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(54) **Vehicle wheel drives**

(57) A vehicle wheel having an internal rim 10 is driven from a shaft 1 passing inside a hollow axle 2 fixed to the chassis. A planetary gear set has planet wheels 31 rotatably mounted on stub axles 30 fast on a hub cover 12. The hub cover 12 is of larger diameter than a ring gear 25 of the planetary so that the drive can be dismantled by withdrawing parts through the front (to the left). A brake comprising internal discs 24 and external discs 27 is applicable to the ring gear 25 by an annular piston 20 mounted on a wheel cap or carrier 16. The carrier 16 is bolted (13) to the hollow axle 2 on which are double taper wheel bearings 5.

FIG. 1

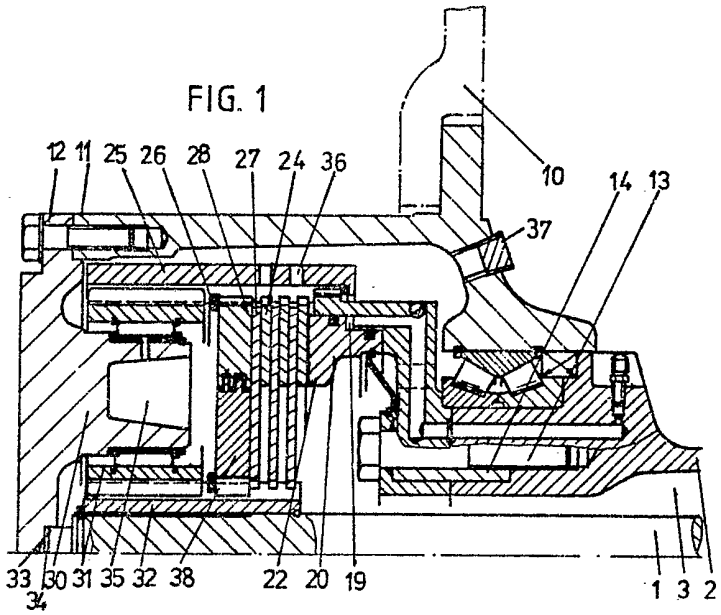

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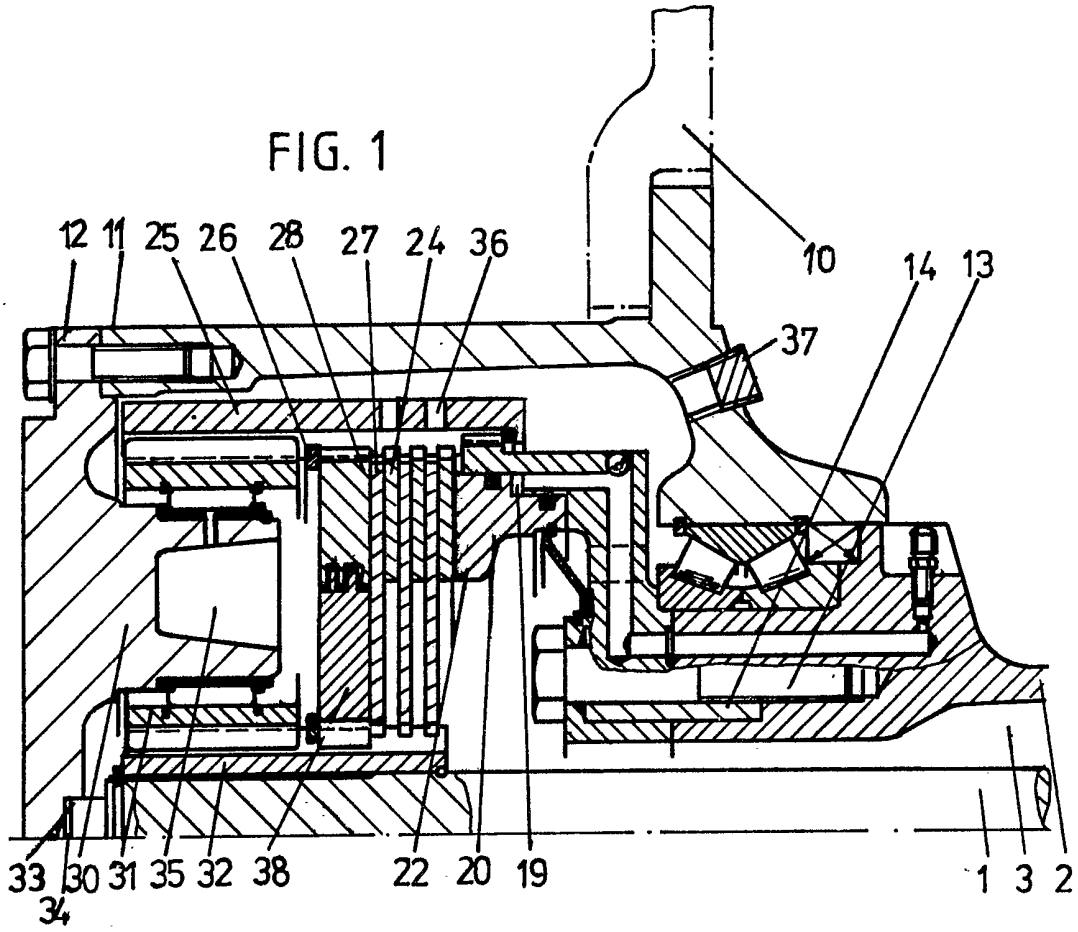
FIG. 1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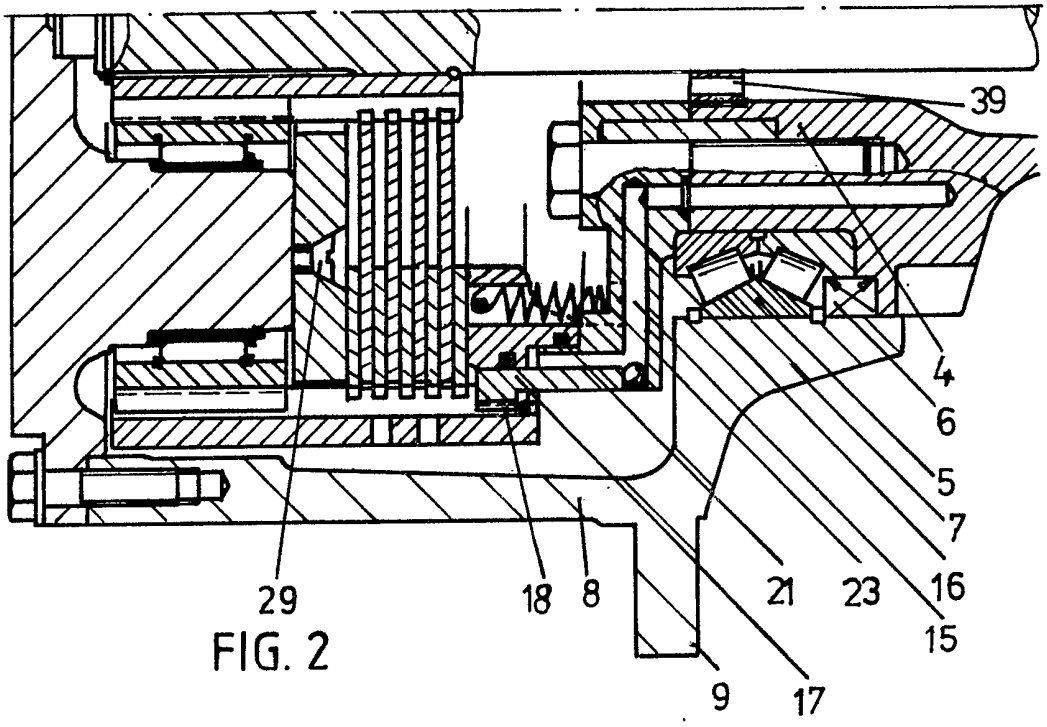
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FIG. 2

SPECIFICATION

Vehicle wheel drives

The invention relates to a final drive for a vehicle wheel which incorporates in a wheel hub an additional planetary reducing gear. Such drives are described in Patent Specifications US 3,754,625 and UK 1,578,277.

A drive according to the invention comprises a planetary gear set and a brake for a ring gear thereof, planetary gear wheels of the said set being rotatably mounted on stub axles fast on a wheel hub cover, and the hub cover being of larger diameter than the ring gear.

By mounting the planetary gear wheels on the hub cover, and making the cover of large diameter, dismantling and access to the brake and axle are made easy, and the axial length of the drive unit can be small. The planetary gears can be kept separate from the brake which makes for good lubrication, servicing of the brake by rinsing away metal particles and the dispersal of heat produced by rubbing in use. The transmission ratio and brake power can be varied by changing the sizes of the planetary gear wheels and/or the number of brake discs.

The drive preferably includes a wheel bearing cap carrying an annular piston and cylinder for applying the brake. Double taper wheel bearings are preferably provided for engagement with a stationary hollow axle. This makes it possible to transfer the vehicle load via a roller bearing, which is very short in length and supported only in the hollow axle itself, directly to the hollow axle which may be reinforced by the flange collar.

The wheel bearing cap may be shaped also as hollow wheel carried and fastened independently from the inner bearing ring by means of bolts and/or centering sleeves arranged below the wheel bearing. This also contributes to a reduction in constructional length and easy dismantling of the hollow wheel carrier and integrally formed annular cylinder. It is thus possible, without altering the wheel bearing to use different annular cylinders and hollow wheel dimensions in the same hub housing. The wheel remains in the assembled position and can be adapted or adjusted without having to jack up the vehicle. By flange-mounting the wheel bearing cap or the hollow wheel carrier to the flange collar of the hollow axle, and simultaneously sealing the pressure-medium channel in the wall of the hollow axle or the hollow wheel carrier, a reliable seal is achieved. The hollow axle eliminates the need for costly splines with preceding thread on the hollow axle. Machining is simple and the wheel bearing cap can be assembled/removed with normal tools.

The bearing cap carrying an annular piston and cylinder makes it possible to give the annular piston the largest possible effective diameter. The annular piston contact surfaces can be arranged solely on the inside walls of a protruding ring collar in such a way as to achieve not only a simple manufacture, but also a reliable sealing effect of the piston rings. The small filling volume of the annular cylinder for a large effective surface on the ring cross section also leads to a fast response in operation. Co-ordinating the hollow wheel diameter with the clearance cross section of the housing flange opens up the possibility of removing the hollow wheel carrier together with the hollow wheel without having to remove the hub housing/the wheel or jack up the vehicle.

The annular piston and cylinder distribute the pressing effect from the piston over a large pressure surface radially to the brake discs and to simultaneously protect the piston contact surfaces by the same pressure surface against the cooling oil which may sometimes be contaminated with rubbings from the brakes. Return springs for the piston may advantageously be assembled in the ring collar of the pressure surface without additional constructional length and without coming into contact with the annular cylinder space.

The supporting disc ensures that cooling of the brakes is separated from lubrication of the gears. If the brake is destroyed through excessive loading or if the brake is running dry, there is emergency lubrication of the gears which prevents damage for quite a while.

Long drive shafts, for example on wide gauge vehicles, need not be displaced far from the centre during withdrawal of the housing cover or the planetary gearing and the hollow wheel carrier with its array of brake discs and supporting discs. Distance pieces, without further aids ensure that the brake and gearing components can be replaced without being hindered by an inadmissibly far, eccentrically displaced drive shaft. Care has been taken that the distance and the drive will loose contact with each other during threading of the brakes and the gearing parts into the hollow wheel.

DRAWINGS

Figure 1 is a part-section through a final drive according to the invention; and

Figure 2 is a section similar to that of Figure 1 through another such drive, a single set of reference numerals being used as corresponding parts of the two drives can readily be seen.

In Figure 1 a driven shaft 1 passes through a stationary hollow axle 2 connected to the chassis of the vehicle. An annular clearance 3 for coolant separates the shaft 1 from the axle 2. The axle 2 terminates in a flange collar 4 on which is mounted the wheel bearing 5 and its seal 6. Rotatable on the wheel bearing 5 is a wheel hub 7 which is integral with a hub housing 8 and a wheel rim flange 9. The arrangement is such that the vehicle load is carried from the wheel via a wheel rim 10 without any major deviation directly via the wheel bearing 5 to the hollow axle 2 and so to the chassis without being transferred through a brake or gear. The wheel bearing 5 is largely safeguarded against the bar emitted from a hot brake.

At the front or left hand end, the hub housing 8

terminates in a flange 11 to which is attached a hub cover 12 using a single cover seal. A brake 24,27 and a planetary reducing gear set 31,32,25 are coaxial with the shaft 1 inside the hub housing 8 between the flange collar 4 and the hub cover 12. A wheel-bearing cap 16 is attached to the hollow axle 2 by bolts 13 and a centering sleeve 14. A pressure-medium supply channel 15 in the hollow axle 2 passes via a simple seal on the face into the flange collar 4 and the wheel bearing cap 16. The cap 16 is also a hollow wheel carrier in which it supports lateral forces from the wheel bearing 5 as well as drive torque.

The hollow wheel carrier or cap 16 has a ring collar 17 protruding on the brake or left hand side with external drive gears 18 formed thereon and two stepped cylindrical surfaces therein. The pressure-medium supply channel 15 opens into an annular cylinder 19 formed by the cylindrical surfaces on the inside of the collar 17 and guiding an annular piston 20. The piston 20 has two stepped cylindrical surfaces on the outside which carry slipped-over piston rings 21. The piston 20 has a wide annular collar 22 protruding in towards the shaft 1 and having a contact surface on the brake or left hand side. The collar 22 is provided with a number of bores which oppose corresponding bores in the carrier 16 and hold return springs 23 which do not require any additional constructional length beyond the dimensions of the piston 20 and the carrier 16. If the number of brake discs is small, cup springs instead of coil springs can be supported in annular grooves between the piston and carrier, and this would eliminate the need for the bores.

Opposite the piston 20 on the brake side is an external brake disc 24 retained in a hollow wheel 25 or its internal toothing. The brake itself consists of several pairs of brake discs. The external brake discs 24 alternate with internal brake discs 27. The last internal brake disc 27 is made to touch a supporting disc 28 by pressure from the piston 20. In the arrangement of Figure 1, the supporting disc 28 is non-rotatably secured to the internal toothing of the hollow wheel 25 and has a fastening or retaining ring 26 arranged in the internal toothing to prevent it from being passed against the planetary gear wheels 31 to the left. The planet wheels 31 are rotatably mounted on the stub axles or pins 30 which are fast on the hub cover 12, i.e. are integral with and protrude from it. The planetaries 31 mesh not only with the internal toothing of the hollow wheel 25 which functions as their ring gear, but also with a sun gear wheel 32 on the shaft 1. The sun gear 32 may alternatively according to requirements and dimensions, be worked directly out of the shaft 1 or may be designed as a gear non-rotatably attached and pushed onto to it. The shaft 1 ends on the inside of the hub cover 12 with an axial support bearing 33 and is guided radially in a corresponding recess by spacers 34. Cavities 35 in the open ends of the planet wheel stub axles 30 are advantageously used to house lubricants which pass through small radial bores to the planet wheel bearings. Radial openings 36 on the circumference of the hollow gear 25 in the area of the brake 24,27 allow metal particles formed by rubbing in operation to be rinsed away into the free space of the hub, and thence to be drained during occasional servicing through a filler and drain connection 37 in a calm flow area near the hub flange 11. The area containing the gears is separated from the brake by an inner partition disc 38 adjacent the supporting ring 28, overlapping with it via a labyrinth seal, and non-rotatably and axially held in the external toothing of the sun wheel 32 by a fastening element. A completely separate lubrication system for the planetary gearset may be provided by alternative link bores in the shaft 1.

In Figure 2, the supporting disc 28 is attached by screws 29 to the planet wheel stub axles 30 and rotates with them. The supporting disc 28 contacts an external brake disc 24, but alternatively it might contact with an internal brake disc 27.

The procedure for dismantling is as follows: The wheel is brought into a position where the oil drain 37 is pointing downwards, and is secured against rolling by a brake shoe. When the oil is drained, the hub cover 12 is unbolted and withdrawn to the left together with the planetary gears 31 directly attached to it. With the drive of Figure 1 the retaining ring 26 is then released first and the supporting disc 28 withdrawn. Since distance pieces 39 in the annular clearance 3 prevent displacement of the shaft 1, the supporting disc 28 may be withdrawn without problems along with the hollow wheel 25, as the hub cover 12 is of greater diameter, and the sun wheel 32. With the drive of Figure 2, there is no retaining ring 26 to remove after opening. The supporting disc 28 remains on the planet wheel stub axle 30, and free access to the brake is obtained immediately after removing the hub cover 12. The hollow wheel 25 is removed by unscrewing the bolts 13 from the flange collar 4. Then the entire wheel carrier 16 including the annular piston 20 and the return springs 23 can easily be pulled forward as a complete assembly and withdrawn. Now the component parts as well as the wheel bearings are open to inspection, and spare or replacement parts for other transmission ratios or brake ratings can be installed.

Instead of a shaft with a sunwheel attached to it, a single drive motor with rotating external toothing may be used, or the hollow wheel may be supported against a spur gear or the hollow wheel may be the external brake disc carrier.

CLAIMS

1. A final drive for a vehicle wheel comprising a planetary gear set and a brake for a ring gear thereof, planetary gear wheels of the said set being rotatably mounted on stub axles fast on a wheel hub cover, and the hub cover being of larger diameter than the ring gear.

2. A final drive according to claim 1 including a wheel bearing cap carrying an annular piston and

cylinder for applying the brake.

3. A final drive according to claim 1 or claim 2 including double taper wheel bearings for engagement with a stationary hollow axle.

4. A final drive according to claim 2 in which the piston is provided with cavities containing return coil springs bearing on the cap.

5. A final drive according to any preceding claim which includes a separate lubricant supply for the gears and for the brake.

6. A final drive for a vehicle wheel as herein described with reference to Figure 1 or Figure 2 of the drawings.

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