(12) UK Patent Application (19) GB (11) 2 116 674 A

(21) Application No **8307223**
(22) Date of filing **16 Mar 1983**
(30) Priority data
(31) **3209690**
(32) **17 Mar 1982**
(33) **Fed. Rep of Germany (DE)**
(43) Application published **28 Sep 1983**
(51) **INT CL³ F16D 3/22**
(52) Domestic classification **F2U** 503 504 534 571 **U1S** 1820 F2U
(56) Documents cited **GB A2104191** **GB 1553369**
(58) Field of search **F2U**
(71) Applicants **Uni-Cardan AG, (FR Germany), Alte Lohmarer Str 59, 5200 Siegburg, Germany.**
(72) Inventors **Werner Krude**
(74) Agent and/or Address for Service **B. Thorpe, G.M. Dodd, B.C. Robertson, Guest Keen and Nettlefolds PLC, Group Patents and Licensing Dept., P O Box 55, Cranford Street, Smethwick, Warley, West Midlands, b66 2r7.**

(54) **Hub assembly**

(57) A hub assembly comprises an outer bearing member 5 and an inner bearing member 2 constituting both a hub to carry a wheel at its outer end and an outer member of a universal joint having internal axially extending grooves 3, the joint having an inner member 7 having grooves 8 facing the outer member grooves and balls disposed one in each pair of facing grooves, wherein the centre lines of the grooves are curved in longitudinal cross section and the grooves of each opposed pair thereof diverge towards an opening at the outer end of the assembly and are undercut-free considered from such end, the balls being retained in the grooves by a supporting element 12 provided at such end and the shapes of the grooves being such that the angle defined between a line joining the centre of a ball to the centre of curvature of its groove, and the rotational axis of the relative joint member, is less than or equal to 85°.

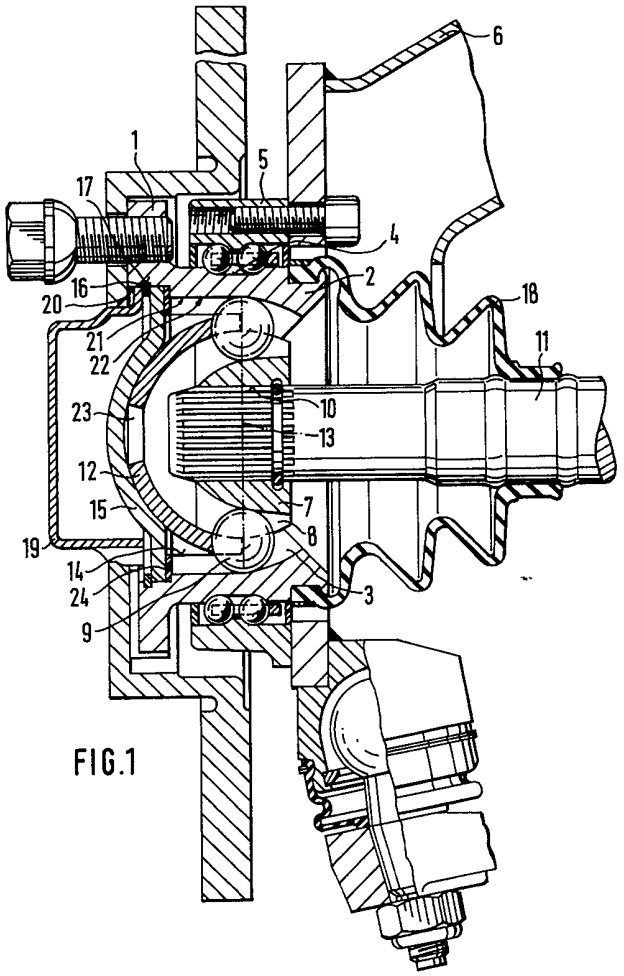

FIG.1

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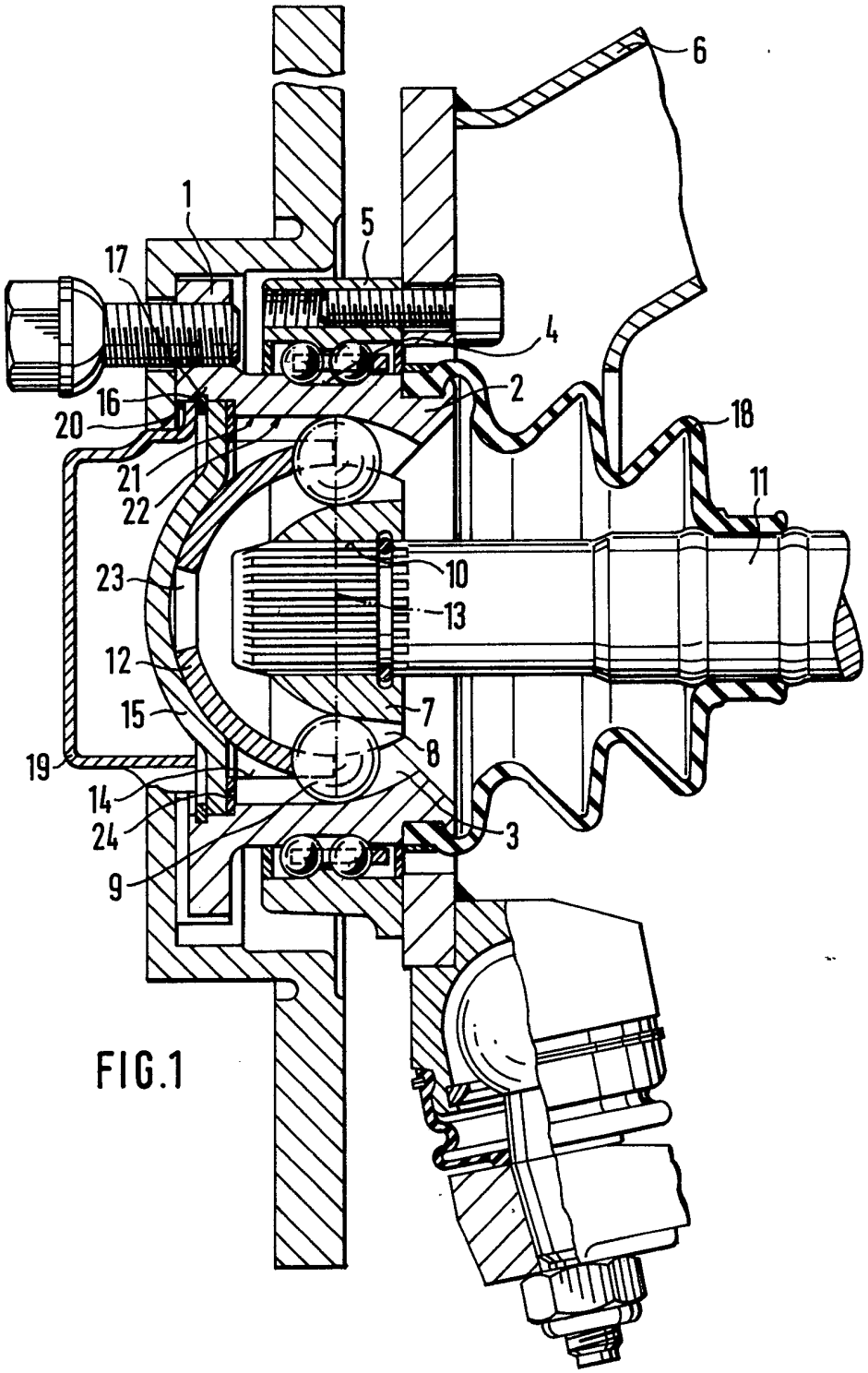

FIG.1

SPECIFICATION

Hub assembly

This invention relates to a hub assembly for a drivable wheel of a motor vehicle, comprising an outer bearing member adapted to be secured to a supporting component of the vehicle, an inner bearing member carried by bearing means for rotation relative to the outer bearing member, and also constituting a hub member, adapted to carry a wheel at or adjacent one end (the outer end) of the assembly, and the outer member of a constant velocity ratio universal joint having internal axially extending grooves, the joint further comprising an inner member disposed within the outer joint member and having grooves facing the grooves of the outer member and a plurality of balls disposed one in each pair of grooves in the joint members, the inner joint member being conected or adapted for connection to a drive shaft extending from the other end (the inner end) of the assembly. Such a hub assembly will hereafter be referred to as an assembly of the kind specified.

Hub assemblies of the kind specified have been proposed (for example in US Patent Specification 3295626 and German OS 2708416) in which an integrally formed inner bearing member and universal joint outer member is utilized. One disadvantage of such assemblies, however, is that the grooves in the universal joint members are of a configuration which is difficult to manufacture. A further disadvantage is that attention to or replacement of the drive shaft requires complete dismantling of the hub assembly and removal from the vehicle. This is difficult and expensive.

It is the object of the present invention to overcome or reduce such difficulties.

According to the invention, we provide an assembly of the kind specified wherein the centre lines of the grooves in the joint members are curved as viewed in longitudinal cross section and the grooves of each opposed pair thereof diverge towards an opening at the outer end of the assembly and are undercut-free considered from such end, the balls being retained in the grooves by a supporting element provided at such end and the shapes of the grooves being such that the angle defined between a line joining the centre of a ball to the centre of curvature of its groove, and the rotational axis of the relative joint member, is less than or equal to 85°.

The undercut free configuration of the grooves in the outer joint member means that it can be manufactured by a process which does not involve removal of metal by cutting or grinding techniques, e.g. by cold or hot extrusion. The shapes of the groove in the joint members are such that for angles of joint articulation encountered in use the divergence of the grooves towards the outer end of the assembly cannot become reversed such that the grooves diverge to the inner end of the assembly. If the assembly is required to be dismantled, removal of the supporting element permits removal of the balls from the joint and thereafter the inner joint member and drive shaft is required.

The opening at the outer end of the inner joint member may be closed by a cover member which engages and supports the supporting element.

By use of a cover member to engage and support the supporting element, the size of the opening at the outer end of the outer joint member can be kept relatively large. This facilitates dismantling of the joint if required. Further, the cover member may be positioned so as to compensate for production tolerances and eliminate any play from the joint.

Preferably the diameter of the opening at the outer end of the outer joint member is greater than or equal to that of the circumscribed circle of the bases of the grooves therein.

The supporting element may have a central aperture, of a diameter smaller than the smallest diameter of the drive shaft associated with the inner joint member.

To provide for dismantling the assembly when required, the cover member should be secured to the outer joint member by removable securing means. Such securing means may comprise a securing ring engaging a recess in the outer joint member.

The entire interior shape of the outer joint member may be free of undercut, enabling its economical manufacture as aforesaid.

Because of the possibility of dismantling the assembly as described above, the drive shaft may be secured to the inner joint member in such a way that it cannot be removed therefrom.

The invention will now be described by way of example with reference to the accompanying drawing, which is a section through a hub assembly according to the invention.

The illustrated assembly comprises a member 2 which constitutes the outer member of a constant velocity ratio universal joint and is provided at its outer end with a flange 1 for vehicle wheel attachment. The member 2 is provided internally with grooves 3 which extend axially, and externally with circumferential grooves 4 which provide the inner race of a two row angular contact ball bearing with an outer race 5. The outer race 5 is adapted to be secured to a wheel carrier element 6 by bolts. The flange 1 has threaded apertures for receiving wheel securing bolts, one of which is illustrated, which also serve to secure a brake disc to the member 2.

The universal joint of which the member 2 constitutes the outer member further comprises an inner member 7 having grooves 8 which face the internal grooves of the outer member. Each facing pair of grooves receives one of a plurality of balls 9 which serve for torque transmission between the joint members. The grooves are of non-undercut configuration considered from the outer end of the assembly, and diverge from one another towards such end. The shape of the grooves is such that the angle subtended between a line joining the centre of a ball to the centre of curvature of its groove, and the rotational axis of the relative joint member, is less than or equal to 85°. A drive shaft 11 is torque transmittingly connected to the inner joint member, fitting in a splined bore 10 therein and retained by a spring ring. A flexible sealing boot 18 is connected

between the outer joint member 2 and the drive shaft 11.

The balls 9 of the universal joint are kept in position in the grooves, and maintained such that their centres occupy a common plane 13, by a supporting element 12 which is in the form of a part-spherical shell. The shape of the grooves 3, 8 is such that when the joint is articulated the plane 13 bisects the angle between the rotational axes of the inner and outer joint members. The supporting element 12 is held in position, and runs against, a cover member 15 which has a part-spherical internal surface. The cover member 15 is retained in the member 2 by a spring ring 16 engaging a recess 17. A seal 24 is interposed between the cover member 15 and a step formed by the end of the groove-containing part of the internal surface of the member 2. A dust cover 19 is retained outside the cover member 15, by the brake disc secured to the flange 1.

It will be noted that the entire internal surface of the member 2 is of undercut free configuration as viewed from the outer-most end thereof, permitting manufacture by cold or hot forming or extruding techniques, with the exception of recess 17 which would have to be machined in the member 2. The diameter of the opening which receives cover member 15 and dust cap 19 is greater than a circle 21 circumscribed around the bases 22 of the grooves in the member 2. It will be apparent that dismantling of the universal joint, with removal of the supporting element, balls, and then the drive shaft 11 is easily possible from the outer end of the assembly after removal of dust cap 19 and cover member 15.

The supporting element 12 has a central aperture 22, which is of smaller diameter than the drive shaft 11. Such aperture asists circulation of lubricant within the joint, to provide for adequate lubrication of the supporting element 15.

CLAIMS

1. An assembly of the kind specified wherein the centre lines of the grooves in the joint members are curved as viewed in longitudinal cross section and the grooves of each opposed pair thereof diverge towards an opening at the outer end of the assembly and are undercut-free considered from such end, the balls being retained in the grooves by a supporting element provided at such end and the shapes of the grooves being such that the angle defined between a line joining the centre of a ball to the centre of curvature of its groove, and the rotational axis of the relative joint member, is less than or equal to 85°.

2. An assembly according to claim 1 wherein said opening is closed by a cover member which engages and supports the supporting element.

3. An assembly according to claim 1 or claim 2 wherein the diameter of said opening at the outer end of the outer joint member is greater than or equal to that of the cicumscribed circle of the bases of the grooves therein.

4. An assembly according to any one of the preceding claims wherein the supporting element has a central aperture, of a diameter smaller than the smallest diameter of the drive shaft associated with the inner joint member.

5. An assembly according to claim 2, or claim 3 or 4 as appendant thereto, wherein the cover member is secured to the outer joint member by removable securing means.

6. An assembly according to claim 5 wherein said securing means comprises a securing ring engaging a recess in the outer joint member.

7. An assembly according to any one of the preceding claims wherein the entire interior shape of the outer joint member is free of undercut.

8. An assembly according to any one of the preceding claims wherein the drive shaft is secured to the inner joint member in such a way that it cannot be removed therefrom.

9. An assembly substantially as hereinbefore described with reference to the accompanying drawing.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1983.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.