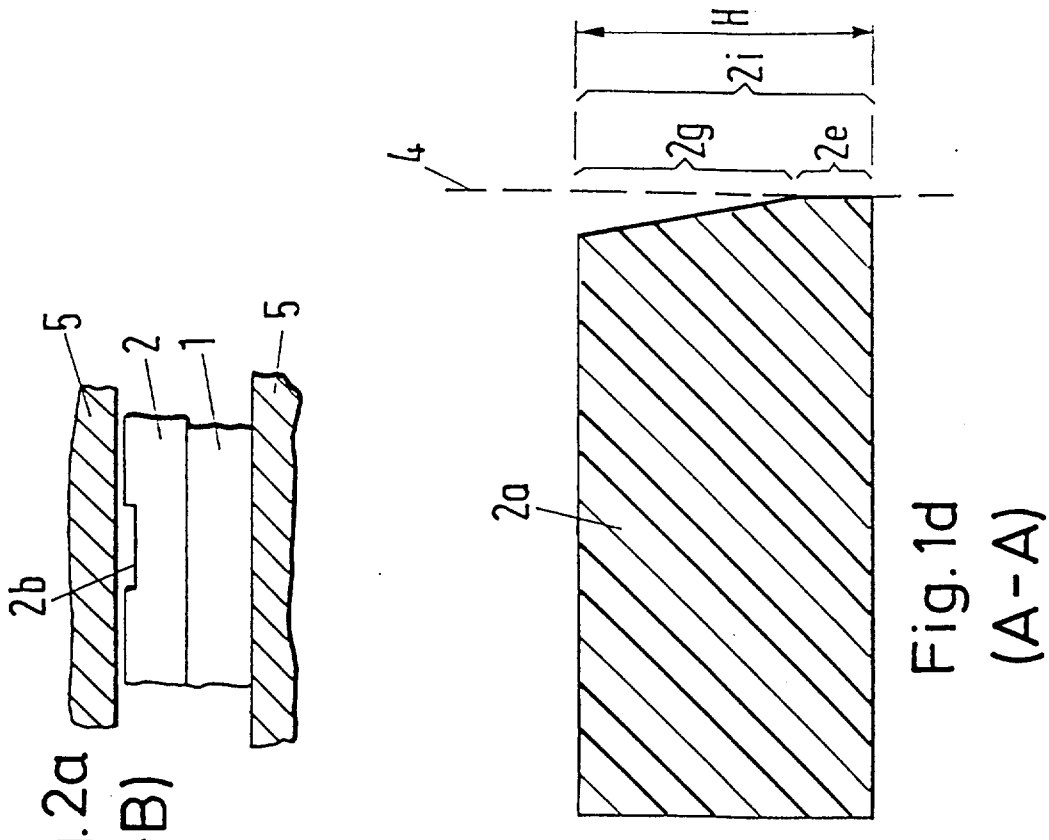


Fig.1d
(A-A)

Fig.2a
(B-B)

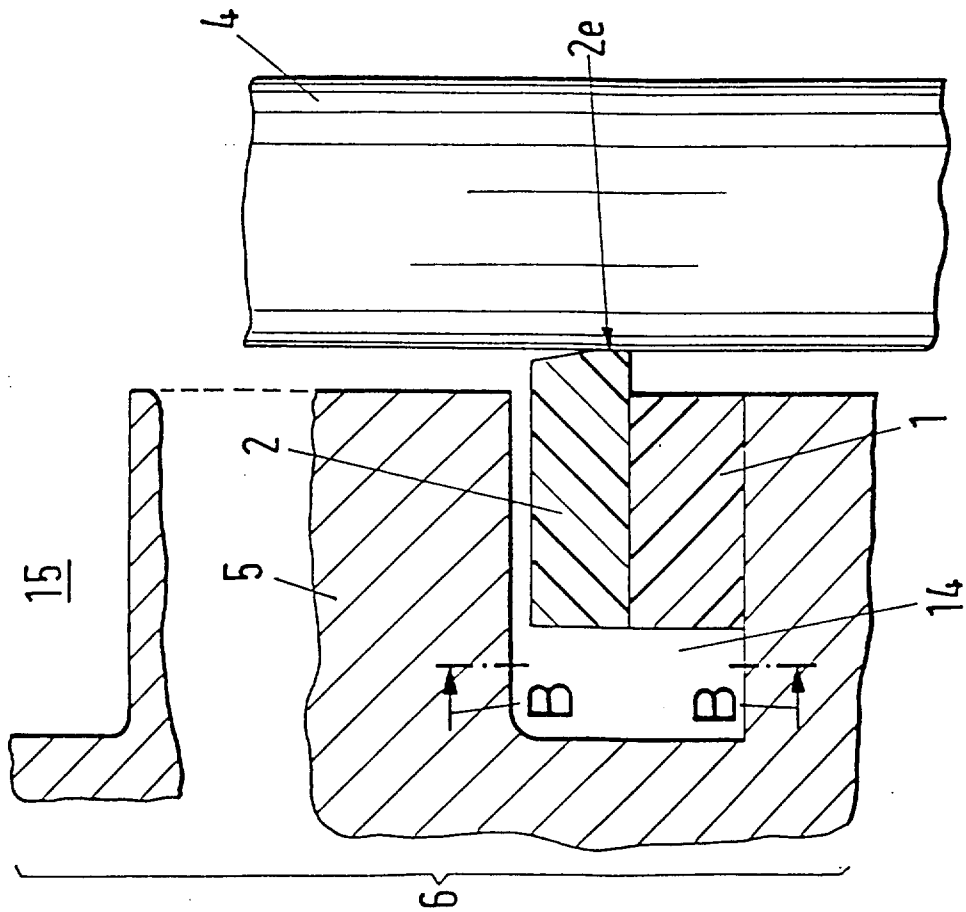
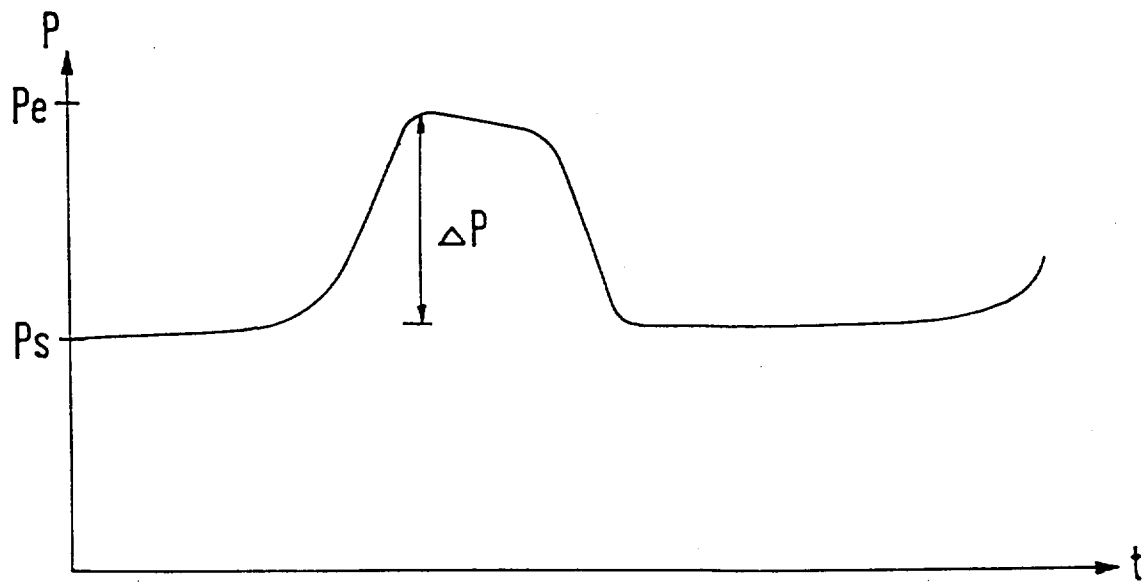


Fig. 2

Fig. 3



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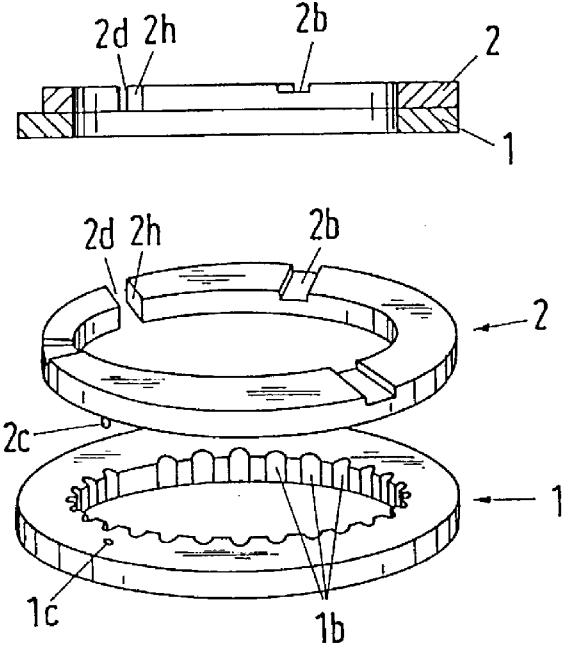
2d
2h
2b
2
1
2d
2h
2b
2
2c
1
1c
1b