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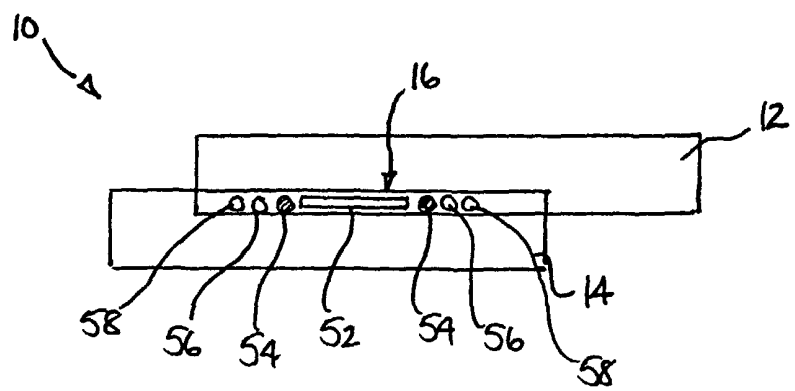
(54) Title: TRACK ASSEMBLY



(57) Abstract: A track assembly (10) comprises a seat track member (12) that in use is secured to the base of a vehicle seat, slidably engaged with a floor track member (14) that in use is secured to the floor of a vehicle. At least one bearing assembly (16) is form fittingly retained between engaging portions of the track members (12, 14) so as to facilitate sliding movement of the seat track member (12) along the length of the floor track member (14).The or each bearing assembly (16) comprises an elongate spacer (52) provided with a steel ball (54) at either of its ends. At least one plastic ball (56) is provided in a side by side arrangement with each of the steel balls (54) such that a steel ball (54) is located between each plastic ball (56) and the spacer (52). In preferred embodiments, two plastic balls (56, 58) are provided in a side by side arrangement with each steel ball (54). The use of plastic balls in the or each bearing assembly (16) reduces the formation of indentations in the track members (12, 14).

TRACK ASSEMBLY

The invention relates to a track assembly suitable for slidably mounting a seat on the floor of a vehicle.

Vehicle seats are commonly mounted on the floor of a vehicle by engagement between a seat track member secured to the base of the seat and a floor track member secured to the floor of the vehicle.

To facilitate sliding movement of the seat track member along the length of the floor track member, it is known to provide bearing assemblies, such as the bearing assembly 1 shown in Figure 1, form fittingly retained between engaging portions of the two track members. The bearing assembly 1 effectively reduces friction between the relevant engaging portions of the two track members, and comprises a first steel ball 2, a spacer 3 and second and third steel balls 4,5 in a side by side configuration, that in use extends along the length of the two track members.

When a force is applied to a vehicle seat mounted in this way, in order to move the seat in either direction along the length of the floor track member, the vehicle seat transmits the force to the bearing assemblies 1. The majority of the force is transmitted to either the first steel balls 2, or the second and third steel balls 4,5, depending on the direction in which the force is applied to the seat, i.e. the desired direction of movement of the seat in respect to the floor track member. The force causes the particular steel balls to rotate and move in the general direction of the force. This effectively reduces friction between the two track members,

and allows the seat track member to slide along the length of the floor track member in the direction of movement of the relevant steel balls.

There is a disadvantage associated with using steel balls however. When a force is applied to the seat, it causes the seat to tip slightly in the direction of the force. Thus the force transmitted from the vehicle seat to the steel balls includes a first component generally perpendicular to the length of the track members (herein referred to as the first component), as well as a second component generally parallel to the length of the track members (herein referred to as the second component). The first component of the force causes the steel balls to form indentations in the track members. Over the lifetime of a track assembly, the formation of such indentations, known as brinnelling, has an adverse effect on the movement of the seat track member along the length of the floor track member. The movement becomes bumpy and jerky due to the indentations, and this is particularly noticeable in vehicles in which the seats are moved frequently e.g. taxis and police cars.

An alternative to using steel balls in the bearing assembly is the use of balls that are made from a plastics material. Plastic balls have a certain degree of resilience, and so when the first component of a force is transmitted from the seat to the bearing assembly, they are much less likely to form indentations in the track members.

However, there are several disadvantages to using plastic balls in such assemblies, one being plastic balls do not withstand the same loads as steel balls.

Also, track members in such track assemblies are usually painted. Movement of steel balls between these track members causes burnishing of portions of the track members between which the bearing assemblies are form fittingly retained. Such burnishing involves removal of paint from the respective portions of the tracks, polishing these portions and increasing the overall clearance between the two track members. Plastic balls do not perform this burnishing action and so tend to slide between the track members, so forming flat edges. These flat edges eventually prevent any rolling movement of the plastic balls, and have a detrimental effect on the movement of a seat track member along the length of a floor track member in a track assembly.

According to a first aspect of the invention there is provided a track assembly suitable for slidably mounting a seat to the floor of a vehicle, comprising:

a first track member, slidably connected to a second track member; and

at least one bearing assembly retained between the first and second track members to facilitate sliding movement of the first track member along the length of the second track member;

the or each bearing assembly including first and second groups of ball bearings separated by an elongate spacer extending in the longitudinal direction of the tracks, each group of ball bearings including a rigid ball formed from a rigid material and a resilient ball formed from a resilient material, the rigid ball being located between the resilient ball, and the respective end of the elongate spacer.

This track assembly is advantageous because it includes both rigid and

resilient balls. The rigid balls burnish relevant portions of the first and second track members between which the or each bearing assembly is retained. The provision of at least one resilient ball in the or each bearing assembly, at a position further away from the elongate spacer than the rigid ball, means that a relatively larger proportion of the first component of a force transmitted to the bearing assembly will be transmitted to the resilient ball, or balls, than to the rigid ball. Thus brinnelling of the track members is reduced.

According to a second aspect of the invention there is provided a track assembly suitable for slidably mounting a seat to the floor of a vehicle, comprising:

a first track member, slidably connected to a second track member; and

at least one bearing assembly retained between the first and second track members to facilitate sliding movement of the first track member along the length of the second track member;

the or each bearing assembly including first and second groups of ball bearings separated by an elongate spacer extending in the longitudinal direction of the tracks, each group of ball bearings including at least two different types of ball, wherein the compressibility of each of the different types of ball is such that the ball bearings burnish the track members and brinnelling of the track members is prevented.

In a particularly preferred embodiment of the invention, the or each bearing assembly comprises an elongate spacer, and at either end of the spacer, two resilient balls and a rigid ball in a side by side configuration, the rigid ball being located between the resilient balls and the respective

end of the spacer.

This particular configuration is advantageous over an assembly including a single resilient ball at either end of the bearing assembly. This is because a majority of the first component of a force transmitted to the bearing assembly will be spread over three balls at one end of the spacer, rather than two. Furthermore, the largest proportion of this component of the force will be transmitted to the resilient ball located furthest away from the spacer. This means that the size of the proportion of the first component of the force that is transmitted to the relevant rigid ball will be less than the proportion that is transmitted when only one resilient ball is provided in a side by side configuration with the rigid ball. Thus, brinnelling of the track member is further reduced.

The elongate spacer acts to space apart each set of resilient and rigid balls located at either of its ends, preventing them from grouping together. This allows the first track member to move in either direction along the length of the second track member. If the elongate spacer were removed, and the two sets of balls grouped themselves together, then movement of the first track member in one particular direction along the length of the second track member may be prevented.

The resilient and rigid balls used in the or each bearing assembly may have the same diameter as each other.

In other embodiments of the invention, the resilient balls used in the or each bearing assembly may have a relatively larger diameter than the rigid balls used in the or each bearing assembly. The relative difference in size

of the resilient and rigid balls may compensate for compression of the resilient balls in use.

In preferred embodiments of the invention, the material from which the resilient balls are made is sufficient to absorb downward forces during movement of the seat, in order to avoid indentation of the track. However, the resilient material is also rigid enough to maintain a generally spherical shape to facilitate rolling.

In such embodiments, the resilient material may be an acetal resin such as Delrin (RTM), or a polyamide-amide resin or polyamide-imide resin such as Torlon (RTM).

The rigid material may be steel.

The elongate spacer in the or each bearing assembly may be an elongate cylindrical member having a diameter relatively smaller than the diameter of each of the resilient and rigid balls. The elongate spacer may be formed from metal or from a plastics material.

It is particularly advantageous to use a spacer member formed from a plastics material because sliding movement of a plastic spacer between the relevant engaging portions of two track members produces less noise than a metal spacer member. Car manufacturers are particularly keen to reduce any type of noise within their vehicles.

In preferred embodiments of the invention, the elongate spacer member is between 12.7cm and 15.2cm (5 in and 6 in) in length.

An embodiment of the invention will now be described, by way of a non-limiting example, with reference to the accompanying figures in which:

Figure 1 is a plan view of a bearing assembly used in a prior art track assembly;

Figure 2 is a simplified representation of a track assembly in accordance with an embodiment of the invention;

Figure 3 is a detailed representation of the track assembly of Figure 2;

Figure 4 is a plan view of the bearing assembly used in the track assembly of Figures 2 and 3;

Figure 5 is a simplified representation of the track assembly of Figure 2 when a force is applied to the track assembly in a first direction parallel to the length of the track assembly; and

Figure 6 is a simplified representation of the track assembly of Figure 2 when a force is applied to the track assembly in a second direction, parallel to the length of the track assembly and opposite in direction to the first direction.

A simplified representation of a track assembly 10 according to an embodiment of the invention is shown in Figure 2. The track assembly 10 comprises a first elongate track member 12 that in use is secured to the base of a vehicle seat (not shown) slidably engaged with a second elongate

track member 14 that in use is secured to the floor of a vehicle (not shown).

In order to facilitate sliding movement of the first elongate track member 12 along the length of the second elongate track member 14, a bearing assembly 16 is form fittingly retained between engaging portions of the two track members 12,14 along opposing sides of the track assembly 10.

A detailed representation showing the engagement between the first and second track members 12,14 is shown in Figure 3.

The first track member 12 is formed from two limbs 18,20 that are secured together proximate to the seat. The free ends of the limbs 18,20 remote from the seat, are shaped to form an inverted U-shaped cross-sectional engaging portion 22.

The second track member 14 is generally U-shaped in cross-section, and includes lip portions 24,26 that curve inwardly towards the hollow interior of the second track member 14.

Rollers 28 are provided on the floor 30 of the second track member 14 so that when the first track member 12 is slidably engaged within the hollow interior of the second track member 14, the engaging portion 22 rests over the rollers 28.

The side walls 32,34 of the engaging portion 22 of the first track member 12 each include a curved portion 36 towards their free ends.

The side walls 38,40 of the second track member 14 each include a correspondingly curved portion 42. When the first and second track members 12,14 are slidably engaged, the relative positions of the curved portions 36,42 are such that they align to define two channels 44,46 of circular cross-section extending along opposing sides of the track assembly 10.

A bearing assembly 16 is form fittingly retained on each opposing side of the track assembly 10, within the relevant channel 44,46.

The first track member 12 also includes two upwardly extending retaining limbs 48,50. The retaining limbs 48,50 engage within the curved lip portions 24,26 of the second track member 14. This engagement prevents movement of the first track member 12, relative to the first track member 14, in a direction perpendicular to the length of the track assembly 10. It thus ensures that the curved portions 36,42 remain in alignment with each other so that the cross-sectional shape of each of the channels 44,46 does not become distorted.

The bearing assemblies 16 are prevented from escaping from the relevant channels 44,46 at either end of the track assembly 10, by ball retention dimples 49 provided in the curved portion 42 of each of the side walls 38,40 of the second track member 14.

Figure 3 shows ball retention dimples 49 provided in the second track member 14 at one end of the track assembly 10. The ball retention dimples 49 are provided in a similar manner at the other end of the second track member 14 in the track assembly 10.

The bearing assemblies 16 and the channels 44,46 may be lubricated with grease.

The bearing assembly 16, shown generally in Figure 2, and also referred to in Figure 3, is shown in more detail in Figure 4. The bearing assembly 16 according to this embodiment of the invention includes an elongate spacer 52 provided at either end with a steel ball 54. First and second resilient balls 56,58 formed from an acetal resin such as, for example, Delrin (RTM) or a polyamide-amide resin or a polyamide-imide resin such as, for example, Torlon (RTM), are provided in a side by side arrangement with the steel ball 54, at either end of the spacer 52, so that each steel ball 54 is located between the spacer 52 and the first and second resilient balls 56,58.

When a force F is applied to the seat to which the first track member 12 is attached, in a direction generally parallel to the length of the track assembly 10, as shown in Figure 5, the resultant turning moment causes the seat to tip slightly in the direction of the force F. This means that a first component F_1 of the force F, generally perpendicular in direction to the length of the track assembly 10, as well as a second component F_2 of the force F, generally parallel in direction to the length of the track assembly 10, is transmitted to the bearing assemblies 16 in the channels 44,46.

A large proportion of the first component F_1 is transmitted to the first resilient balls 58 of the bearing assemblies 16, each positioned furthest away from the relevant spacer 52, in the general direction of the force F. A smaller proportion of the first component F_1 is transmitted to the second

resilient balls 56, each positioned between the relevant first resilient ball 58 and the relevant spacer 52. An even smaller proportion of the first component F_1 is transmitted to the steel balls 54, each positioned between the relevant second resilient ball 56 and the relevant spacer 52.

The resilience of the first and second resilient balls 56,58 means that the proportion of the first component F_1 of the force F transmitted to these balls 56,58 does not cause indentations to be formed in the first and second track members 12,14. The relative position of the steel balls 54 means that the indentation effect of the proportion of the first component F_1 of the force F transmitted to the steel balls 54 is greatly reduced than if only one or two steel balls had been used in each of the bearing assemblies 16.

The second component F_2 of the force F is also transmitted to the resilient and steel balls 54,56,58 causing them to turn and move in a direction generally parallel to the direction of the force F. This in turn allows the first track member 12 to slide along the second track member 14 in the direction of the force F.

When a force F is applied to a seat, to which the first track member 12 is secured, in an opposite direction, as shown in Figure 5, then the first and second components F_1,F_2 of the force F are transmitted to the steel and resilient balls 54,56,58 at the opposite end of each of the spacers 52 in a similar manner.

CLAIMS

1. A track assembly suitable for slidably mounting a seat to the floor of a vehicle, comprising:

a first track member, slidably connected to a second track member; and

at least one bearing assembly retained between the first and second track members to facilitate sliding movement of the first track member along the length of the second track member;

the or each bearing assembly including first and second groups of ball bearings separated by an elongate spacer extending in the longitudinal direction of the tracks, each group of ball bearings including a rigid ball formed from a rigid material and a resilient ball formed from a resilient material, the rigid ball being located between the resilient ball, and the respective end of the elongate spacer.

2. A track assembly suitable for slidably mounting a seat to the floor of a vehicle, comprising:

a first track member, slidably connected to a second track member; and

at least one bearing assembly retained between the first and second track members to facilitate sliding movement of the first track member along the length of the second track member;

the or each bearing assembly including first and second groups of ball bearings separated by an elongate spacer extending in the longitudinal direction of the tracks, each group of ball bearings including at least two different types of ball, wherein the compressibility of each of the different types of ball is such that the ball bearings burnish the track members and

brinnelling of the track members is prevented.

3. A track assembly, as claimed in Claim 1 or Claim 2, wherein the or each bearing assembly comprises an elongate spacer and, at either end of the spacer, two resilient balls and a rigid ball in a side by side arrangement, the rigid ball being located between the resilient balls and the respective end of the elongate spacer.

4. A track assembly, as claimed in any preceding claim, wherein each of the rigid and resilient balls have the same diameter as each other.

5. A track assembly, as claimed in any preceding claim, wherein the resilient material is an acetal resin.

6. A track assembly as claimed in any of Claims 1 to 4, wherein the resilient material is a polyamide-amide engineering resin or a polyamide-imide engineering resin.

7. A track assembly, as claimed in any preceding claim, wherein the rigid material is steel.

8. A track assembly, as claimed in any preceding claim, wherein the elongate spacer is an elongate cylindrical member having a diameter relatively smaller than the diameter of said balls.

9. A track assembly, as claimed in any preceding claim, wherein the elongate spacer is formed from a plastics material.

10. A track assembly, as claimed in any of Claims 1 to 8, wherein the elongate spacer is formed from metal.

11. A track assembly generally as herein described with reference to and/or as illustrated in the accompanying drawings.

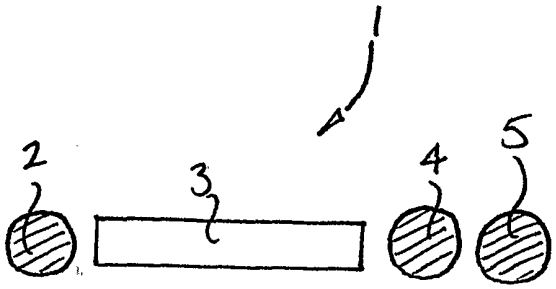


Figure 1

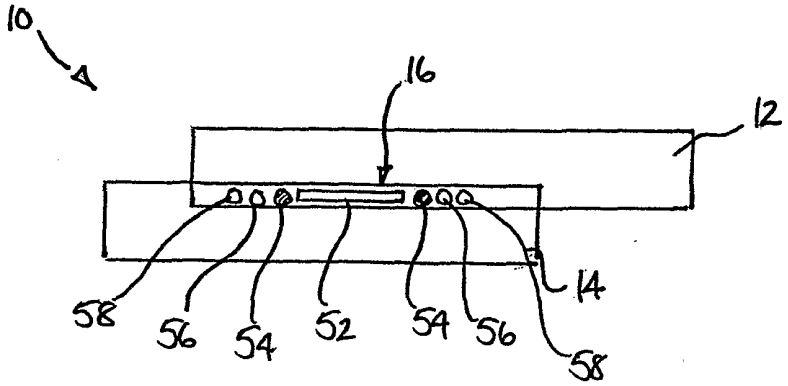


Figure 2

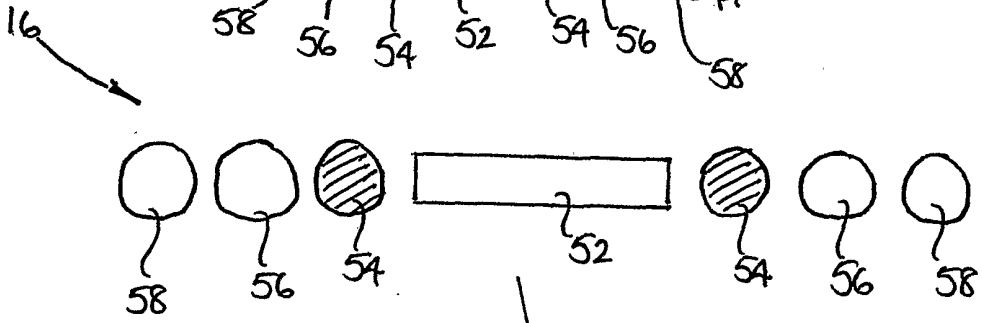


Figure 4

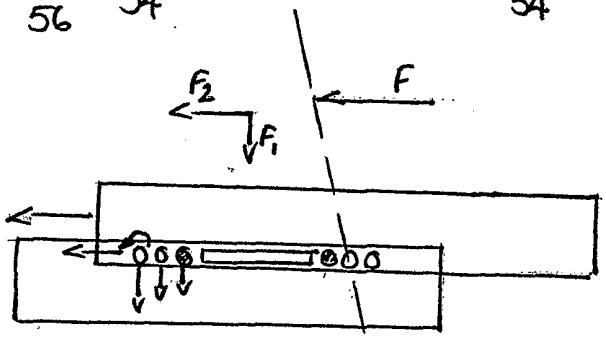


Figure 5

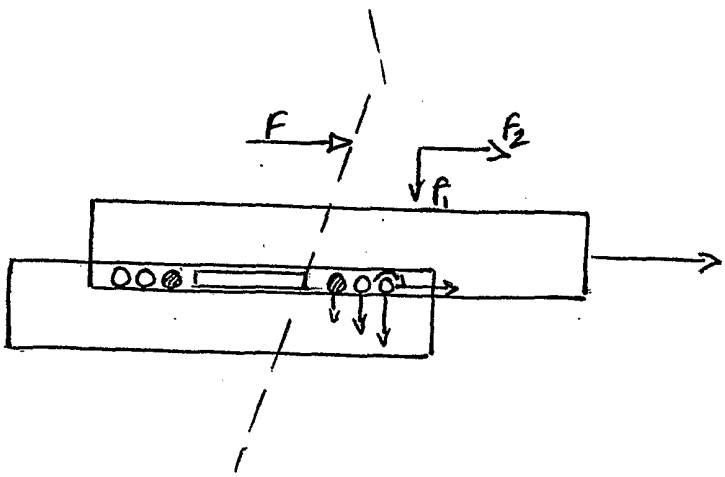


Figure 6

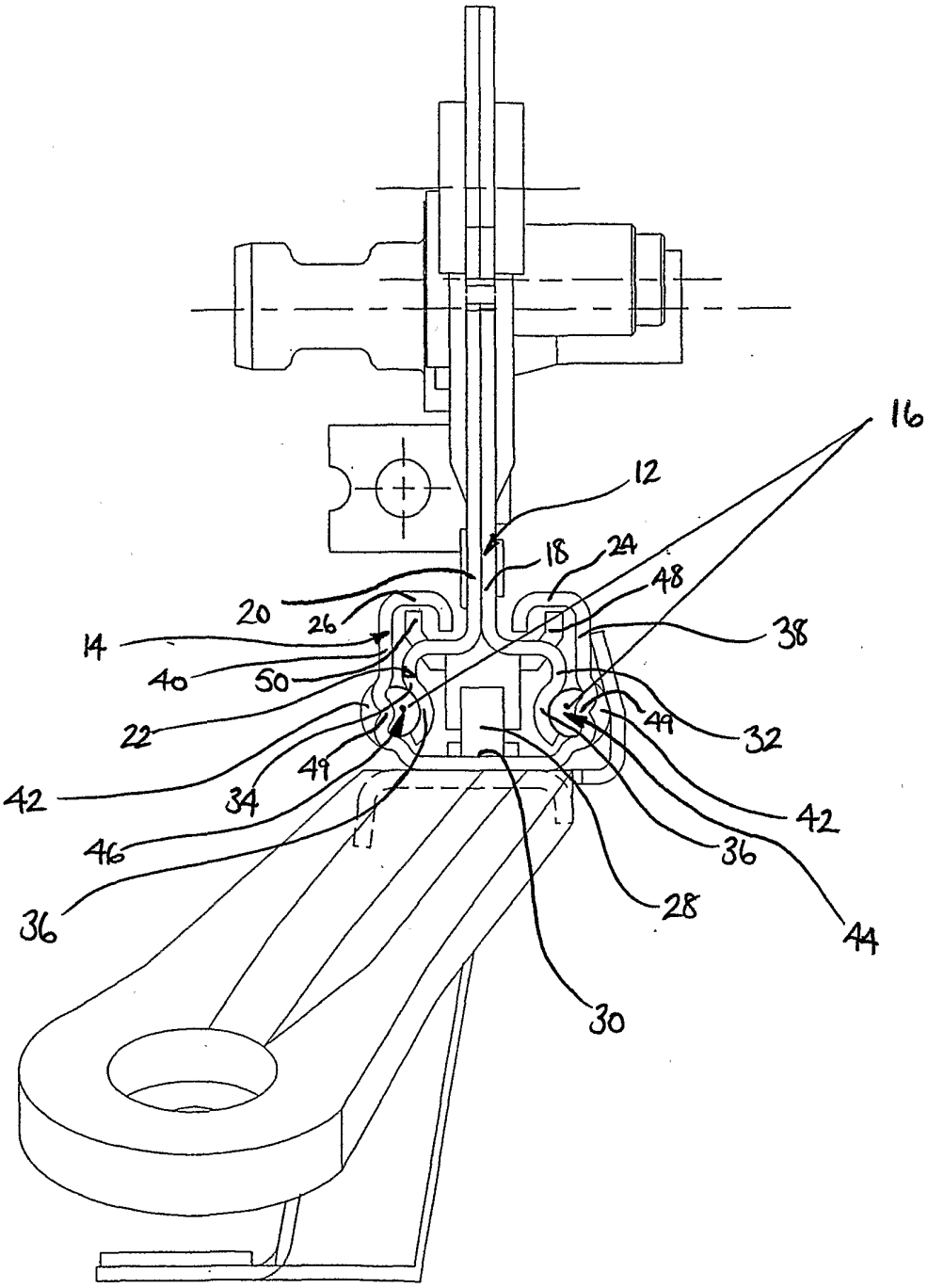


Figure 3

INTERNATIONAL SEARCH REPORT

	ional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60N2/07

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5 984 254 A (ROHEE RENE ET AL) 16 November 1999 (1999-11-16) column 5, line 3 - line 11; figure 2	1
A	US 6 036 253 A (GARRIDO PASCAL) 14 March 2000 (2000-03-14) column 4, line 57 - line 67; figure 3	1
A	FR 2 380 462 A (COBOS ALVAREZ ALEJANDRO) 8 September 1978 (1978-09-08) page 1, line 20 - line 25; figure 1	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
26 October 2001	02/11/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Pétiaud, A

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INTERNATIONAL SEARCH REPORT

onal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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