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(54) Universal joints

(57) A drive shaft 12 is adapted to provide a driving connection between a motive means 24 and a hub 1 for a wheel 30 the hub having an opening 8 of a size to allow the shaft to pass therethrough from the side of the hub adapted to receive the wheel connecting means. The drive shaft 12 may be removed from the side of a hub adapted to be connected to a wheel 30 in use, without removal of the hub 1 or wheel 30. The universal joint at one end of the shaft 12 may be connected to the hub 1 by splines 17 (or 31) and axially secured by spring rings 9, 10. The invention may be applied to the connecting of a differential unit to a road wheel of a motor road vehicle.

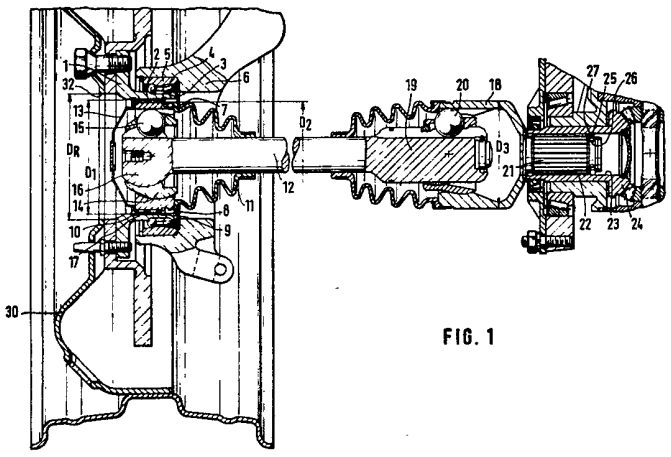

FIG. 1

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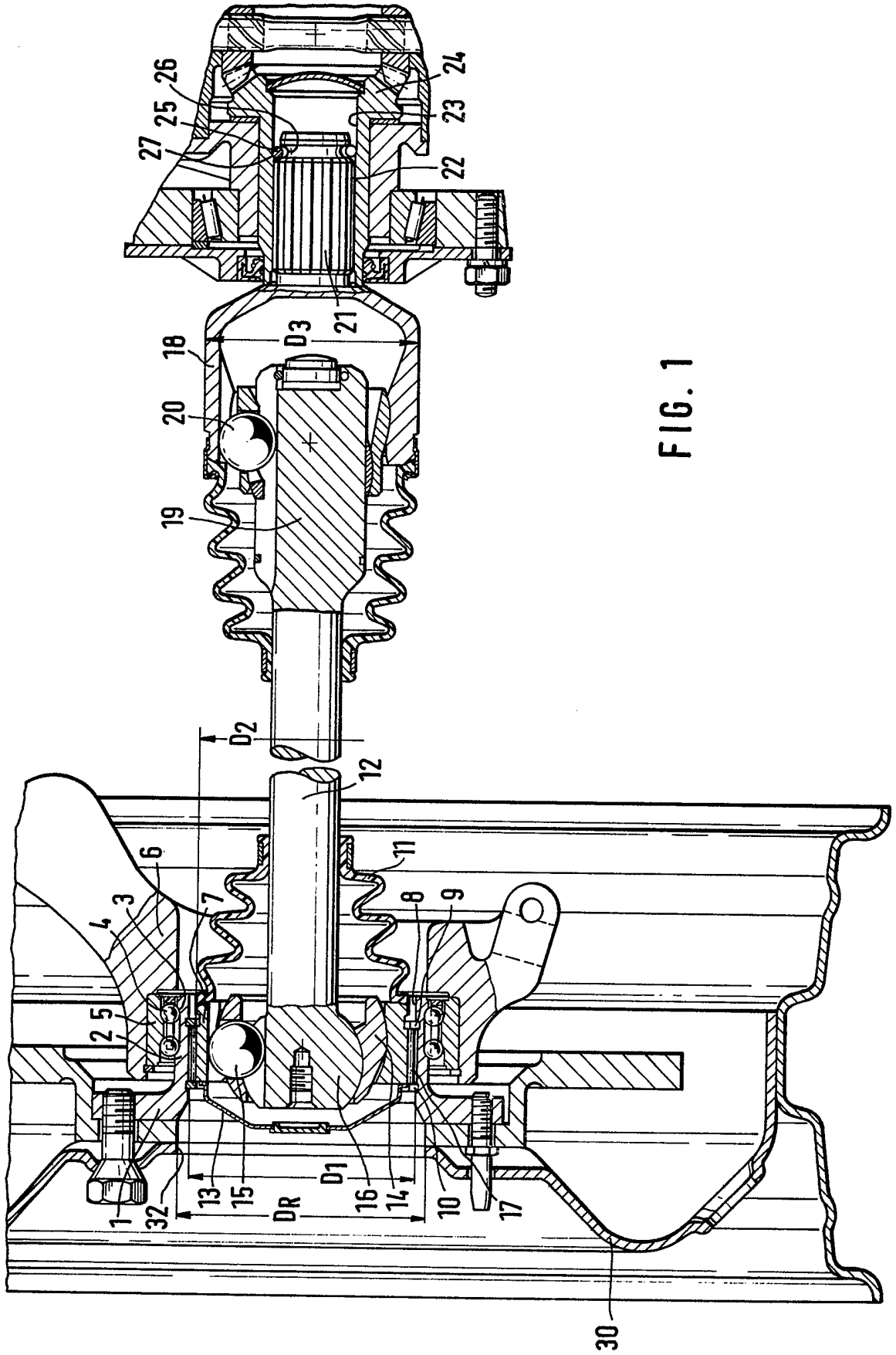

FIG. 1

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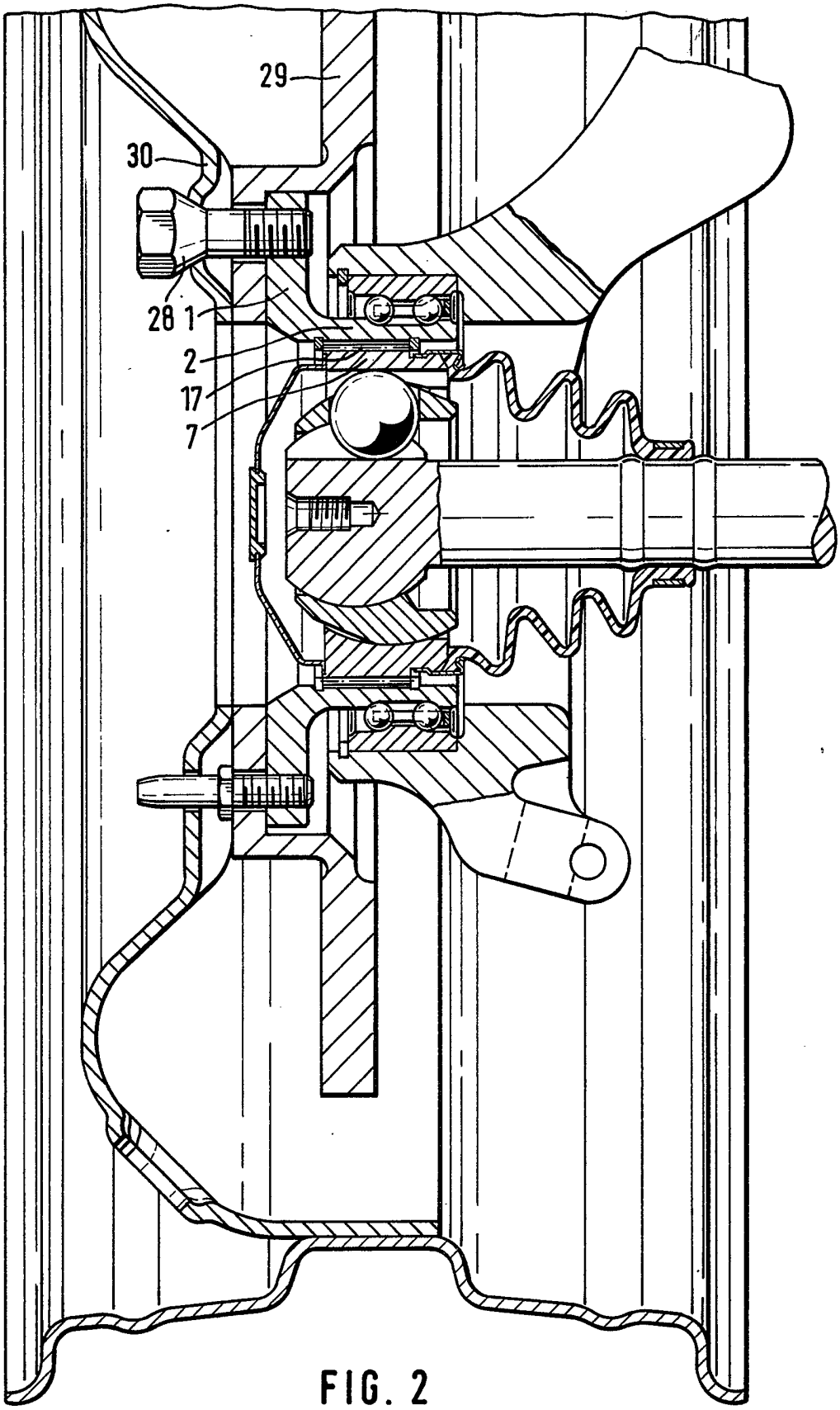

FIG. 2

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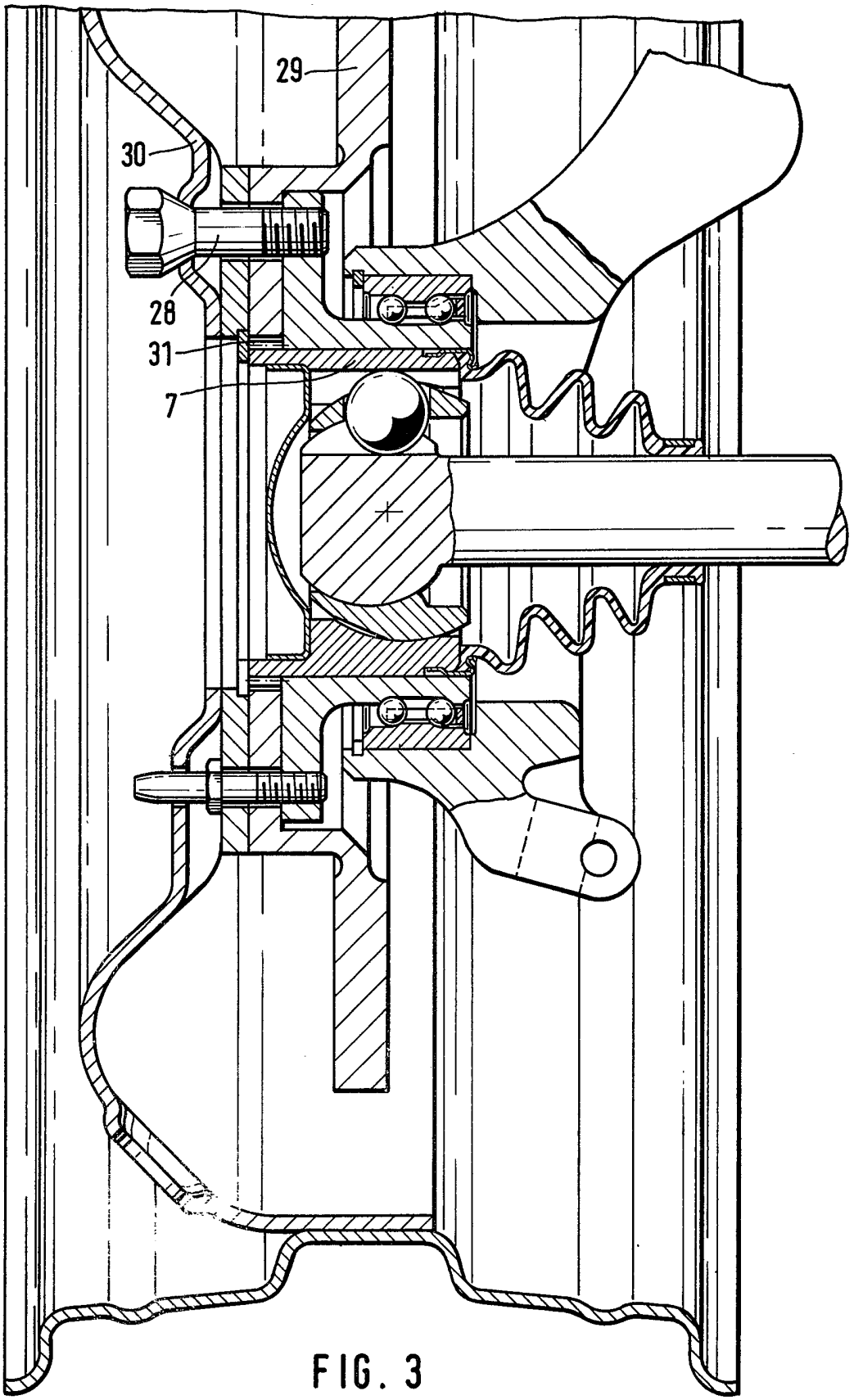

FIG. 3

SPECIFICATION

An assembly comprising a drive shaft and a hub

The present invention relates to an assembly comprising a drive shaft and a hub.

British patent specification No. 1,553,258 describes and illustrates a hub for a motor vehicle road wheel in which the hub is adapted to be driven from a drive shaft through a constant velocity ratio universal joint. The hub is mounted in a bearing assembly for rotation relative to a bearing assembly support member, the arrangement being such that after removal of the wheel hub, the universal joint and drive shaft may be removed through an opening afforded by the bearing assembly.

British patent specification No. 1,213,931 describes and illustrates part of a drive shaft assembly, in particular the end of the drive shaft connected to a gear box/differential gear unit. The drive shaft assembly includes a constant velocity ratio universal joint, one of the joint members forming an integral part of the differential gear unit thus necessitating dismantling of the gearbox/differential gear unit before the drive shaft may be completely removed.

It is an object of the present invention to provide a new or improved assembly comprising a drive shaft and hub.

According to the present invention we provide an assembly comprising a drive shaft and a hub, one side of the hub being adapted to receive wheel connecting means, the drive shaft including at least one universal joint and detachable connecting means for drivingly connecting the drive shaft to the hub, the hub having an opening therein of a size to allow the drive shaft to pass therethrough from the side of the hub adapted to receive the wheel connecting means to permit the drive shaft to take up an operative position in which it is adapted to provide driving connection between the hub and motive means.

Motive means may comprise any part of a drive line from a prime mover, for example, in a road vehicle the drive will normally co-operate with a differential gear unit.

Since the drive shaft may enter the opening in the hub from the side of the hub adapted for connection to wheel, and be moved into its operative position, it follows that the drive shaft may also be removed from its operative position from its connection with the hub through the opening therein in order to enable replacement of the drive shaft without removal of the hub.

Thus, when such an assembly is present in the road vehicle, simple fitting and removal of the drive shaft from the vehicle without necessitating dismantling the hub and/or suspension of the vehicle is possible.

Preferably, a wheel fitted to the hub has a central aperture of a diameter at least as great as that in the opening of the hub thereby enabling the fitting and/or removal of the drive shaft without necessitating the removal of the road wheel and jacking up of the vehicle. The drive shaft may be removed by being pulled in a direction along the longitudinal axis of the drive shaft by using a simple pulling device.

Preferably, the drive shaft includes a pair of universal joints, at least one of which is a constant velocity ratio universal joint preferably situated adjacent the hub. The other joint which may also be a constant velocity ration universal joint is preferably situated adjacent or near the end of the drive shaft which in use communicates with the motive means which, in a road going vehicle, is likely to be a differential gear unit.

Where the drive shaft includes more than one universal joint it will be appreciated that the largest diameter of each joint will be such that the drive shaft may pass through the opening provided in the hub.

Preferably said at least one universal joint provided on the drive shaft comprises a constant velocity ratio universal joint having an inner joint member and an outer joint member and torque transmitting means engaged therebetween to transmit torque from the inner joint member to the outer joint member, the outer joint member having splines formed in its external surface, which splines cooperate with corresponding splines formed in an annular inner surface defining the opening in the hub, said cooperating splines on the wheel hub and the outer joint member providing the driving connection between the drive shaft and the hub.

Preferably detachably locking means are provided to prevent relative movement along the direction of the splines between the hub and the outer joint member when the drive shaft is in an operative position.

Conveniently said locking means may comprise an annular member locatable in an annular groove in either the hub or the outer joint member and engaging a surface of the outer joint member of the hub respectively.

If the annular ring is made of a resilient material and is located in the groove in the outer joint member if the groove is formed oversize, in that it is deeper than is necessary for accommodating the ring when in its normal state, if it is desired, for example, to remove the drive shaft by providing a pulling force along its axis, the ring may be compressed into the groove in the outer joint member thereby allowing the drive shaft to be removed.

Each joint provided in the drive shaft, if of the type which allow plunging movement, preferably has some means to prevent disassembly otherwise a force in an axial direction

applied to the drive shaft may result in the disassembling of a joint rather than the removal of the entire drive shaft.

The hub may itself carry a brake disc or alternatively the brake disc may be provided with splines which engage with splines provided on the outer joint member, the brake disc then being connected to the hub via wheel bolts which secure the wheel to the hub. In this case the driving connection between the drive shaft and the hub is provided via the brake disc and the wheel bolts to the hub itself.

The hub may comprise the inner member of the bearing assembly, the bearing assembly comprising an inner member and an outer member which is secured to the wheel support, roller members being situated between the inner and outer members.

The invention will now be described in more detail by way of example only with reference to the accompanying drawings wherein:—

Figure 1 is a part-sectional view of one embodiment of an assembly of the present invention comprising a drive shaft and hub;

Figure 2 is a more detailed view also partly in section of part of the assembly shown in Fig. 1;

Figure 3 illustrates a second embodiment of part of a hub and drive shaft assembly.

An assembly of a hub and drive shaft for a motor road vehicle is shown in Fig. 1 and comprises a hub part 1 which is an integral extension of an inner bearing ring 2. The outer surface of the inner bearing ring 2 has screws 3 which receive roller bodies 4. The bearing includes an outer ring 5 also having grooves for receiving the roller bodies 4. The outer ring 5 is fastened to a wheel support, part of which is shown in the drawing at 6.

A drive shaft 12 includes a constant velocity ratio joint having an outer joint member 7 which is received in an opening 8 of the hub part 1 and is axially secured by means of two locking rings 9 and 10. The constant velocity ration joint further comprises an inner joint member 16, a cage 14 and torque transmitting elements in the form of balls 15. The cage 14 for guiding the balls 15 is arranged in the part-spherical interior surface of the outer joint member 7, the cage being guided with its inner surface on the outer surface of the inner joint member 16. The outer surface of the outer joint member is provided with longitudinal splines 17 which serve to transmit torque from the drive shaft 12 to the hub part 1.

The interior of the constant velocity ratio universal joint is sealed at one end by a convoluted boot 11 which is fixed on the outer surface of the outer joint member 7 and to the shaft part 12, the other end of the joint being closed by a cover 13 which is fastened to the outer joint member 7.

On the end of the shaft part 12 at the opposite end to that at which the hub is situated there is arranged a further universal joint which is adapted for plunging movement and which also comprises an outer joint member 18, an inner joint member 19 arranged in the interior of the outer joint member 18, and torque transmitting members 20 which are arranged in grooves of the two joint members and which serve to transmit torque therebetween. The outer joint member 18 is constructed integrally with a trunnion 21 being provided with longitudinal splines 22 by means of which the trunnion is received in a bore 23 of a bevel gear 24 which forms part of a differential gear unit.

The trunnion 21 is axially fixed in the bore 23 by means of a locking ring 25. The locking ring 25 is resilient and is received in a groove 26 of the trunnion 21, the depth of the groove 26 enabling the ring 26 to proceed into the groove to allow assembly to the correct position and when the correct position has been reached the ring being of a resilient material increases its diameter and provides axial location of the outer joint member 18 relative to the different gear unit.

A vehicle wheel 30 has a central through-bore 32 whose diameter DR is larger than the outer diameter D1 of the outer joint member 7, including the longitudinal splines 17. Provided the diameter D3 is not greater than the diameter D2 which is the clear inner diameter of the opening 8 in the hub part 1, then it is possible for the drive to be completely removed and refitted or a replacement drive shaft refitted without removal of the wheel 30.

This is of considerable benefit in the time saving provided over known systems replacing drive shafts. Furthermore, since the road wheel 30 does not have to be removed, the dangers inherent with removing road wheels and jacking up the car and then providing considerable force to remove the drive shaft is completely eliminated. Thus the operation of removing the drive shaft is not only considerably quicker but also considerably safer.

Fig. 2 illustrates the hub and bearing assembly in greater detail. The hub part 1 is constructed integrally with the inner bearing member 2 and the outer joint member 7 is non-rotatably connected to the hub part 1 through the splines 17. The hub part 1 is non-rotatably connected to a brake disc 29 and the vehicle wheel 30 when in position by means of the wheel bolts 28.

Referring now to Fig. 3, a slightly modified arrangement of hub assembly is illustrated, in this case longitudinal splines 31 are provided only on the outermost part of the outer joint member 7, the splines 31 cooperating with splines formed on the brake disc 29. The brake disc 29 is secured to the hub 1 through the wheel bolts 28 and hence torque is trans-

mitted from the drive shaft to the hub through the intermediary of the splines 31 and engagement between the surfaces of the brake disc 29 with the hub part 1 caused by the tightening of the wheel bolts 28.

CLAIMS

1. An assembly comprising a drive shaft and a hub, one side of the hub being adapted to receive the wheel connecting means, the drive shaft including at least one universal joint and detachable connecting means for driving the connecting drive shaft to the hub, the hub having an opening thereon of a size to allow the drive shaft to pass therethrough from the side of the hub adapted to receive the wheel connecting means to permit the drive shaft to take up an operating position in which it is adapted to provide driving connection between the hub and motive means.

2. An assembly as claimed in Claim 1 wherein a wheel connected to the hub by the wheel connecting means has a central aperture of a diameter at least as great as that of the opening in the hub.

3. An assembly as claimed in Claim 1 or Claim 2 wherein the drive shaft includes two universal joints.

4. An assembly as claimed in claim 3 wherein one of said universal joints permits of plunging movement and means are provided to prevent dismantling of said plunging joint on removal of the drive shaft from the operative position.

5. An assembly as claimed in any one of the preceding claims wherein said at least one universal joint comprises a constant velocity ratio universal joint having an inner joint member and an outer joint member and torque transmitting means engaged therebetween to transmit torque from the inner torque member, the outer joint member, the outer joint member having splines formed in its external surface, which splines co-operate with corresponding splines formed in an annular inner surface defining the opening in the hub said co-operating splines on the hub and the outer joint member providing the driving connection between the drive shaft and the hub.

6. An assembly as claimed in Claim 5 wherein detachable locking means are provided to prevent relative movement along the direction of the splines between the hub and the outer joint member when the drive shaft is in an operative position.

7. An assembly as claimed in Claim 6 wherein said locking means comprises an annular member locatable in an annular groove in either the hub or the outer joint member and engaging the surface of the outer joint member or the hub respectively.

8. An assembly as claimed in Claim 7 wherein said annular groove is of a size which permits compression of the ring into said groove to allow removal of the drive shaft from its operative position.

9. An assembly as claimed in any one of the preceding claims wherein said hub is non-rotatably connected to a brake disc.

11. An assembly as claimed in any one of the preceding claims wherein said hub comprises the inner member of the bearing assembly said bearing assembly comprising an inner member and an outer member the outer member being secured to a wheel support roller members being situated between the inner and outer members.

12. An assembly comprising a drive shaft and a hub substantially as hereinbefore described with reference to and as illustrated in Figs. 1 and 2 of the accompanying drawings.

13. An assembly comprising a drive shaft and a hub substantially as hereinbefore described with reference to and as illustrated in Fig. 3 of the accompanying drawings.

14. As assembly comprising a drive shaft and a hub including any novel feature or combination of features as described herein and/or illustrated in the accompanying drawings.

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