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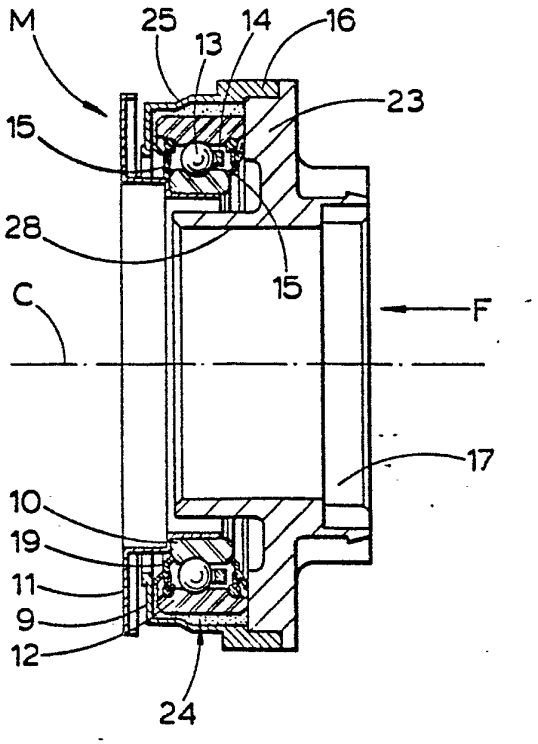
(57) Abstract

As is known a clutch release mechanism (M) employs a bearing assembly with a rotatable race (10) serving to actuate a clutch and a stationary race (12) supported by a hub or thrust sleeve (17) to which external force (F) is applied. The bearing assembly is permitted to move bodily radially to achieve self-alignment with the clutch. In accordance with the invention, a chamber (24) is provided radially adjacent the stationary race (12) and contains a filler medium displaced by the radial adjustment of the bearing assembly.



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IMPROVEMENTS IN CLUTCH RELEASE MECHANISMS

The present invention relates to clutch release mechanisms incorporating rolling element bearing assemblies.

It is well known to employ a rolling element bearing assembly as a thrust bearing in the clutch release mechanism for a motor vehicle clutch. In one known conventional form of mechanism, the axis of rotation of the bearing assembly is constrained to be substantially coincident with the transmission shaft, which may or may not be coincident with the axis of rotation of the clutch on final vehicle assembly. Customarily, one race or ring of the bearing assembly is rotatable, relative to the other and is engageable directly, or indirectly by means of a suitable adapting element, with an associated contact surface of the clutch under an axial thrust force to effect clutch release. Considerable frictional sliding, scuffing and hence wear, heat and noise generation, can be produced as a result of the contact between the contacting surfaces, if slight misalignment or non-coincidence of the axes of rotation occurs.

As described in UK Patent Specification 1478612, it is possible to provide a positive drive location by means of projections on one contacting surface engaging with slots in the other surface so that, inter alia, wear due to

circumferencial sliding can be reduced. Nevertheless, slight misalignment or non-coincidence of the rotational axes an still occur.

In another known form of mechanism described in UK Patent Specification 1126058, the axis of rotation of the bearing assembly is not constrained as aforementioned, and the entire bearing assembly can be displaced radially to ensure coincidence between the respective axes of rotation. In order to retain the bearing assembly in the desired location, an axially directed spring force is applied to the end faces of the non-rotating bearing race to produce a 'frictional grip'. It has been found that if any oil or grease should become present in the vicinity of the end faces, the frictional force locating the bearing can be reduced and the assembly can slip out of the concentric position.

A general object of the present invention is to provide an improved form of clutch release mechanism.

A clutch release mechanism made in accordance with the invention employs a bearing assembly composed of inner and outer rings or races, with rolling elements therebetween and, as is known, the bearing assembly may employ a cage for locating the rolling elements, and seals for retaining lubricant in the assembly and for preventing the ingress of contaminants. One of the races is intended to rotate and contact part of an associated clutch directly or indirectly to impart thrust force thereto for clutch release. The other race is preferably guided for axial movement in response to said force.

In accordance with the invention, a chamber containing a displaceable filler medium is defined radially adjacent the other race. This chamber can assume a

symmetrical or asymmetrical profile relative to the axis of rotation of the assembly. Hence, the entire bearing assembly consisting of the inner and outer races, the cage, the seals and the rolling elements can be displaced, within permitted limits; radially to allow the bearing axis of rotation to become precisely coincident with the axis of rotation of the clutch.

It is possible to provide positive location between the rotatable bearing race or its adaptor and the clutch release part as mentioned previously.

The chamber can be defined radially between the other bearing race itself and a cover, shroud or housing. In embodiments of the invention described hereinafter the other bearing race is the outer race, which is enveloped by the cover or housing, while the rotatable race is the inner race. It is however possible to reverse this arrangement. Normally, the bearing assembly would be supported by a thrust sleeve or hub to which axial force is applied for transmission to the clutch. This hub may have a flange or equivalent radial wall and the chamber can be bounded in the axial sense by an end wall of the cover and the flange of the hub. Conveniently the cover can be connected or bonded to the hub flange; although it is possible to utilize a one-piece or integral component constituting both the hub and the cover.

The filler medium can be introduced directly into the chamber or, in the alternative, the filler medium is contained in a flexible sealed tubular ring member itself located in the chamber. The aforementioned chamber or the ring member is pre-filled during assembly with a filler medium or fluid which is readily deformable and is preferably a pseudo-plastic, i.e. a non-Newtonian fluid, with minimal thixotropic and visco-elastic characteristics at the normal

working temperature of the release mechanism. The filler medium or fluid should preferably exhibit substantial creep flow properties under shear force exceeding its shear yield limit. In this way a controlled threshold force can be applied to the bearing assembly to cause the filler medium or fluid to displace to permit adjustment of the bearing assembly. Thus, if the axis of the bearing assembly or release mechanism made in accordance with the invention becomes offset from the axis of the clutch during vehicle assembly, or subsequently, frictional force between the bearing assembly and the contacted release part of the clutch will tend to cause radial displacement of the bearing assembly and a corresponding flow of the filler medium until re-alignment is established.

It is preferable also that the filler medium exhibits minimal gravity-levelling. Once the bearing assembly has been displaced to achieve co-incidence between its axis and that of the clutch, the bearing assembly will remain in its setting unless compelled by a new force to adopt a fresh location.

There is always a certain resistance to radial displacement when the threshold force is not exceeded which tends to hold the bearing assembly in position despite vibration or shock. The filler medium also provides a certain degree of damping and memory. Preferred forms of filler medium are viscous fluids or substances with a viscosity typically in the order of a few hundred Pa·s. At present, certain commercial grades of grease are considered suitable as the filler medium and particularly silicone greases such as that marketed under the trade name "Silkolene G44".

In another aspect, the present invention provides a

clutch release mechanism comprising a rolling-element bearing assembly with one race supported by a hub member to which axial force is applied, during use, said force being transmitted through the other race, which is rotatable, to a clutch part and means defining a sealed annular chamber or ring containing a filler fluid radially inside or outside the bearing assembly and adjacent said one race, the chamber and filler fluid permitting radial movement of the bearing assembly relative to the hub member and a consequential displacement of the fluid filler once a threshold force is established to achieve self-alignment of the bearing assembly with the clutch during use.

A bearing assembly adapted for use in a clutch release mechanism made in accordance with the invention may have special seals which seal the bearing assembly and also function to seal off the chamber containing the filler medium.

The present invention may be understood more readily and various other features and aspects of the invention may become apparent from consideration of the following description.

Embodiments of the invention will now be described, by way of examples only, with reference to the accompanying drawings, wherein:-

Figure 1 is a sectional side view of a clutch release mechanism with a bearing assembly constructed in accordance with the invention;

Figure 2 is an end view of the mechanism shown in Figure 1;

Figure 3 is an enlarged detail side view of part of the mechanism shown in Figure 1;

Figure 4 is an end view of the part of the mechanism shown in Figure 3;

Figure 5 is an enlarged detail side view of part of the mechanism of Figure 1 and showing an additional modification thereto;

Figure 6 is a side view corresponding to Figure 5 but depicting the bearing assembly in a radially-displaced position;

Figure 7 is a schematic end view of the annular chamber of the mechanism corresponding positionally to Figure 5;

Figure 8 is a schematic end view of the annular chamber of the mechanisms corresponding positionally to Figure 6;

Figure 9 is an enlarged detail sectional side view of part of the mechanism of Figure 5 during assembly;

Figure 10 is a sectional side view of another clutch release mechanism with a bearing assembly constructed in accordance with the invention;

Figure 11 is a side view corresponding to Figure 10 but depicting the bearing assembly in a radially displaced position;

Figure 12 is a perspective view of a flexible tubular member used in the mechanism depicted in Figure 10;

Figure 13 is a cross-sectional view of the tubular member shown in Figure 12; and

Figure 14 is an end view of the tubular member of Figure 12 in the form as fitted in the mechanism of Figure 10.

As shown in Figures 1 and 2, a clutch release mechanism generally denoted M employs a bearing assembly

composed of an inner ring or race 10, an outer ring or race 12 and a plurality of rolling elements - here in the form of balls 13 therebetween. The rolling elements 13 are located and spaced with the aid of a cage 14.

Flexible seals 15 seal and retain lubricant within the bearing assembly and protect the assembly from the ingress of contaminants. The seals 15, shown in more detail in Figure 5, are located in grooves 18 in the outer race 12 and have, inter alia, lips 19 which sealably contact the inner race 10. The inner race 10 is shown to be seated on a clutch-contacting adaptor 11 in the form of a pressing but this adaptor 11 is optional and in an analogous construction the race 10 is extended in the direction of the axis of rotation of the bearing assembly. The inner race 10 or its adaptor 11 is intended to contact a clutch release part, more usually a clutch diaphragm spring or a mechanical linkage acting on a clutch diaphragm or an analogous spring. It is also possible to provide a positive interconnection between a diaphragm spring of the clutch and the adaptor 11 or ring 10 as by projections and slots as described in U.K. patent specification 1478612. A thrust sleeve or hub 17 has an axial portion extending freely within the race 10 and a radial flange 23 in sliding abutment with the outer race 13 of the bearing assembly. The hub 17 has its internal bore surface 28 slidably engaged on a guide surface of, for example, another sleeve (not shown) provided on the vehicle clutch assembly to surround the main transmission shaft. A cover or shroud 16 generally envelops the bearing assembly and is fitted to the flange 23 of the hub 17. The flange 23 and the cover 16 can be

relieved and press-fitted together as represented in Figure 1. In a modified arrangement depicted in Figure 5, the cover 16 is permanently joined to the flange 23 of the hub 17 during assembly by bonding or welding, e.g. ultra-sonically, as described hereafter. The cover 16 has a generally cylindrical body portion 25 extending generally parallel to the axis of rotation of the bearing assembly and a radial end wall 9 extending parallel to the flange 23. An annular chamber 24 which contains a filler medium as described is defined between the cylindrical body portion 25 of the cover 16 and the outer race 12. As shown in Figure 5, the seals 15 have further lips 20 contacting the interior of the cover end wall 9 and the flange 23 to close off the chamber 24.

During operation, a further clutch actuator or lever mechanism (not shown) imparts an axial force 'F' to the hub 17 which is guided for slidable axial motion on the sleeve mentioned previously. The thrust force is then transmitted through the bearing assembly to effect clutch disengagement in generally known manner. As shown in Figures 2 and 3, the hub 17 has a shaped, e.g. relieved region 33 permitting the hub 17 and hence the mechanism M, to be snap-fitted to the clutch release actuator during vehicle assembly. Figures 5 and 7 depict the situation where the bearing assembly and the chamber 24 are both symmetrical relative to the hub 17 and the rotational axis of the clutch and the bearing assembly of the release mechanism M are coincident. These coincident axes are denoted C in Figures 1 and 7. In contrast, Figures 6 and 8 depict the situation where the bearing assembly of the release mechanism M has been

displaced radially relative to the hub 17 to align its rotation axis with the clutch axis. The axis of the bearing assembly is denoted B while the axis of the hub 17 is denoted S. Due to the alignment of the bearing assembly the chamber 24 assumes an asymmetrical shape and the filler medium in the chamber 24 becomes displaced. The filler medium can take a variety of forms but is preferably a fluid with characteristics as discussed previously.

As represented in Figure 5, the flange 23 of the hub 17 can have two holes 34 at diametrically opposed locations which permit the filling and venting of the chamber 24. Once the chamber 24 has been filled, the holes 34 can be sealed off by plugs 35. Conveniently, these plugs 35 are inserted in the holes 34 and bonded to the flange 23 by the application of heat or ultrasonic energy. The plugs 35 can be made from synthetic plastics or metal, e.g. as marketed under the trade name "Sonic-Lok".

To provide a low cost mechanism suitable for mass production, the hub 17 and the cover 16 can be made from synthetic plastics particularly an injection moulded, rigid, high-density plastics material such as Nylon 66. As shown in Figures 5 and 9, the flange 23 of the hub 17 has a shoulder or spigot portion 26 which forms a sliding fit with an inner face 27 of the cover 16. The spigot portion 26 has a raised ridge 38 on its external periphery which engages as a snap-fit with a groove 29 in the face 27 of the cover 16. Naturally, the ridge 38 and the groove 29 could be reversed. The snap-fit between the hub 17 and the cover 16 serves to locate and retain

these components together prior to bonding to join the faces 30,31 of these components together. As shown in Figure 9, the cover has a protruberance 32 on the face 30 which absorbs energy and which therefore melts to fuse the faces 30,31 together during welding when the cover 16 and the hub 17 are held together. It is also possible to fix the cover 16 and the hub 17 together as an interference fit (shear-type weld) especially where these components are made from crystalline polymer materials. It is also possible to fabricate a single component constituting both the hub 17 and the cover 16.

Figures 10 and 11 depict another embodiment of the invention where like reference numerals denote like or analogous parts to the other Figures. In this modified arrangement, the inner race 10 is axially prolonged so that the adaptor 11 is omitted, and the chamber 24 receives a flexible, sealed, tubular, envelope ring member 34 which itself contains the filler medium. The tubular member 34 is preferably a thin-walled structure of elliptical cross-section as shown in Figure 13. The member 34, which can be made from synthetic rubber or plastics can be produced by extrusion to form a tubular strip as shown in Figure 12. The tubular strip is then charged with the filler medium, shaped to ring form and heat sealed at its ends 36 as depicted in Figure 14. The length of the initially formed tube is made commensurate with the diameter of the raceway 12 and a range of lengths can be produced to cope with a range of bearing sizes. Instead of forming the member 34 as described, it is also possible to

manufacture the member 34 directly as an annular component which is charged with the filler medium and sealed. ...

CLAIMS:

1. A clutch release mechanism employing a rolling-element bearing assembly including a rotatable race (10) which in use is intended to transmit force to a clutch and another race (12) which is normally stationary to which the force is applied; characterised by a chamber (24) defined radially adjacent the other race (12) of the bearing assembly, the chamber (24) containing a displaceable filler medium and being capable of adopting a symmetrical or asymmetrical profile with respect to the axis of the bearing assembly to permit the alignment of the bearing assembly with the clutch.

2. A mechanism according to Claim 1, wherein the inner race of the bearing assembly is the rotatable race (10).

3. A mechanism according to Claim 1 or 2, wherein the chamber (24) is defined between the other race (12) of the bearing assembly and a cover or housing (16).

4. A mechanism according to Claim 2 or Claim 3, wherein the bearing assembly is supported by a thrust sleeve or hub (17) which is guided for axial displacement to impart said force to the bearing assembly.

5. A mechanism according to Claim 3 wherein there is further provided a thrust sleeve or hub (17) which is displaceable to impart said force to the bearing assembly, the cover (16) being connected to, or integral with, a flange (23) of said hub (17).

6. A mechanism according to Claim 5, wherein the chamber (24) is further defined between the flange (23) of the hub (17) and an end wall (9) of the cover (16).

7. A mechanism according to Claim 4, 5 or 6, wherein the hub (17) is adapted for snap-fitting engagement with a clutch release actuator.

8. A mechanism according to Claim 6 or Claim 7, wherein the bearing assembly is provided with flexible seals (15) which have lips (20) engaged with the end wall (9) of the cover (16) and the flange (23) of the hub (17).

9. A mechanism according to any one of Claims 1 to 8, wherein the filler medium is contained in a flexible sealed ring member (34) itself located in the chamber (24).

10. A clutch release mechanism comprising a rolling-element bearing assembly with one race (12) supported by a hub member (17), to which axial force is applied, during use, said force being transmitted through the other race (10) which is rotatable, to a clutch part; characterised by means defining a sealed annular chamber (24) or ring (34) containing a filler fluid radially inside or outside the bearing assembly and adjacent said one race (12), the chamber and filler fluid permitting radial movement of the bearing assembly relative to the hub member and a consequential displacement of the fluid filler once a threshold force is established to achieve self-alignment of the bearing assembly with the clutch during use.

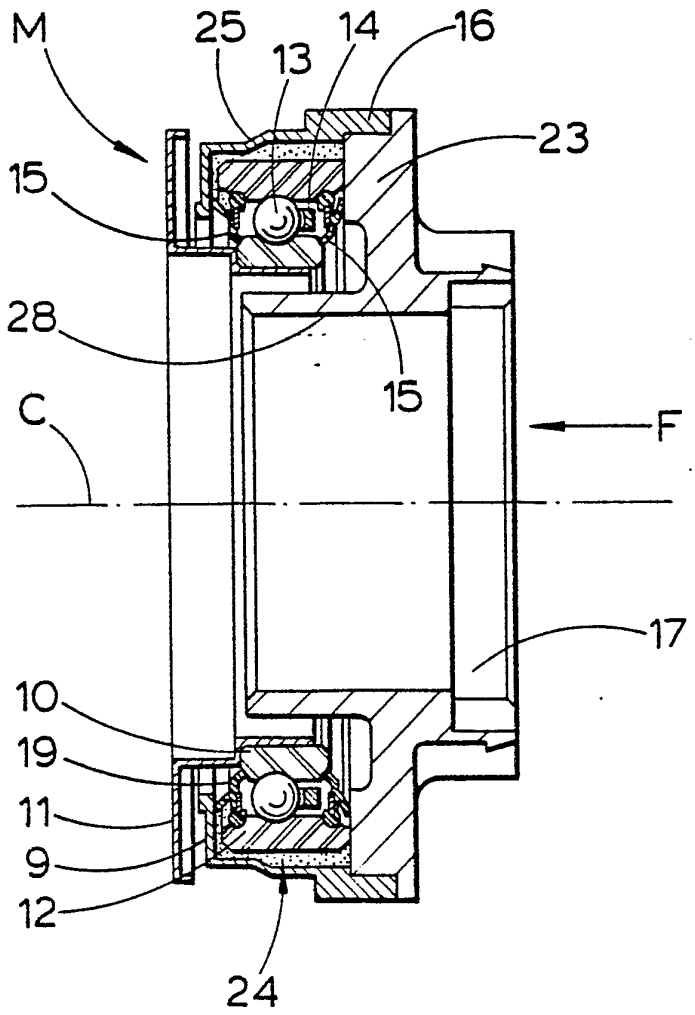

Fig . 1

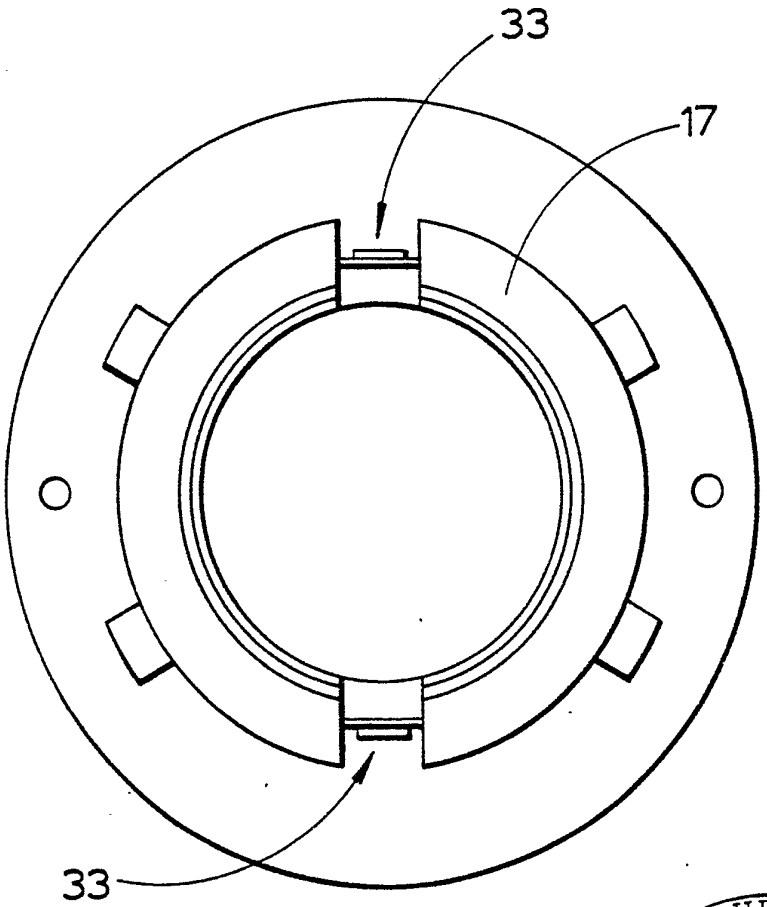

Fig . 2

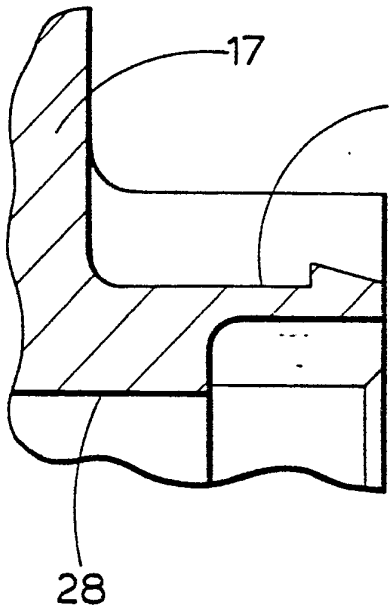

Fig . 3

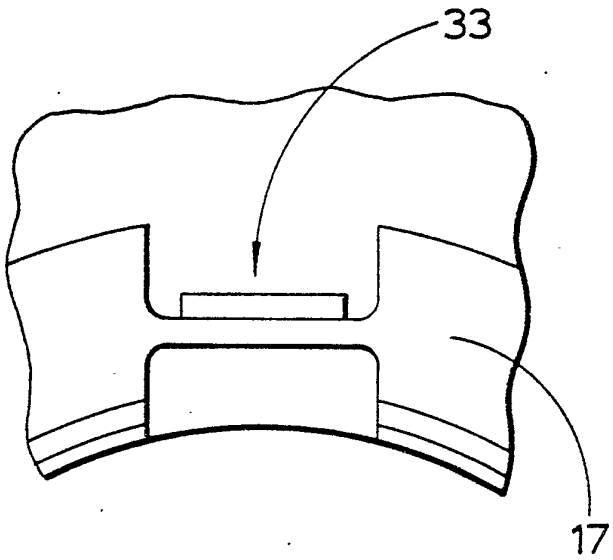

Fig . 4

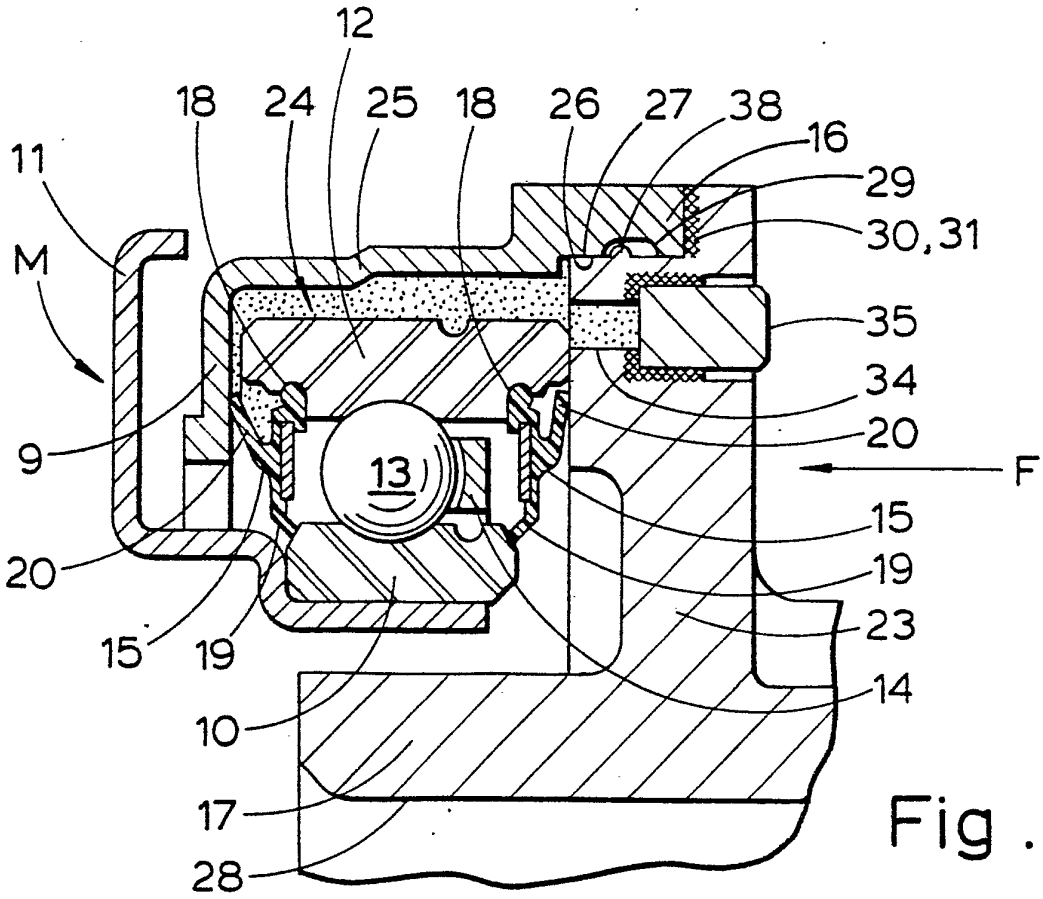

Fig . 5

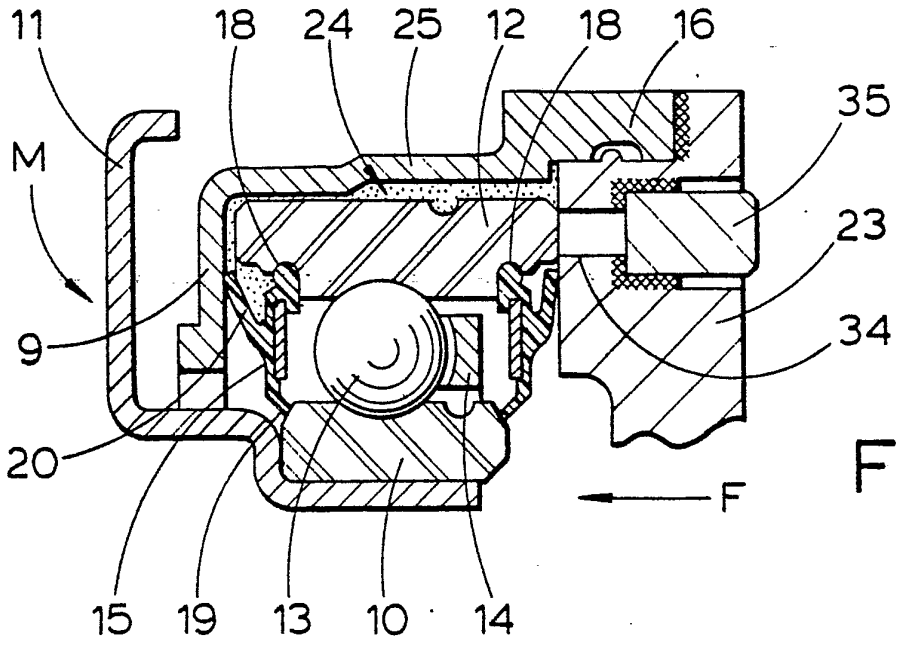

Fig . 6

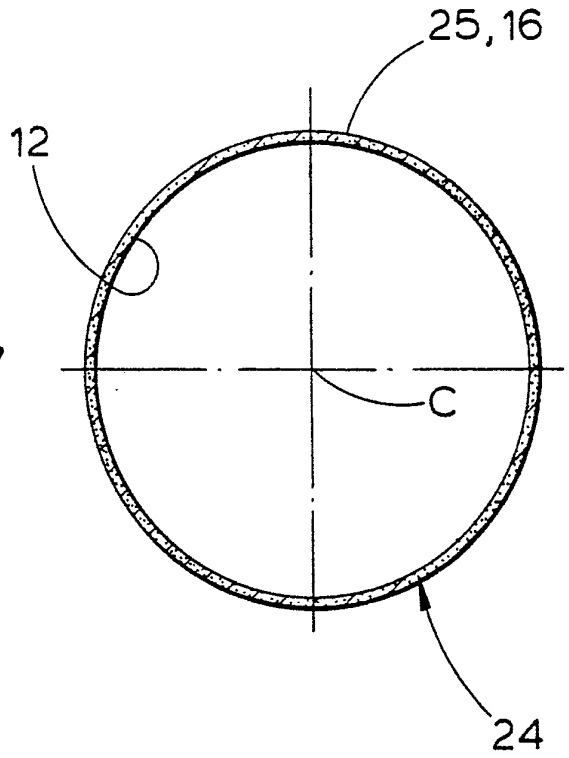

Fig . 7

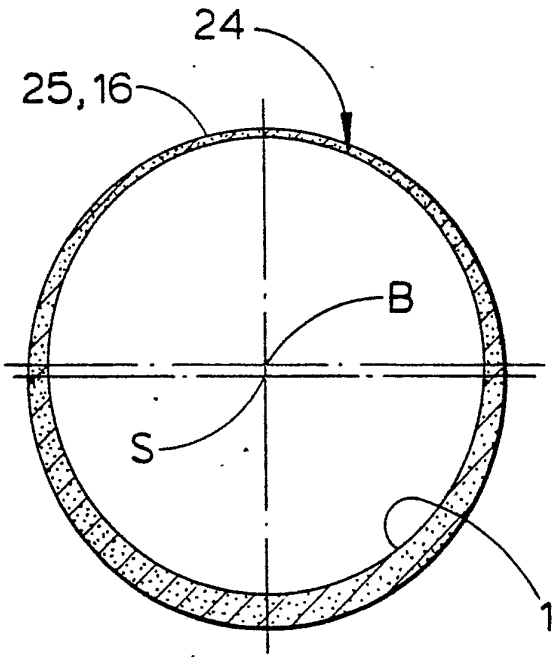

Fig . 8

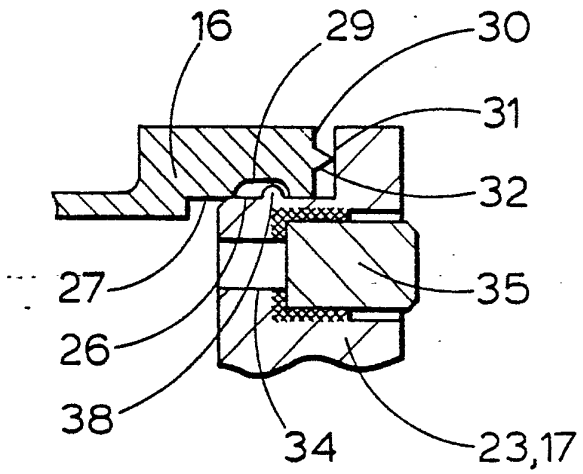

Fig . 9

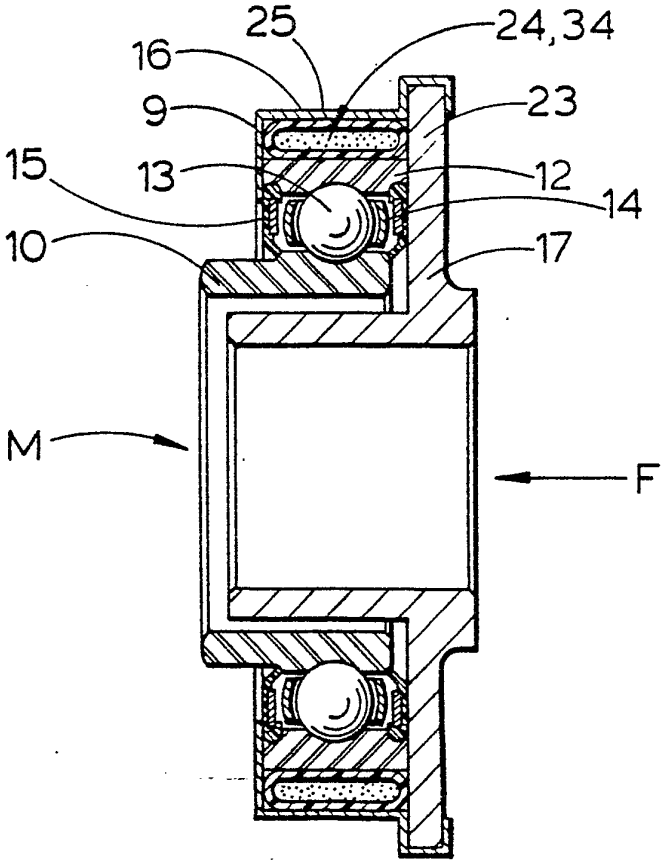

Fig . 10

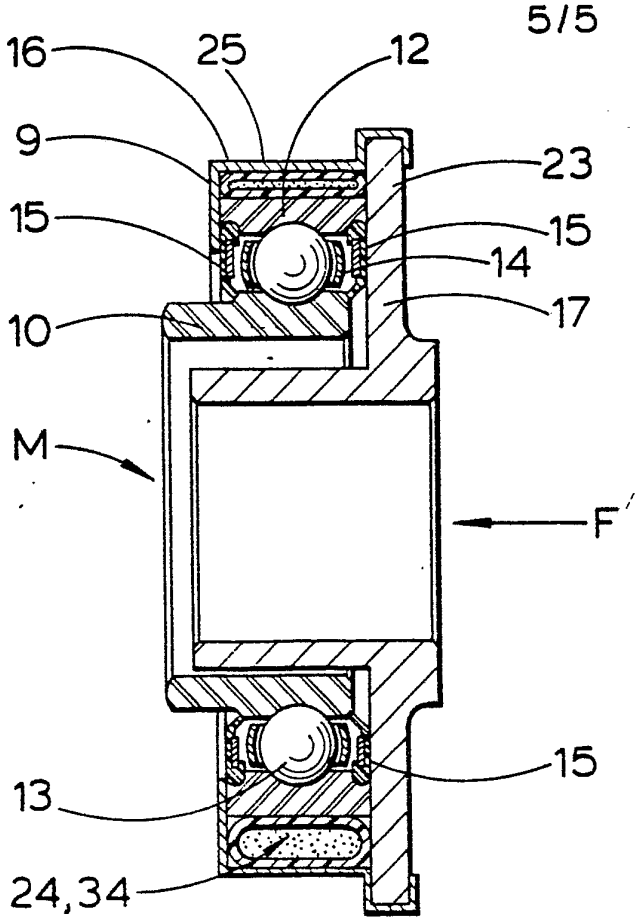

Fig . 11

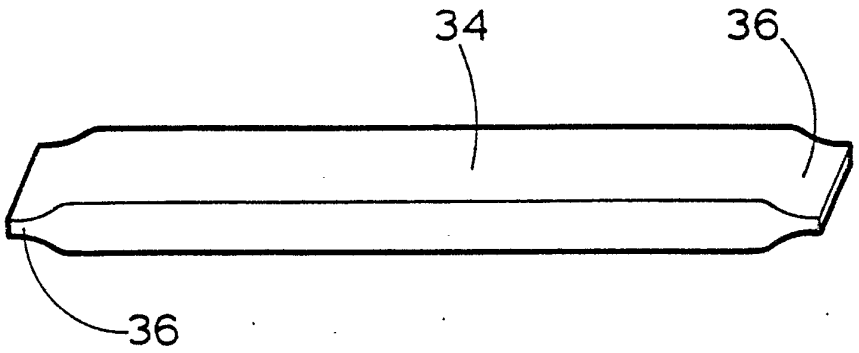

Fig . 12

Fig . 13

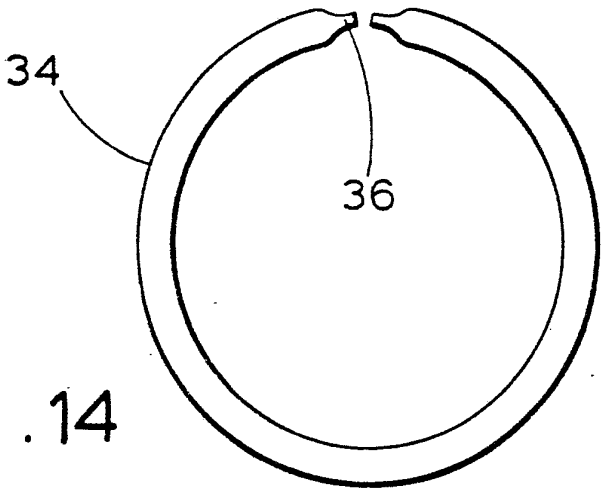

Fig . 14

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 80/00023

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl.[3] F 16 D 23/14

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
Int.Cl.[3]	F 16 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	FR, A, 2364364, published April 7, 1978 see pages 4,6,7,8,9; figures, Nippon Seiko	1,2,3,4,5, 6,10
X,P	GB, A, 2006377, published May 2, 1979 see page 1, line 120 - page 3, line 3; figure 1, Automotive	1,2,3,4,5,7, 10
A	FR, A, 1597553, published August 7, 1970, SKF	
A	FR, A, 2183472, published December 14, 1973 Luk	
A	FR, A, 2345621, published October 21, 1977 SKF	
A	FR, A, 2347571, published November 4, 1977 SKF	

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"T" later document published on or 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

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
29th April 1980	13th May 1980
International Searching Authority [1]	**Signature of Authorized Officer [20]**
European Patent Office	G.L.M. Kruydenberg