



EUROPEAN PATENT SPECIFICATION

Date of publication of patent specification :
19.08.92 Bulletin 92/34

Int. Cl.⁵ : **B24B 5/42, B24B 21/02**

Application number : **89200704.8**

Date of filing : **17.03.89**

Device for grinding a bearing journal of the crankshaft of a combustion engine, in particular a diesel engine.

Priority : **29.03.88 NL 8800793**

Date of publication of application :
04.10.89 Bulletin 89/40

Publication of the grant of the patent :
19.08.92 Bulletin 92/34

Designated Contracting States :
AT BE CH DE ES FR GB GR IT LI LU NL SE

References cited :
CH-A- 174 727
DE-A- 1 577 434

Proprietor : **Aarts, Cornelis Johannes**
Oude Liesboslaan 277
NL-4839 AC Breda (NL)
Proprietor : **Van Beurden, Gerardus Hendrikus**
Veilingweg 17
NL 5301 KM Zaltbommel (NL)

Inventor : **Aarts, Cornelis Johannes**
Oude Liesboslaan 277
NL-4839 AC Breda (NL)
Inventor : **Van Beurden, Gerardus Hendrikus**
Veilingweg 17
NL 5301 KM Zaltbommel (NL)

Representative : **de Bruijn, Leendert C. et al**
Nederlandsch Octrooibureau
Scheveningseweg 82 P.O. Box 29720
NL-2502 LS 's-Gravenhage (NL)

EP 0 335 440 B1

Note : Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

Description

The invention relates to a method for grinding a bearing journal of the crankshaft of a combustion engine, in particular a diesel engine without removing it from the engine.

In diesel engines, in particular those used for the propulsion of ships, a so-called wear ridge often occurs on one or more of the bearing journals of the crankshaft after a long period of use, a phenomenon which results from the lubricating groove present in the bearing shells. For further good functioning of the engine, such a wear ridge must be removed by grinding the bearing journal in question absolutely round again to a diameter slightly smaller than the original diameter.

In DE-A-1577434 a hand operated device for grinding a bearing journal of the crankshaft of e.g. a diesel engine is disclosed, which device comprises a support provided with handles and in which two rollers are journaled of which one roller is driven, over which an endless grinding belt is passed. Between said rollers a pressure member is removably connected to said support, said member having a concave groove at its lower pressure surface, said groove having a curvature which corresponds with the curvature of the journal to be treated. Further guiding elements are provided on both sides of the pressure member which bear against the surface of the journal to be treated at points which are situated on two spaced apart lines extending parallel to the axis of the journal to be treated.

The known devices for grinding bearing journals of a crankshaft are designed in such a way that they can rotate about the bearing journal in question. Very thin bearing shells are, however, used nowadays in engines, and after removal they leave too little space for these devices.

In these engines the bearing journal therefore cannot be ground on the spot inside the engine, so that the crankshaft has to be dismantled completely and taken off the vessel, which generally means that an opening has to be burned out in the ship's skin, and the crankshaft is then treated on a special crankshaft grinding machine and subsequently replaced in the engine.

It goes without saying that this process is very expensive and takes a long time, during which the vessel is out of service.

The object of the invention is to provide a method of the type mentioned above, by which the crankshaft of even today's engines with thin bearing shells can be treated in the engine as regards grinding one or more of its bearing journals.

This object is achieved in that in the method according to the invention a device comprises a support having mounted thereon two upright elements which extend essentially along two parallel planes

spaced apart, and which are provided at their top ends with a circular arc-shaped, concave guide edge in such a way that the imaginary straight line through the centre points of the two circular arcs is perpendicular to the two upright elements and forms the axis of an imaginary cylindrical surface, the diameter of each circular arc being essentially equal to the original diameter of the bearing journal to be treated, and the shortest distance between the guide edges being smaller than the axial length of the bearing journal to be treated, but being greater than the axial dimension of the attacked part of this journal, and the device also has at least one grinding element which is fitted below the guide edges between the upright elements, and the grinding surface of which touches the above-mentioned imaginary cylindrical surface at least along a line, is held by means which are also present with said guide edges pressed against the journal to be treated on either side of the grinding surface, the crankshaft is rotated so that the journal to be treated rotates about its axis, which essentially coincides with the above-mentioned imaginary axis and the journal part to be ground is conveyed in an essentially absolutely circular path along the grinding surface, while this surface is held in a particular fixed position relative to the said axis.

The invention relates also to a device for executing the method which device comprises a support having mounted thereon two upright elements which extend essentially along two parallel planes spaced apart, and which are provided at their top ends with a circular arc-shaped, concave guide edge in such a way that the imaginary straight line through the centre points of the two circular arcs is perpendicular to the two upright elements and forms the axis of an imaginary cylindrical surface, the diameter of each circular arc being equal to a predetermined diameter and the shortest distance between the guide edges having a predetermined dimension, and the device also has at least one grinding element which is fitted below the guide edges between the upright elements, and grinding surface of which touches the above-mentioned imaginary cylindrical surface at least along a line, and means to ensure that the guide edges can be held pressed against the journal to be treated on either side of the grinding surface.

Thus a device designed in this way does not rotate about the journal to be treated, but is put against the journal to be treated at a place where there is always sufficient space inside the engine, generally below the journal to be treated.

The grinding element is preferably disposed adjustably in such a way between the upright elements that the grinding surface can be moved parallel to itself at least in the direction towards the imaginary axis, so that, when it is found after some time that the grinding surface of the grinding element is no longer lying sufficiently against the journal to be able to

carry out its grinding action, this grinding surface can be moved slightly,

The grinding element is disposed adjustably in an advantageous manner between the upright elements in such a way that the ends of the line along which the grinding surface essentially touches the above-mentioned cylindrical surface can be moved independently of each other towards and away from the imaginary axis, so that the grinding surface can be set accurately.

The grinding element preferably has a rotary roller, whose axis of rotation runs essentially parallel to the above-mentioned imaginary axis, the above-mentioned adjustability being obtained through the fact that the roller is mounted on its axis of rotation, said axis being provided at both ends with an eccentric journal, said journals being in line with each other and each being accommodated in an eccentric sleeve which is rotatably connected to the upright element in question.

Since the use of an endless grinding belt as the grinding surface offers many advantages in general for grinding operations the rotary roller is preferably a supporting roller for an endless grinding belt running over the roller and also being guided around at least one drive roller.

The above-mentioned pressure means are preferably formed by a compressed gas-filled cushion under the frame. This ensures that any movements of the crankshaft which may occur during the grinding are followed.

It can be desirable to prevent the guide edges from shifting in the axial direction relative to the journal to be treated. For this, outward-projecting guide elements can be disposed on the upright elements, near their guide edges.

The invention is described in greater detail with reference to the drawing, in which:

Fig. 1 shows an example of an embodiment of the device according to the invention;

Fig. 2 shows a section along the line II-II in Fig. 1; and

Figs. 3 and 4 show more clearly the adjustment means for the pressure roller.

As shown in Fig. 1, the device comprises a frame made of a U-section 1, with a U-section 3 fastened thereto by means of strips 2. Two upright elements 4, 4', in the form of plates, are mounted on either side of the U-section 3, and are held extending accurately parallel to each other by the spacing sleeves 5. Each plate 4, 4' is provided at its top end with a circular arc-shaped concave recess along which a guide edge 6, 6' of, e.g., aluminium is disposed.

Extending between the plates 4 and 4' is a shaft 7 which at both ends merges into an eccentric journal 8, 8', said journals 8, 8' being in line with each other. These journals 8, 8' are accommodated in eccentric sleeves 9, 9' which are fixed rotatably inside aper-

tures disposed in the plates 4, 4'.

A supporting roller 10 is mounted on the shaft 7 by means of ball bearings in such a way that it rotates about the shaft 7. An endless grinding belt 11 runs round the supporting roller 10 and also runs around a driven roller 12 and a tensioning roller 13. The shaft of the tensioning roller 13 can be moved to and fro along the forks 14 by means of adjusting screws (not shown), and said forks 14 can be moved jointly relative to the frame 3 by means of the set bolt 15 with locking nut.

Guide blocks 16, 16', which are adjustable due to the fact that they are provided with eccentric apertures, are fitted on the outsides of the plates 4, 4'.

The whole device is supported by an air cushion 17 when it is in operation.

When the device is in operation, it is placed under the bearing journal 18 of a crankshaft 19 to be treated, and by increasing the air pressure inside the air cushion 17, the guide edges 6, 6' are pressed against the non-attacked parts 18' of the bearing journal 18. Since these non-attacked parts 18', with the original diameter of the journal 18, are still absolutely round, the imaginary axis through the centre points of the circular arcs formed by the guide edges 6, 6' will coincide with the axis of the journal bearing 18. The crankshaft 19 is then turned slowly by means of the turning engine, for example at a speed of 3/4 r.p.m., while the motor driving the driven roller 12 is put into operation, so that the grinding belt 11 is put into rotary motion, while the part of this belt running over the supporting roller 10 has a grinding effect on the bearing journal 18.

Due to the fact that the shaft 7 of the supporting roller 10 is fixed in plates 4, 4' in a specific position relative thereto, said shaft 7 and thereby also the top part of the periphery of the supporting roller 10 is in a fixed position relative to the above-mentioned imaginary axis, and therefore also relative to the axis of the journal to be treated, so that when said journal is rotated the attacked part thereof to be ground is conveyed along the part of the grinding belt 11 running over the supporting roller 10, this part being at a fixed distance from the axis of the journal 18. The shaft 7 of the supporting roller 10 is generally set in such a way that said shaft runs parallel to the above-mentioned imaginary axis, so that the journal part to be ground is ground absolutely round to a specific diameter over the entire axial length thereof. If, however, the journal 18 has a certain taper, it can be corrected by turning the sleeves 9, 9' slightly, so that the shaft 7 can be set slightly at an angle.

If necessary, the shaft - and thus the periphery of the supporting roller - can be moved towards or away from the journal 18 to be treated, by turning the shaft 7 a little.

In order to prevent the device from shifting in the axial direction relative to the journal 18, the guide

blocks 16, 16' are forced against the particular radius of the journal 18, as shown in Fig. 2.

Claims

1. A method of grinding a bearing journal of the crankshaft of a combustion engine, in particular a diesel engine without removing it from the engine, characterized in that a device which comprises a support having mounted thereon two upright elements which extend essentially along two parallel planes spaced apart, and which are provided at their top ends with a circular arc-shaped, concave guide edge in such a way that the imaginary straight line through the centre points of the two circular arcs is perpendicular to the two upright elements and forms the axis of an imaginary cylindrical surface, the diameter of each circular arc being essentially equal to the original diameter of the bearing journal to be treated and the shortest distance between the guide edges being smaller than the axial length of the bearing journal to be treated, but being greater than the axial dimension of the attacked part of this journal, and which device further comprises at least one grinding element which is fitted below the guide edges between the upright elements, and the grinding surface of which touches the above-mentioned imaginary cylindrical surface at least along a line, is held by means which are also present with said guide edges pressed against the journal to be treated on either side of the grinding surface, the crankshaft is rotated so that the journal to be treated rotates about its axis, which essentially coincides with the above-mentioned imaginary axis, and the journal part to be ground is conveyed in an essentially absolutely circular path along the grinding surface, while this surface is held in a particular fixed position relative to the said axis.

2. Device for executing the method according to claim 1, characterized in that the device comprises a support (1, 3) having mounted thereon two upright elements (4, 4') which extend essentially along two parallel planes spaced apart, and which are provided at their top ends with a circular arc-shaped, concave guide edge (6, 6') in such a way that the imaginary straight line through the centre points of the two circular arcs is perpendicular to the two upright elements and forms the axis of an imaginary cylindrical surface, the diameter of each circular arc being equal to a predetermined diameter and the shortest distance between the guide edges having a predetermined dimension and the device also has at least one grinding element (11) which is fitted below the guide edges between the upright elements, and the grinding surface of which touches the above-mentioned imaginary cylindrical surface at least along a line, and means (17) to ensure that the guide edges can be held pressed against the journal to be treated on

either side of the grinding surface.

3. Device according to claim 2, characterized in that the grinding element (11) is disposed adjustably in such a way between the upright elements (4, 4') that the grinding surface can be moved parallel to itself at least in the direction towards the imaginary axis.

4. Device according to claim 2 or 3, characterized in that the grinding element (11) is disposed adjustably between the upright elements (4, 4') in such a way that the ends of the line along which the grinding surface essentially comes into contact with the above-mentioned cylindrical surface can be moved independently of each other towards and away from the imaginary axis.

5. Device according to claims 2-4, characterized in that the grinding element (11) has a rotary roller (10) whose axis of rotation runs essentially parallel to the imaginary axis.

6. Device according to claim 5, characterized in that the roller (10) can rotate about an axis which is provided at both ends with an eccentric journal (8, 8'), said journals being in line with each other and each being accommodated in a sleeve (9, 9') which is connected to the upright element in question.

7. Device according to claim 6, characterized in that the sleeves are eccentric sleeves (9, 9') which are rotatably connected to the upright elements.

8. Device according to claims 5-7, characterized in that the roller is a supporting roller (10) for an endless grinding belt (11) running over the roller and also being guided round at least one drive roller (12).

9. Device according to claims 2-8, characterized in that the above-mentioned pressure means are formed by a compressed gas-filled cushion (17) under the frame (1).

10. Device according to claims 2-9, characterized in that outward-projecting guide elements (16, 16') are provided on the upright elements (4, 4'), near their guide edges (6, 6').

Patentansprüche

1. Verfahren zum Schleifen eines Lagerzapfens einer Kurbelwelle eines Verbrennungsmotors, insbesondere eines Dieselmotors, ohne dessen Entfernen vom Motor, gekennzeichnet durch eine Vorrichtung mit einer Stütze mit zwei darauf angeordneten aufrechten Elementen, die sich im wesentlichen entlang zwei parallel beabstandeter Ebenen erstrecken und die an ihren Oberenden mit einer kreisförmig bogenförmigen, konkaven Führungskante so vorgesehen sind, daß die gedachte gerade Linie durch die Mittelpunkte der zwei kreisförmigen Bogen senkrecht zu den zwei aufrechten Elementen ist und die Achse einer gedachten zylindrischen Fläche bildet, wobei der Durchmesser jedes kreisförmigen Bogens im wesent-

lichen gleich dem Originaldurchmesser des zu bearbeitenden Lagerzapfens ist und der kürzeste Abstand zwischen den Führungskanten kleiner ist als die axiale Länge des zu bearbeitenden Lagerzapfens, jedoch größer als die axiale Abmessung des angegriffenen Teils des Zapfens, und wobei die Vorrichtung ferner mindestens ein Schleifelement aufweist, das unterhalb der Führungskanten zwischen die aufrechten Elemente gepaßt ist und dessen Schleiffläche die zuvor genannte gedachte zylindrische Fläche mindestens entlang einer Linie berührt, durch auch vorgesehene Einrichtungen gehalten wird, wobei die Führungskanten gegen den zu bearbeitenden Zapfen auf jeder Seite der Schleiffläche gedrückt werden, wobei die Kurbelwelle so gedreht wird, daß sich der zu bearbeitende Zapfen um seine Achse dreht, die im wesentlichen mit der zuvor genannten gedachten Achse zusammenfällt, und das zu schleifende Zapfenteil auf einem im wesentlichen absolut kreisförmigen Weg entlang der Schleiffläche bewegt wird, wobei die Fläche in einer bestimmten festen Position zu der Achse gehalten wird.

2. Vorrichtung zum Ausführen des Verfahrens nach Anspruch 1, dadurch gekennzeichnet, daß die Vorrichtung eine Stütze (1, 3) aufweist mit zwei darauf angeordneten aufrechten Elementen (4, 4'), die sich im wesentlichen entlang zwei parallel beabstandeter Ebenen erstrecken und die an ihren Oberenden mit einer kreisförmig bogenförmigen, konkaven Führungskante (6, 6') derart versehen sind, daß die gedachte gerade Linie durch die Mittelpunkte der zwei kreisförmigen Bogen senkrecht zu den zwei aufrechten Elementen ist und die Achse einer gedachten zylindrischen Fläche bildet, wobei der Durchmesser jedes kreisförmigen Bogens gleich einem vorbestimmten Durchmesser ist und der kürzeste Abstand zwischen den Führungskanten eine bestimmte Abmessung hat, und die Vorrichtung ferner mindestens ein Schleifelement (11) hat, das unterhalb der Führungskanten zwischen die aufrechten Elemente gepaßt ist und dessen Schleiffläche die zuvor genannte gedachte zylindrische Fläche mindestens entlang einer Linie berührt, und Einrichtungen (17), die sicherstellen, daß die Führungskanten gegen den zu bearbeitenden Zapfen auf jeder Seite der Schleiffläche gedrückt werden können.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß das Schleifelement (11) derart einstellbar zwischen den aufrechten Elementen (4, 4') angeordnet ist, daß die Schleiffläche parallel zu sich mindestens in die Richtung zur gedachten Achse bewegt werden kann.

4. Vorrichtung nach Anspruch 2 oder 1, dadurch gekennzeichnet, daß das Schleifelement (11) einstellbar zwischen den aufrechten Elementen (4, 4') derart angeordnet ist, daß die Enden der Linie, entlang der die Schleiffläche im wesentlichen mit der zuvor genannten zylindrischen Fläche in Kontakt kommt, un-

abhängig voneinander zur gedachten Achse hin und von dieser weg bewegt werden können.

5. Vorrichtung nach den Ansprüchen 2 bis 4, dadurch gekennzeichnet, daß das Schleifelement (11) eine Drehwalze (10) aufweist, deren Rotationsachse im wesentlichen parallel zu der gedachten Achse verläuft.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß sich die Walze (10) um eine Achse drehen kann, die an beiden Enden mit einem exzentrischen Zapfen (8, 8') vorgesehen ist, wobei die Zapfen miteinander fluchten und jeder von einer Buchse (9, 9') aufgenommen wird, die mit dem aufrechten, in Frage kommenden Element verbunden ist.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die Buchsen exzentrische Buchsen (9, 9') sind, die drehbar mit den aufrechten Elementen verbunden sind.

8. Vorrichtung nach den Ansprüchen 5 bis 7, dadurch gekennzeichnet, daß die Walze eine Stützwalze (10) für ein Endlosschleifband (11) ist, das über die Walze läuft und ebenso um mindestens eine Antriebswalze (12) geführt wird.

9. Vorrichtung nach den Ansprüchen 2 bis 8, dadurch gekennzeichnet, daß die zuvor genannten Druckeinrichtungen durch ein komprimiertes, gasgefülltes Kissen (17) unter dem Rahmen (1) gebildet werden.

10. Vorrichtung nach den Ansprüchen 2 bis 9, dadurch gekennzeichnet, daß nach außen vorstehende Führungselemente (16, 16') auf den aufrechten Elementen (4, 4') nahe ihren Führungskanten (6, 6') vorgesehen sind.

Revendications

1. Procédé pour rectifier un tourillon d'un vilebrequin d'un moteur à combustion interne, d'un moteur diesel en particulier, sans l'enlever du moteur, caractérisé en ce que, un dispositif qui comprend un support sur lequel sont montés deux éléments verticaux qui s'étendent sensiblement le long de deux plans parallèles écartés l'un de l'autre, et qui sont munis à leurs extrémités supérieures d'un bord de guidage concave en forme d'arc de cercle de telle manière que la ligne droite imaginaire passant par les centres des deux arcs de cercle est perpendiculaire aux deux éléments verticaux et forme l'axe d'une surface cylindrique imaginaire, le diamètre de chaque axe de cercle étant sensiblement égal au diamètre d'origine du tourillon à traiter et la plus courte distance entre les bords de guidage étant inférieure à la longueur axiale du tourillon à traiter, mais étant supérieure à la dimension axiale de la partie attaquée de ce tourillon, ledit dispositif comprenant en outre un élément de rectification qui est monté sous les bords de guidage entre les éléments verticaux et dont la surface de rectification

touche la surface cylindrique imaginaire mentionnée ci-dessus selon au moins une ligne, est maintenu par des moyens qui sont également présents, avec les bords de guidage pressé contre le tourillon à traiter de chaque côté de la surface de rectification, le vilebrequin est entraîné en rotation de sorte que le tourillon à traiter tourne autour de son axe, qui coïncide sensiblement avec l'axe imaginaire mentionné ci-dessus, et la partie du tourillon à rectifier se déplace selon un trajet sensiblement parfaitement circulaire le long de la surface de rectification, tandis que cette surface est maintenue dans une position fixe particulière par rapport audit axe.

2. Dispositif pour mettre en oeuvre le procédé selon la revendication 1, caractérisé en ce que le dispositif comprend un support (1, 3) sur lequel sont montés deux éléments verticaux (4, 4') qui s'étendent sensiblement selon deux plans parallèles écartés l'un de l'autre, et qui sont munies à leurs extrémités supérieures d'un bord de guidage concave en forme d'arc de cercle (6, 6') de telle manière que la ligne droite imaginaire passant par les centres des deux arcs de cercle est perpendiculaire aux deux éléments verticaux et forme l'axe d'une surface cylindrique imaginaire, le diamètre de chaque arc de cercle étant égal à un diamètre prédéterminé et la plus courte distance entre les bords de guidage ayant une valeur prédéterminée et en ce que le dispositif possède également au moins un élément de rectification (11) qui est monté au-dessous des bords de guidage entre les éléments verticaux et dont la surface de rectification touche la surface cylindrique imaginaire mentionnée ci-dessus selon au moins une ligne, et des moyens (17) pour garantir que les bords de guidage peuvent être maintenus pressés contre le tourillon à traiter de chaque côté de la surface de rectification.

3. Dispositif conforme à la revendication 2, caractérisé en ce que l'élément de rectification (11) est disposé de telle manière entre les éléments verticaux (4, 4') que la surface de rectification peut être déplacée parallèlement à elle-même au moins en direction de l'axe imaginaire.

4. Dispositif selon l'une des revendications 2 ou 3, caractérisé en ce que l'élément de rectification (11) est disposé de manière réglable entre les éléments verticaux (4, 4') de telle sorte que les extrémités de la ligne selon laquelle la surface de rectification vient sensiblement en contact avec la surface cylindrique mentionnée ci-dessus puissent être déplacées indépendamment l'une de l'autre dans un mouvement de rapprochement ou d'éloignement de l'axe imaginaire.

5. Dispositif selon l'une des revendications 2 à 4 caractérisé en ce que l'élément de rectification (11) comporte un rouleau rotatif (10) dont l'axe de rotation s'étend sensiblement parallèlement à l'axe imaginaire.

6. Dispositif selon la revendication 5, caractérisé en ce que le rouleau (10) peut tourner autour d'un axe

qui est muni à ses deux extrémités d'un tourillon excentrique (8, 8'), lesdits tourillons étant dans l'alignement l'un de l'autre et chacun d'eux étant logé dans un manchon (9, 9') qui est relié à l'élément vertical en question.

7. Dispositif selon la revendication 6, caractérisé en ce que les manchons sont des manchons excentriques (9, 9') qui sont reliés de manière rotative aux éléments verticaux.

8. Dispositif selon l'une des revendications 5 à 7, caractérisé en ce que le rouleau est un rouleau support (10) pour une bande abrasive sans fin (11) passant sur le rouleau et étant également guidée autour d'au moins un rouleau commandé (12).

9. Dispositif selon l'une des revendications 2 à 8, caractérisé en ce que les moyens de pression mentionnés ci-dessus sont formés par un matelas rempli de gaz comprimé (17) sous le châssis (1).

10. Dispositif selon l'une des revendications 2 à 9, caractérisé en ce que des éléments de guidage en saillie vers l'extérieur (16, 16') sont prévus sur les éléments verticaux (4, 4') près de leurs bords de guidage (6, 6').

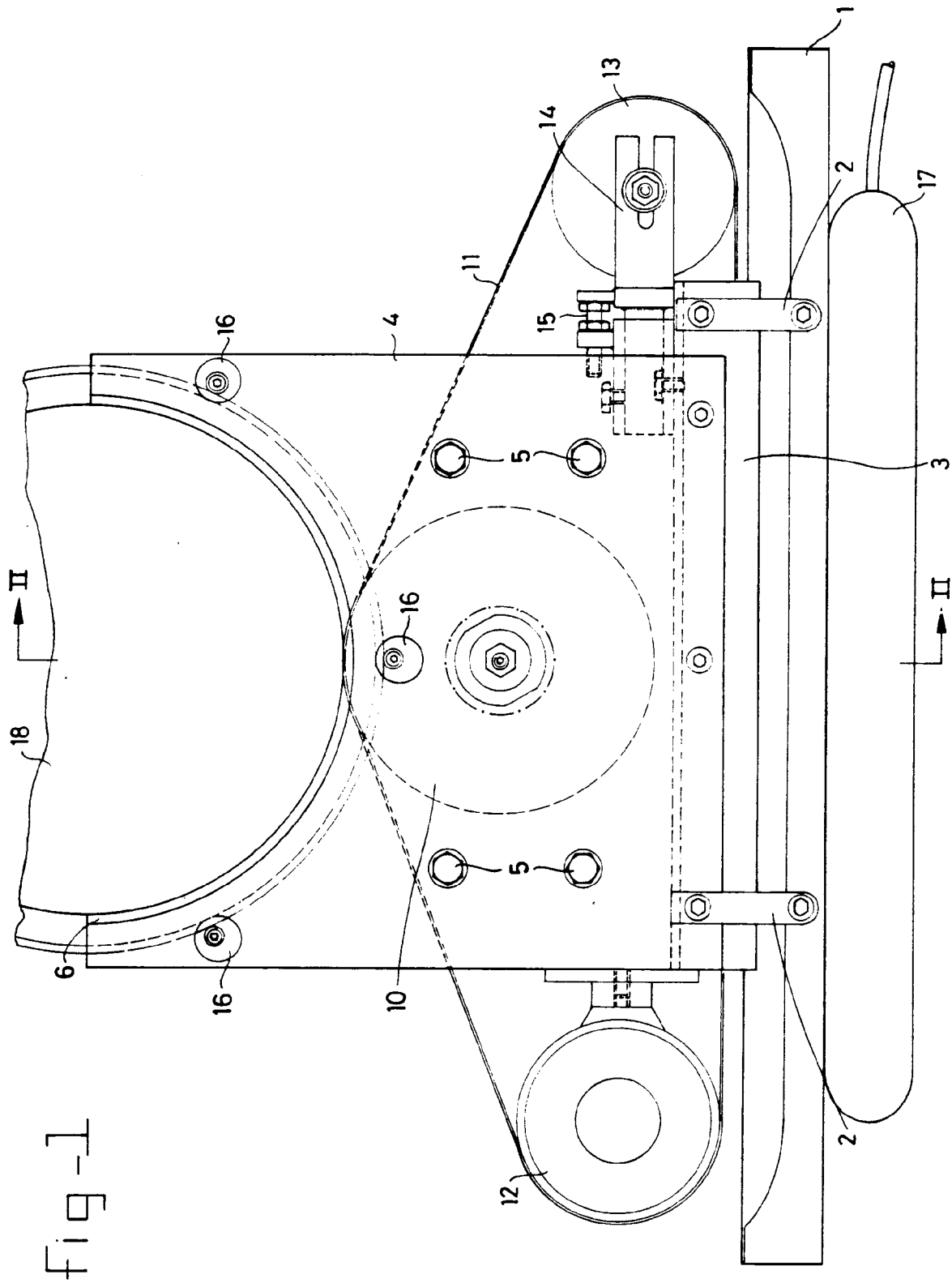


fig - 2

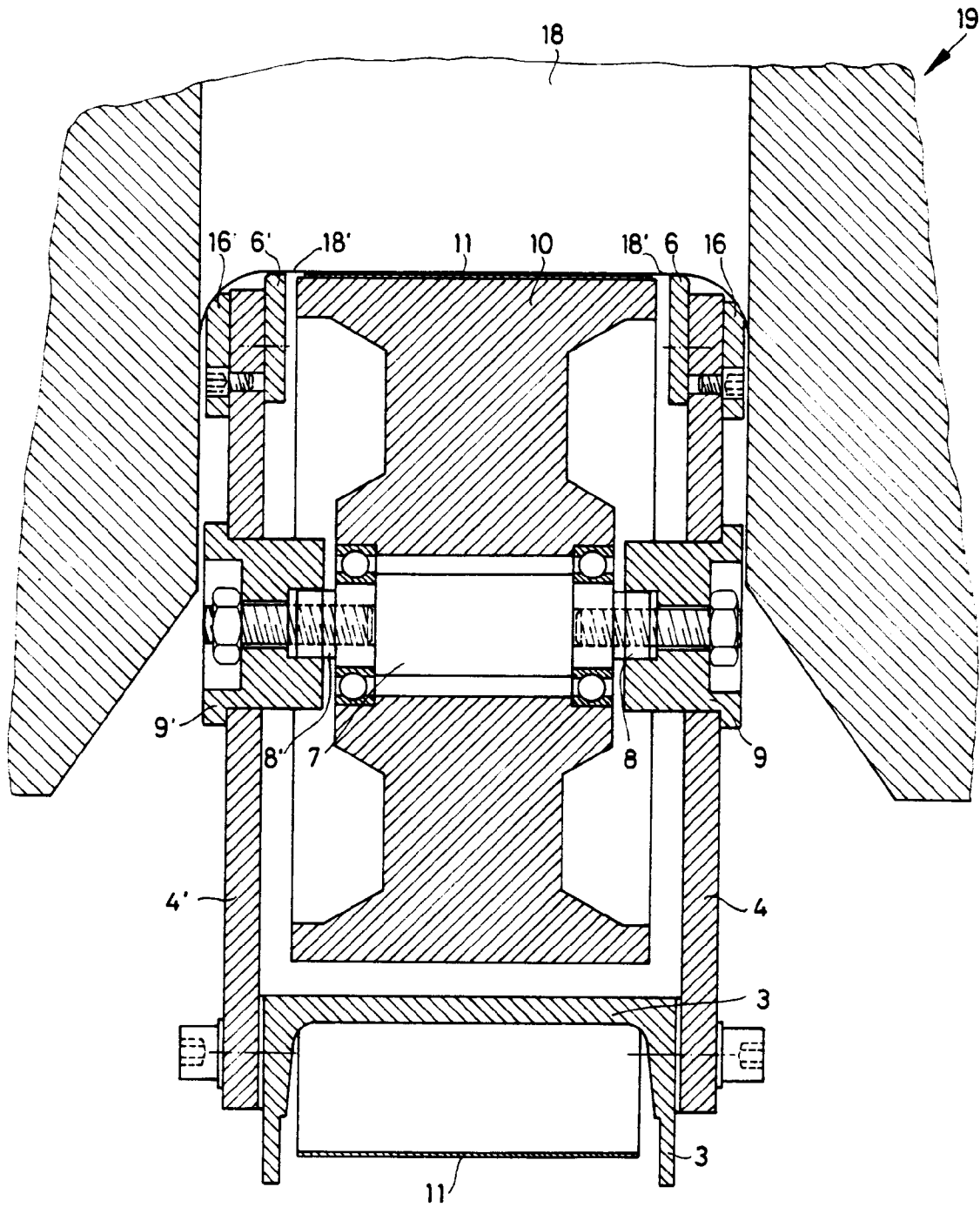


fig - 3

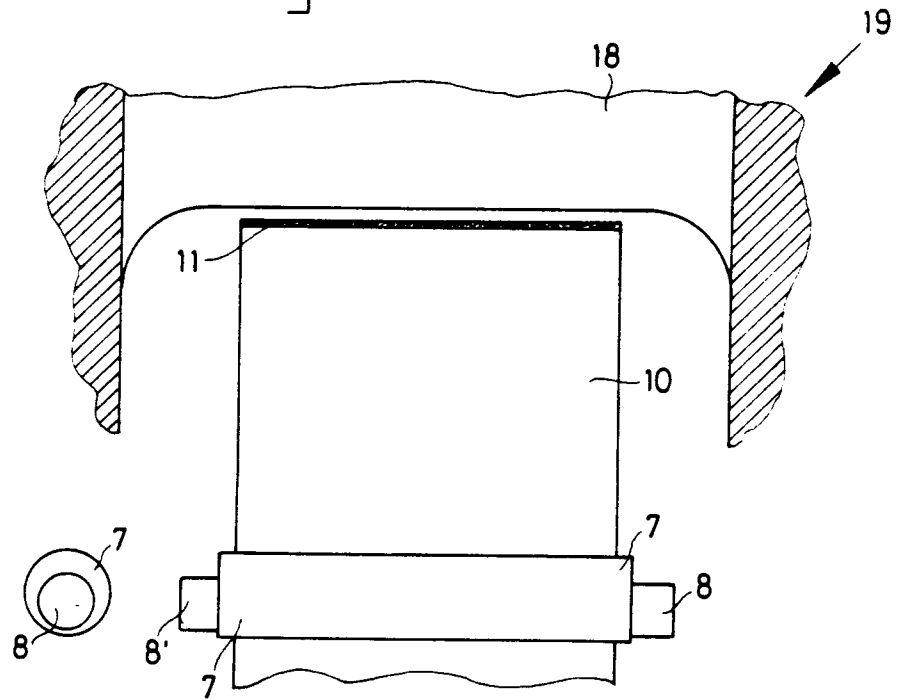


fig - 4

