(19) DANMARK

(10) DK/EP 2761198 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *F 16 D 65/092 (2006.01)* *F 16 D 55/226 (2006.01)* *F 16 D 65/095 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2018-02-12**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2017-12-27**

(86) Europæisk ansøgning nr.: **12759109.7**

(86) Europæisk indleveringsdag: **2012-09-13**

(87) Den europæiske ansøgnings publiceringsdag: **2014-08-06**

(86) International ansøgning nr.: **EP2012067888**

(87) Internationalt publikationsnr.: **WO2013045275**

(30) Prioritet: **2011-09-28 DE 102011115213**

(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**

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(54) Benævnelse: **Skivebremse, samt bremsebelægning til en skivebremse**

(56) Fremdragne publikationer:
DE-A1- 2 925 785
DE-A1-102007 057 992
US-A- 4 289 216

Disc brake, and brake lining for a disc brake

The invention relates to a disc brake according to the preamble of claim 1 and to a brake lining for a disc brake.

Such disc brakes are primarily used in commercial vehicles. For braking, upon actuation of a clamping means, also referred to as a brake application means, firstly an application-side brake lining and consequently a reaction-side brake lining are pressed against the brake disc. The brake linings are usually positioned in lining channels of a fixed-location brake carrier, where, at the time of a braking operation, they bear against brake carrier horns, in the direction of rotation of the brake disc, through which the forces arising during braking, or the braking torque acting on the brake linings, are absorbed.

The application of the brake, i.e. the bearing or abutment of the brake linings against the brake disc on both sides, during which the brake application force acts in the axial direction of the brake disc, leads to a loading of the brake calliper and, in the case of a correspondingly high braking force, to its deformation such that the brake calliper widens in the axial direction on its side facing towards the brake disc axis. In this way, the opposite-lying area of the rear-end wall of the brake calliper, which faces towards an assembly opening for inserting the brake linings and forms a bearing surface, or abutment surface, is pressed with greater strength against the lining carrier plate. In other words, the pressure distribution of the reaction-side lining carrier plate is variable.

Over the lifespan of the reaction-side brake lining, the uneven bearing pressure, or contact pressure, leads to significant wear, namely the radial wear that arises in a slanting form (i.e. obliquely) of the friction lining in the area facing towards the assembly opening.

A certain wear limit is already reached in this area while the friction lining, for the rest, is still sufficiently thick. The brake lining therefore has to be replaced prematurely, which is counterproductive to the desired longest possible service life.

To remedy this, it is proposed in DE 29 25 785 A1, in accordance with the preamble of claim 1, to form a gap, which is wider with respect to the adjacent area, between the rear-end wall of the brake calliper and the reaction-side brake lining in an area facing towards an assembly opening of the brake calliper in the non-operating position. This is achieved in that the lining carrier plate, on its rear side facing

towards the rear-end wall of the brake calliper, is bevelled towards the assembly opening.

A comparable disc brake is known from DE 10 2007 057 992 A1. Here, the bevelled rear side of the brake lining has a receptacle, or recess, which serves to receive a casting burr.

However, this results in substantial production-orientated problems during the manufacture of the brake lining, these being due to the bevelled design, or sloping formation, of the rear side. The friction lining is usually applied to the lining carrier plate by pressing under high pressures and increased temperatures. In this process, the lining carrier plate lies with its rear side on a planar thrust bearing of a pressing tool. The support required in order to absorb the pressing force in the vertical direction is not ensured by the bevel, or sloped formation, of the rear side, with the consequence that the friction lining is not applied sufficiently homogeneously. This leads to a reduction in the service life of the friction lining and, under certain conditions, to the operational reliability of the brake lining as a whole being limited.

In addition to this, the reduced support of the lining carrier plate leads to a high level of wear of the expensive pressing tool due to lateral forces arising, and this is also problematic.

All in all, this brake lining does not therefore satisfy the demand for an optimised service life and the most cost-effective production that is possible.

It is the object of the invention to further develop a disc brake of the generic type and also a brake lining for a disc brake so that their service life is optimised and the operational reliability is improved.

This object is achieved through a disc brake having the features of claim 1 and through a brake lining having the features of claim 4.

Through the invention it is ensured that the lining-related wear of the reaction-side brake lining arises evenly, as a result of which a longer service life is achieved.

In this respect, the deformation of the brake calliper in the sense described can be taken into consideration. In fact, even a design of the brake calliper with a lighter weight is possible, since for this purpose the fairly large gap between the rear-end wall of the brake calliper and the reaction-side brake lining, as provided according to the invention in the non-applied position of the disc brake, merely has to be

correspondingly adapted in an area facing towards the assembly opening of the brake calliper with respect to the adjacent area, i.e. being widened.

The lighter construction of the brake calliper that is possible through the invention is very accommodating with respect to the constant requirement for weight optimisation of the disc brake. In particular, this results in the fuel consumption being reduced and the operating costs thereby being lowered without affecting the functional reliability. In addition, the production costs are also favourably influenced through the material reduction in the design of the new brake calliper.

In addition to this, the invention offers the advantage that a deformation of the brake disc, occurring due to the braking heat, in the axial direction is not critical insofar as the brake lining can now deflect in the area of the assembly opening, the largest expansion of the brake disc. Thus, the pressure distribution between the friction lining and the brake disc is improved and the crack sensitivity of the brake disc, having long since been a problematic issue, is now reduced.

Depending on the brake application force and thus the degree of deformation of the brake calliper, the rear-end wall of the brake calliper increasingly comes to bear against the lining carrier plate of the brake lining, wherein the surface pressure, which results from the force applied and the bearing area between the rear-end wall of the brake calliper and the lining carrier plate, remains substantially constant throughout the entire brake application process

The wider gap is realised according to the invention through a receptacle, the dimensions of which are determined by the deformation behaviour of the brake calliper, and which extends spaced apart from the edges of the lining carrier plate delimiting the long sides.

Since the rear side, lying opposite the friction lining, extends with the receptacle as a whole parallel to the side carrying the friction lining, a full-surface bearing of the lining carrier plate in the pressing tool, which is positioned exactly transversely to the pressing direction, is produced during the manufacturing process of the brake lining.

At least the two edge areas of the rear side of the lining carrier plate assigned to the long sides of the lining carrier plate are planar and thus form a full support.

The receptacle can be designed so that the adjacent planar areas have a large surface area, which guarantees a good heat transfer and an even introduction of force.

This in turn is a prerequisite for achieving a homogeneous strength of the friction lining, as required for both service life optimisation and also for high operational reliability.

In addition to this, the wear of the pressing tool is reduced through the even force distribution during the pressing process, with the result that the invention leads to a quite remarkable reduction in the production and operating costs.

Usually, the brake linings in their contour correspond to the brake disc, i.e. they are formed in the sense of a circular ring segment. The contour of the receptacle corresponds to that of the bearing surface of the wall and extends almost over the entire length of the lining carrier plate or is segmented corresponding to the configuration and the deformation behaviour of the brake calliper. Here, the receptacle can extend symmetrically or asymmetrically to the radial axis.

Depending upon requirements, the receptacle in the lining carrier plate can have a sharp-edged design or have flat transitions to the adjacent areas raised with respect to the receptacle, wherein the angles of the transitions are adapted to the deformations to be expected during the operation. The depth of the receptacle is dependent on the production possibility, but in particular on the strength of the lining carrier plate and it is preferably between 0.5 and 2 mm.

In addition to a production of the receptacle through a machining process, the receptacle can also be produced through a moulding or shaping process, for example by imprinting or similar. It is also conceivable to produce the receptacle through an eroding-type process or to incorporate it during the formation of the lining carrier plate as a casting during the casting, or moulding, process.

In contrast with this one-piece design of the lining carrier plate, the receptacle can also be incorporated into an insert that can be inserted into the lining carrier plate.

In any case there is a possibility of subsequently inserting the new brake lining into an existing brake calliper, for example in the course of a replacement, meaning that the advantages of the invention also materialise with existing brake systems.

Further advantageous configurations of the invention are characterised in the sub-claims.

Exemplary embodiments of the invention are described below based on the attached drawings, in which:

Fig. 1	shows a disc brake according to the invention in a cut apart, schematic lateral view in the non-operating position,
Fig. 2	shows the disc brake according to Fig. 1 in the operating position,
Figs. 3 - 5	show exemplary embodiments according to the invention in a rear view,
Figs. 6 and 7	each show an exemplary embodiment of the brake lining according to the invention in a cross-section, according to the line A-A,
Fig. 8	shows a further exemplary embodiment of a brake lining in a rear view,
Fig. 9	shows the brake lining according to Fig. 8 in cross-section.

Figs. 1 and 2 show, schematically, a part of a disc brake, Fig. 1 depicting a position in which the disc brake is not yet fully applied, Fig. 2 depicting the position in a full brake application.

The disc brake has a brake calliper 1 designed as a floating calliper, which comprises a brake disc 3 and in which an application-side brake lining 5 and a reaction-side brake lining 4 are arranged. In the event of a braking process by means of a brake application means 8, these brake linings 5, 4 can be pressed on both sides against the brake disc 3.

Here, the reaction-side brake lining 4 is supported with a lining carrier plate 6 carrying a friction lining 7 on a rear-end wall 2 of the brake calliper 1, the bearing surface of which is shown as a hatched area in the drawings.

Between the rear-end wall 2 of the brake calliper 1 and the reaction-side brake lining 4, a gap that is fairly wide with respect to the adjacent area is formed in an area facing towards an assembly opening 11, via which the brake linings 4, 5 can be inserted, in the non-operating position of the brake, corresponding to Fig. 1. The length of the gap corresponds in the example shown in Figs. 3 and 8 at least to the

length L of the abutment of the wall 2 against the lining carrier plate 6 in the contact position.

This gap is formed through a receptacle 9 provided in the lining carrier plate 6 on its rear side 12 facing towards the wall 2, wherein the cross-sectional profile thereof, corresponding to the exemplary embodiments according to Figs. 6 and 7, can vary. The rear side 12 extends parallel to a side 13 carrying the friction lining.

While Fig. 1, as mentioned, shows the disc brake in a non-operating position, in which the brake calliper 1 is in its starting form, Fig. 2 shows a deformation of the brake calliper 1 as produced during a full brake application.

It can clearly be seen that the brake calliper has spread open on the side facing away from the assembly opening 11, such that the wall 2 lying opposite lies against the receptacle 9, of which the contour is adapted to the wall profile 2.

In Figs. 3 to 7, a lining carrier plate 6 of the reaction-side brake lining 4 is shown, whereby Figs. 3 to 5 clearly show the profile of the receptacle 9, which extends thereby adapting to the individual contour of the bearing surface in the brake calliper.

In Fig. 4, the lining carrier plate 6 is provided with two receptacles arranged on both sides of a radial axis 11, into which the wall 2 adapted thereto, with its bearing surfaces immerses. Here, the two receptacles 9 are arranged mirror-symmetrically with respect to the radial axis 11.

In Fig. 5, two receptacles 9 can likewise be seen in the lining carrier plate 6, but which extend asymmetrically to the radial axis 11, the arrangement thereof likewise being dependent on the deformation behaviour of the wall 2.

In Fig. 6, the receptacle 9 can be seen in cross-section. In this variant, the receptacle 9 is of a sharp-edged design, whereas, in the example in Fig. 7, the receptacle 9 has a lower area flattened away from the upper edge area 14 convexly curved at the edge side, wherein the receptacle 9 in Fig. 7a), starting from the upper edge area 14, initially merges as a planar surface 9' parallel to the rear side 12 into a bevel 9".

In Fig. 7b), on the other hand, the receptacle 9 is designed exclusively as a bevel 9" extending in the direction of the edge area 14. In other respects, the edge area 14 and the area of the rear side 12 located opposite are arranged aligned with each other, i.e. being arranged in a common plane extending parallel to the side 13. The thickness of the lining carrier plate 6 in this area is therefore the same.

As with the examples shown in Figs. 3 to 5, the receptacle 9 in the variant shown in Fig. 8 is also arranged in the upper half of the lining carrier plate 6 assigned to the convex outer edge.

In this example, the receptacle 9 is incorporated into an insert 10, which is inserted into the lining carrier plate 6. Obviously, the receptacle 9 in the insert 10 can also be provided in the form proposed in Figs. 7a) and 7b).

Patentkrav

1. Skivebremse til et erhvervskøretøj, med en bremsesaddel (1), der omfatter en bremseskive (3) og er udformet som skydesaddel, i hvilken bremsesaddel der er anbragt en bremsebelægning (5, 4) på tilspændingssiden og en på reaktionssiden, hvilke ved en bremsning kan presse mod bremseskiven (3) på begge sider ved hjælp af en tilspændingsindretning (8), hvor bremsebelægningen (4) på reaktionssiden støtter sig på en bagvæg (2) af bremsesadlen (1) med en belægningsbærepladе (6), som har en friktionsbelægning (7), og der mellem bagvæggen (2) af bremsesadlen (1) og bremsebelægningen (4) på reaktionssiden i et område, der vender mod en monteringsåbning (11) af bremsesadlen (1), i ikkefunktionsstillingen er dannet en spalte, der er bredere i forhold til det tilgrænsende område, hvis længde i det mindste svarer til længden (L) af væggens (2) anlæg mod belægningsbærepladen (6) i kontaktpositionen, **kendetegnet ved, at** spalten er dannet af mindst en udsparing (9) af belægningsbærepladen (6), der er indført i den plane bagside (12), der er parallel med den side (13), der bærer friktionsbelægningen (7), hvor udsparingen (9) forløber i afstand fra de kanter af belægningsbærepladen (6), der afgrænser de langsgående sider.

2. Skivebremse ifølge krav 1, **kendetegnet ved, at** udsparingens (9) tværsnitsforløb er tilpasset til den anlægsvinkel af væggen (2), der ændrer sig ved hjælp af bremsekraft ved tilspænding af bremsen ved deformering af bremsesadlen (1).

3. Skivebremse ifølge krav 1 eller 2, **kendetegnet ved, at** spalten udvider sig i stigende grad i retning mod monteringsåbningen (11).

4. Bremsebelægning til en skivebremse, med en belægningsbærepladе (6) og en på denne fastgjort friktionsbelægning (7), **kendetegnet ved, at** belægningsbærepladen (6) på den plane bagside (12), der vender bort fra bremsebelægningen (7) og er parallel med den side (13), der bærer friktionsbelægningen (7), har mindst en udsparing (9), som strækker sig i belægningsbærepladens (6) længderetning, og som forløber i afstand fra de kanter af belægningsbærepladen (6), der afgrænser langsiderne.

5. Bremsebelægning ifølge krav 4, **kendetegnet ved, at** udsparingen (9) forløber buet eller i det mindste bare knækket.

6. Bremsebelægning ifølge krav 4 eller 5, **kendetegnet ved, at** udsparingen (9) er anbragt i den halvdel af belægningsbærepladen (6), der vender mod den konvekse yderside.

7. Bremsebelægning ifølge et af kravene 4-6, **kendetegnet ved, at** udsparingen (9) er udformet med skarp kant eller i det mindste i tværsnit fladt forløbende på den side, der vender bort fra den konvekse side.

8. Bremsebelægning ifølge et af kravene 4-7, **kendetegnet ved, at** udsparingen (9) er tilvejebragt i en indsats (10), som er forsænket i belægningsbærepladen (6).

9. Bremsebelægning ifølge et af kravene 4-8, **kendetegnet ved, at** de flere udsparinger (9) er anbragt symmetrisk eller asymmetrisk med radialaksen (11).

Fig. 1

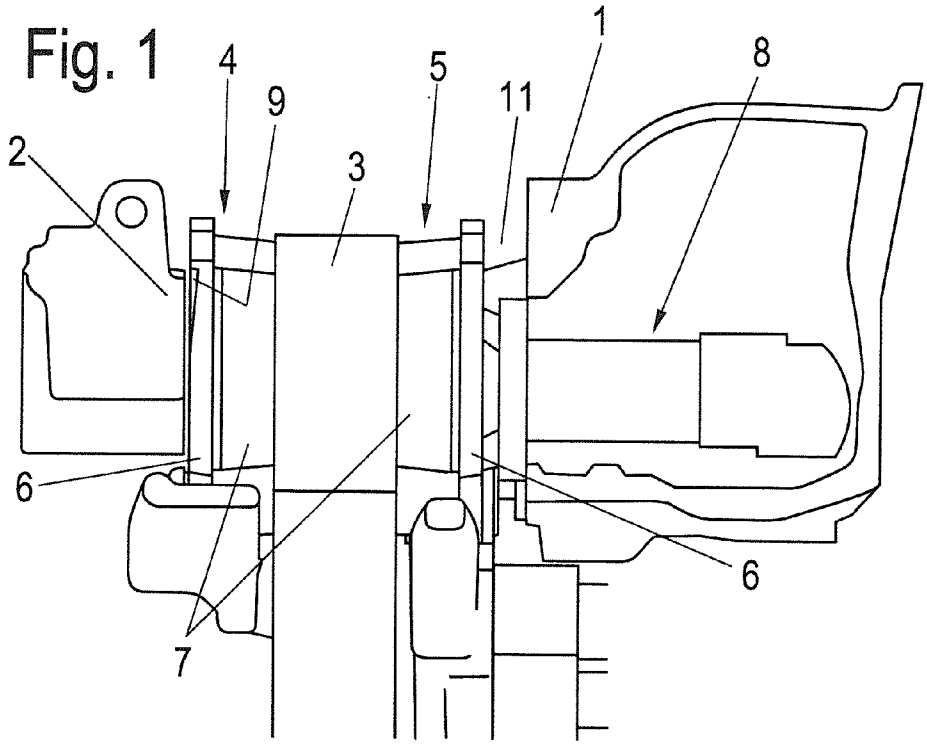
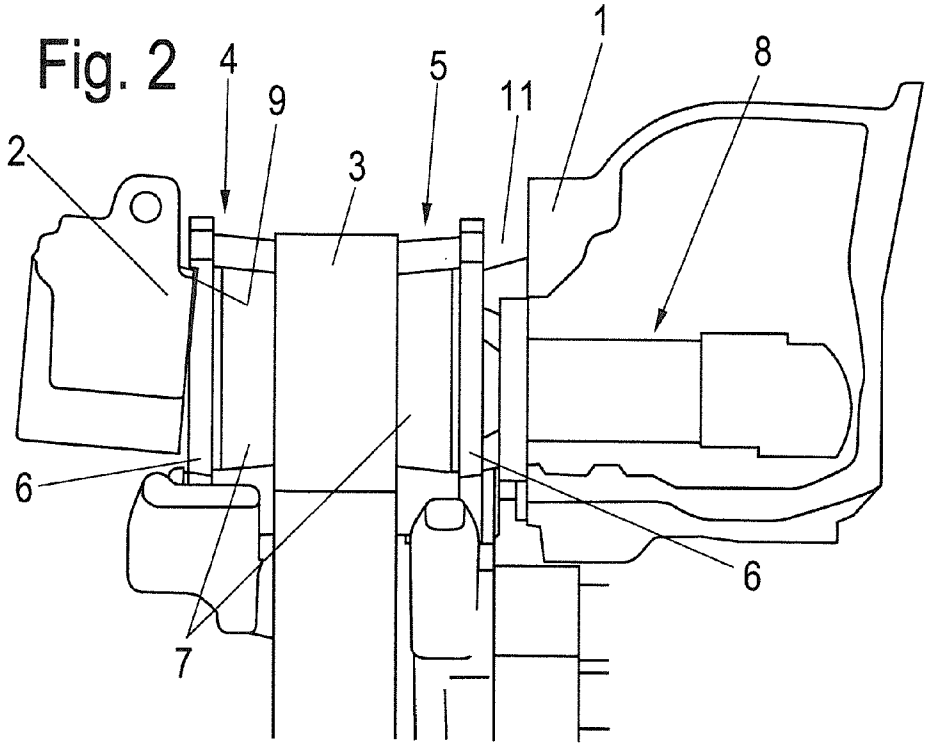


Fig. 2



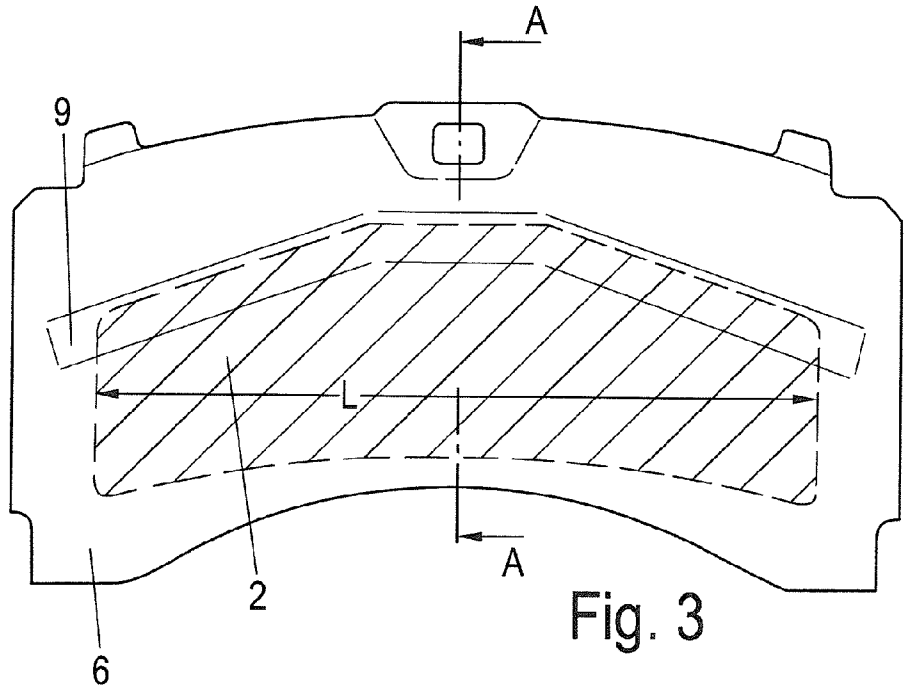


Fig. 3

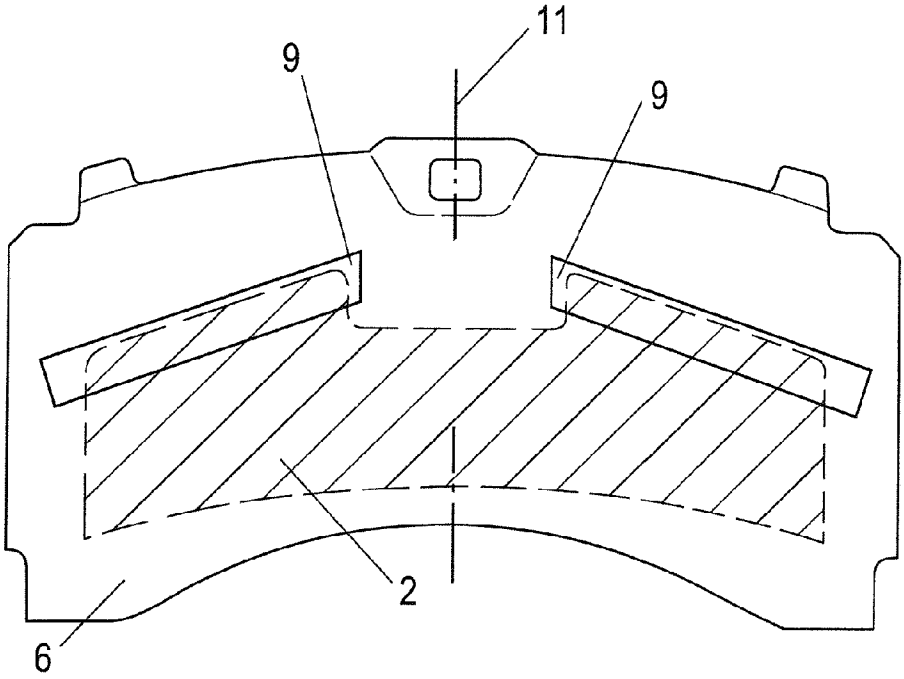


Fig. 4

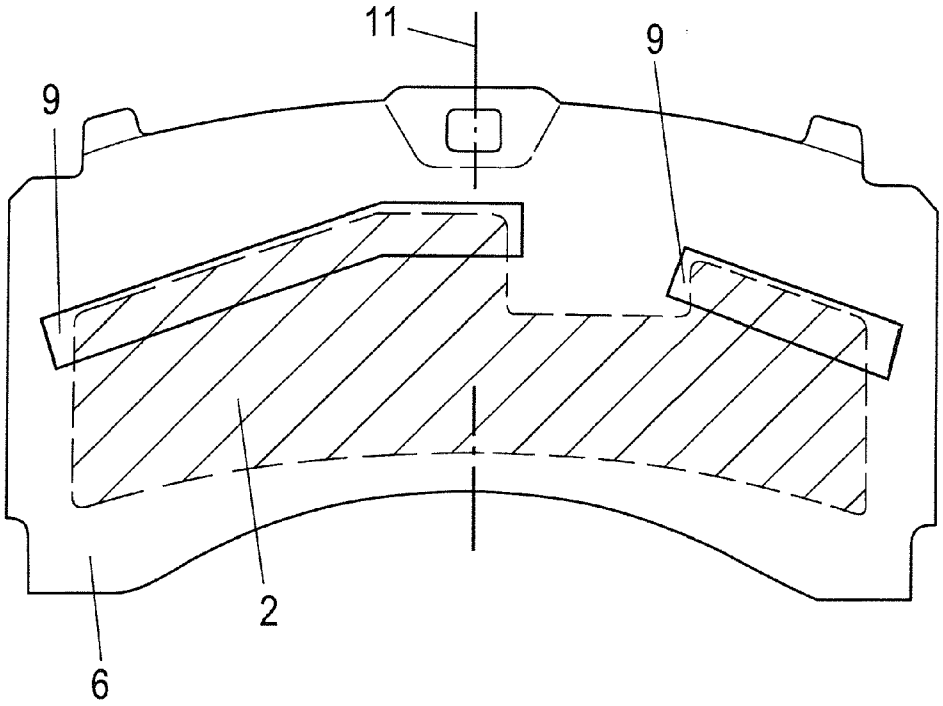


Fig. 5

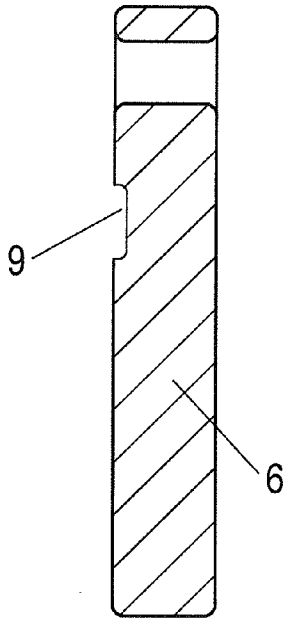


Fig. 6

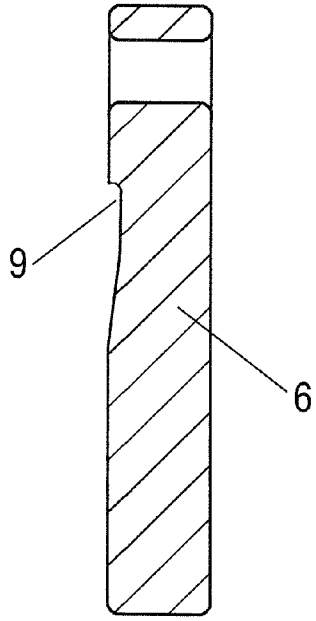


Fig. 7

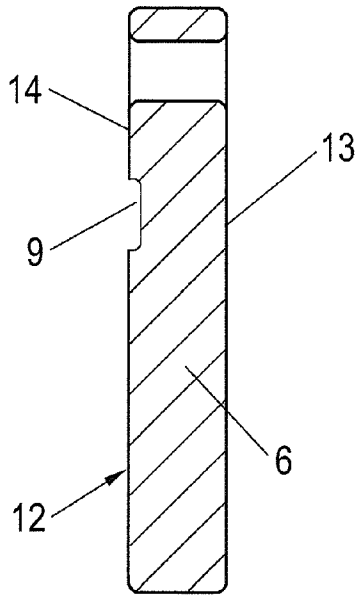


Fig. 6

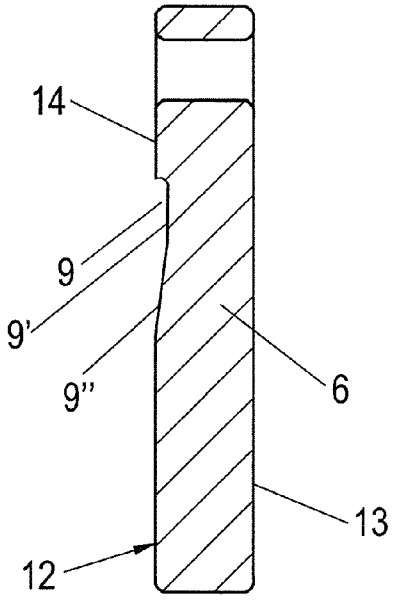


Fig. 7a

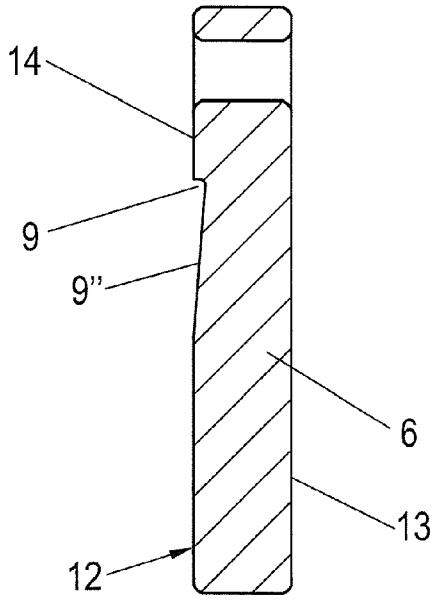


Fig. 7b

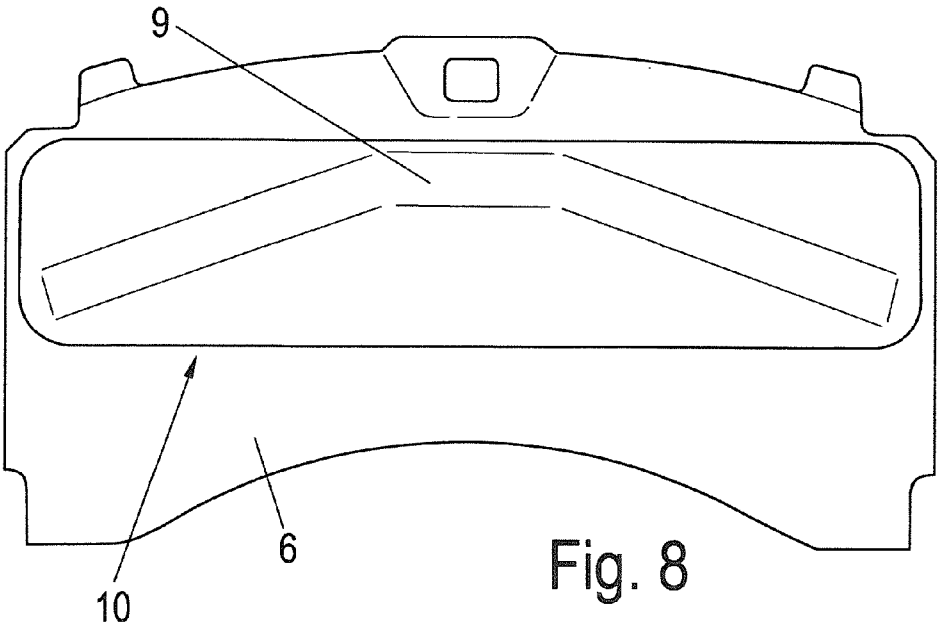


Fig. 8

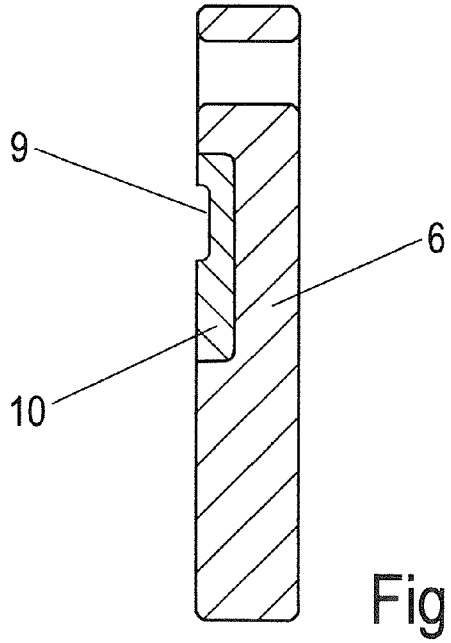


Fig. 9