



(51) International Patent Classification:

B60K 7/00 (2006.01) **B62D 5/04** (2006.01)
B60K 17/04 (2006.01)

(21) International Application Number:

PCT/EP2009/001481

(22) International Filing Date:

3 March 2009 (03.03.2009)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10 2008 015 825.9 27 March 2008 (27.03.2008) DE

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: WHEEL HUB DRIVE FOR A MOTOR VEHICLE

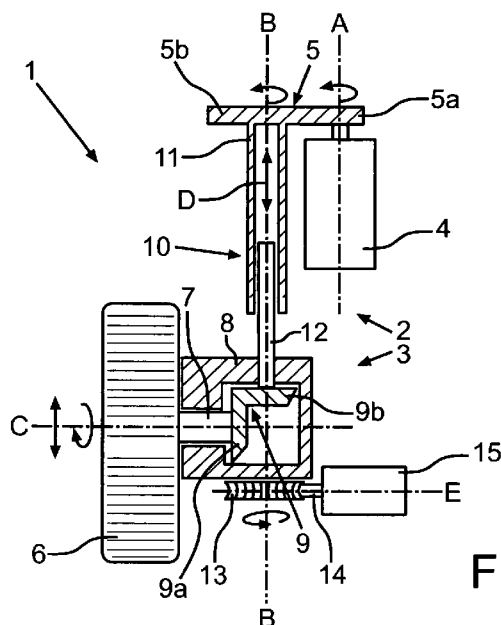


Fig. 1

(57) Abstract: The present invention relates to a wheel hub drive (1) for a motor vehicle, having a drive part (2) arranged on the vehicle body side and a drive part (3) on the wheel hub side, which comprises an angular drive (9) for driving a wheel hub (7), which is held by a hub carrier (8), wherein a transmission element (13) of a steering gear is arranged on the hub carrier (8). The present invention further relates to a motor vehicle having such a wheel hub drive.

WHEEL HUB DRIVE FOR A MOTOR VEHICLE

The present invention relates to a wheel hub drive for a motor vehicle, having a drive part arranged on the vehicle body side and a drive part on the wheel hub side, which comprises an angular drive for driving a wheel hub, which is held by a hub carrier. The present invention further relates to a motor vehicle having such a wheel hub drive.

Such wheel hub drives are already known from the state of the art. DE 10 2005 034 278 A1 discloses a wheel hub drive for a motor vehicle, a drive part arranged on the vehicle body side being coupled to a drive part on the wheel hub side by means of a coupling for longitudinal compensation. In this known wheel hub drive a wheel hub of a wheel of the motor vehicle is driven by way of an angular drive. A hub carrier is furthermore provided, which serves to hold the wheel hub. The known wheel hub drive is aimed at reducing an unsprung mass of the wheel hub drive and at giving it a compact construction. This is ensured by a device for transmitting torque between the drive part arranged on the vehicle body side and the drive part on the wheel hub side.

The object of the invention is to develop the wheel hub drive for a motor vehicle disclosed by DE 10 2005 034 278 A1, in such a way that further functions can be incorporated, measures being taken to ensure a compact construction.

According to the invention this object is achieved by a wheel hub drive having the features according to claim 1 and by a motor vehicle having the features according to claim 7.

Advantageous embodiments with suitable developments of the invention are specified in the dependent claims.

A wheel hub drive for a motor vehicle according to the invention comprises a drive part arranged on the vehicle body side and a drive part on the wheel hub side, which comprises an angular drive for driving a wheel hub, which is held by a hub carrier. A substantial idea here is that a transmission element of a steering gear is arranged on the hub carrier.

In other words a fundamental concept of the present invention is to develop the known wheel hub drive in such a way that the hub carrier is connected to a transmission element of a steering gear of a steering system of the motor vehicle. This advantageously affords a functional integration and a compact construction of the wheel hub drive.

In one embodiment the angular drive is accommodated inside the hub carrier. In this embodiment, in particular, the hub carrier is embodied in the form of a housing, it being possible to arrange the angular drive in an internal space formed in the hub carrier.

The transmission element of the steering gear is preferably embodied as a gearwheel rotationally locked to the hub carrier, the steering gear preferably being embodied as a worm gear. At the same time the transmission element may furthermore mesh with a worm driven by an electrical machine. If the worm is driven from the side of the electrical machine, the transmission element affords a change in the steering direction of the hub carrier and consequently of the wheel hub and a wheel connected to the wheel hub. Using a worm gear advantageously affords a fine resolution of the steering direction of the wheel hub, so that the electrical machine can be designed with a relatively high speed.

The angular drive may preferably comprise two bevel gears, which are arranged at an angle to one another and intermesh with one another. In particular, the bevel gears are arranged at a right angle to one another, although the bevel gears may also be arranged at angle of less than 90 to one another. It has also proved advantageous to provide a coupling, which is arranged on the output side of a further electrical machine and a transmission, between the drive part arranged on the vehicle body side and the drive part on the wheel hub side. Using the angular drive including two bevel gears and using the coupling, which is preferably embodied as a torsion coupling or a coupling with longitudinal compensation, advantageously ensures that the drive part arranged on the vehicle body side can be isolated from the unsprung mass of the wheel hub drive.

A motor vehicle according to the invention comprises at least one wheel hub drive according to the invention.

In the motor vehicle according to the invention a wheel hub drive may be provided for each wheel of the motor vehicle. By making modular use of the wheel hub drive on each wheel of the motor vehicle, an all-wheel drive can advantageously be achieved.

Further advantages, features and details of the invention are set forth in the following description of individual preferred exemplary embodiments and in the drawings, in which:

shows a schematic representation of a wheel hub drive according to one embodiment of the present invention;

shows a schematic representation in plan view of a motor vehicle according to one embodiment of the present invention;

shows a schematic representation in plan view of the motor vehicle, the wheels of the motor vehicle having different steering directions.

The exemplary embodiments described in more detail below represent preferred embodiments of the present invention.

A wheel hub drive 1 represented in Fig. 1 comprises a drive part 2 arranged on the vehicle body side and a drive part 3 on the wheel hub side. Here the drive part 2 arranged on the vehicle body side comprises a first electrical machine 4, which in the present example is embodied as an internal rotor machine, although the electrical machine 4 may alternatively be embodied as an external rotor machine. For the sake of greater clarity, springs, shock absorbers, A-arms and other essential components of a chassis have been omitted from the representation in Fig. 1.

The drive part 2 arranged on the vehicle body side further comprises a transmission 5 having a first gearwheel 5a and a second gearwheel 5b meshing with the first gearwheel 5a. At the same time the first gearwheel 5a is rotatable about an axis of rotation A and can be driven by the first electrical machine 4. It should further be mentioned that the

second gearwheel 5b is rotatable about an axis of rotation B. When the first gearwheel 5a is driven by the electrical machine 4, the second gearwheel 5b rotates about the axis of rotation B.

The hub-side drive part 3 comprises a hub 7, which is rotationally locked to a wheel 6 of the motor vehicle and is held by a hub carrier 8. The hub 7 can here be driven by way of an angular drive 9 comprising a first and a second bevel gear 9a, 9b, the two bevel gears 9a, 9b being arranged at an angle, in this example at a right angle, to one another. The two bevel gears 9a, 9b intermesh with one another, so that a rotation of the second bevel gear 9b about the axis of rotation B produces a rotation of the first bevel gear 9a about an axis of rotation C.

The drive part 2 arranged on the vehicle body side and the drive part 3 on the wheel hub side are connected together by means of a coupling 10. In this example the coupling 10 is embodied as a torsion coupling or a coupling with longitudinal compensation. The coupling 10 comprises a guide element 11, in which a shank 12 is guided. In this example the guide element 11 is embodied as a closed sleeve, it being possible in an alternative embodiment for the guide element 11 to be of open design in some areas. The guide element 11 and the shank 12 are configured in such a way that they are rotationally locked to one another, but the shank 12 is capable of moving in a direction inside the guide element 11 represented by a double arrow D. This allows a springing of the hub-side drive part 3 so as to be able to absorb the road surface impacts.

It should be mentioned at this point that the guide element 11 of the coupling 10 constitutes a part of the drive part 2 arranged on the vehicle body side and is rotationally locked to the second gearwheel 5b of the transmission 5. The shank 12 of the coupling 10 furthermore forms part of the hub-side drive part 3 and is rotationally locked to the second bevel gear 9b of the angular drive 9.

In the present example the hub carrier 8, which holds the hub 7, is embodied in the form of a housing, the angular drive 9 being accommodated inside the hub carrier 8. It is advantageous to integrate the hub-side drive part 3 with the steering system of the motor vehicle. For this purpose a transmission element 13, which in this example is embodied as a gearwheel rotationally locked to the hub carrier 8, is arranged on the hub carrier 8. In this case the transmission element 13 is a part of a steering gear. The transmission

element 13 meshes with a worm 14 of the steering gear, which can be driven by a second electrical machine 15. At the same time the worm 14 is rotationally locked to a rotor of the second electrical machine 15, a rotation of the worm 14 about an axis of rotation E producing a rotation of the transmission element 13 about the axis of rotation B. In this example the steering gear is therefore embodied as a worm gear, so as to ensure a fine resolution in a steering direction of the wheel 6, with a view to the ride comfort.

By making modular use of the wheel hub drive 1 an all-wheel drive for a motor vehicle can advantageously be achieved. Figs 2 and 3 show a schematic representation in plan view of a motor vehicle 16 according to one embodiment of the invention, in which a wheel hub drive 1 is assigned to each wheel 6. Figs. 2 and 3 represent different positions or steering directions of the wheels 6.

List of reference numerals

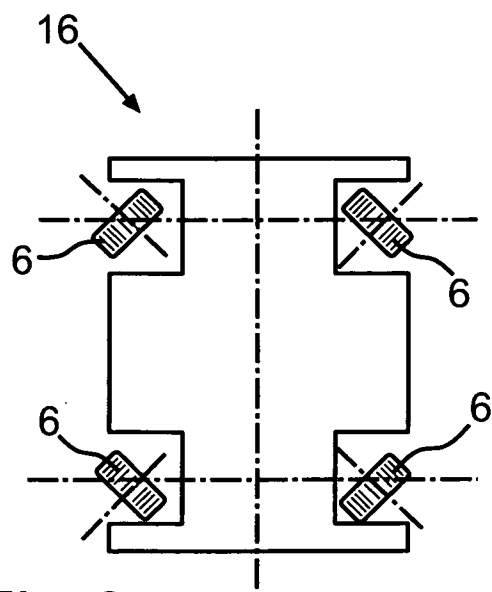
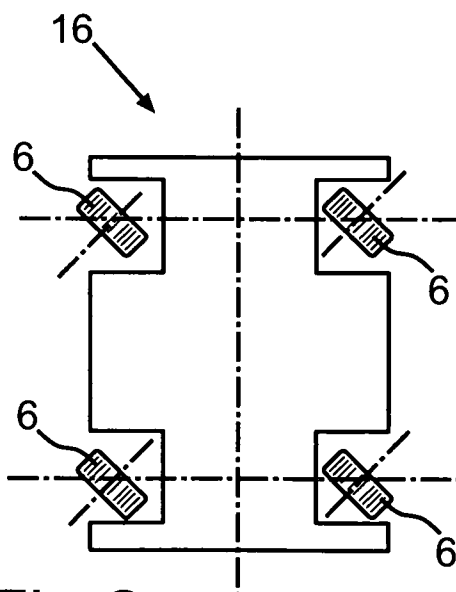
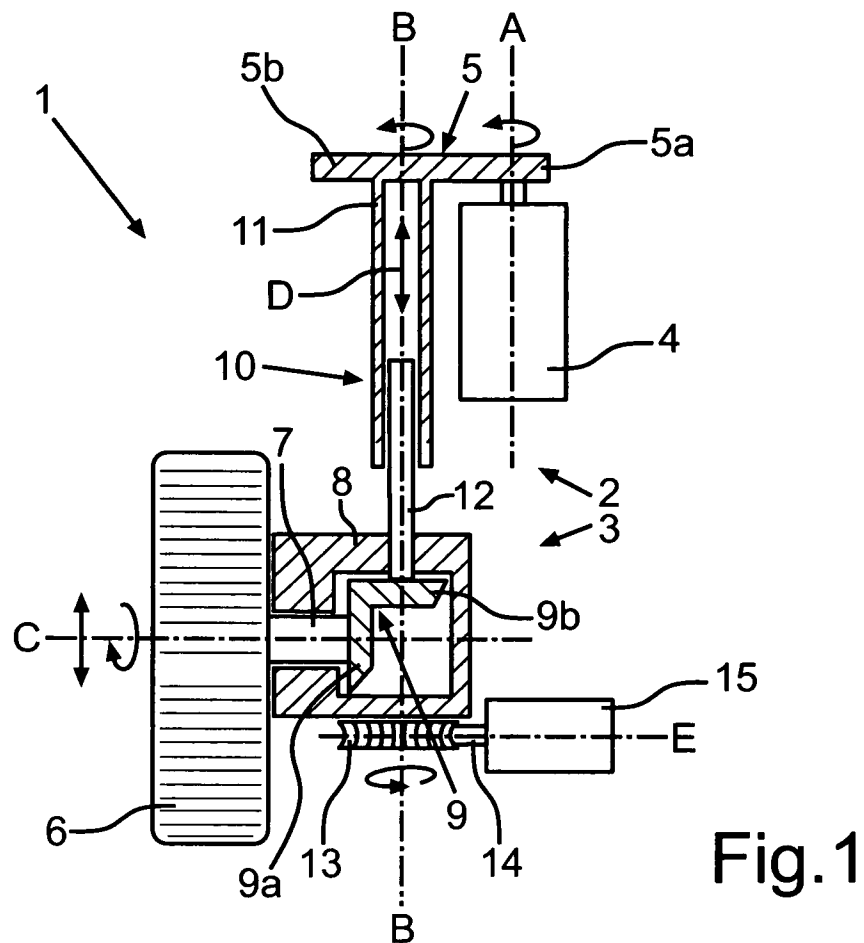
1	wheel hub drive
2, 3	drive part
4, 15	machines
5	transmission
5a, 5b	gearwheels
6	wheels
7	hub
8	hub carrier
9	angular drive
9a, 9b	bevel gears
10	coupling
11	guide element
12	shank
13	transmission element
14	worm
16	motor vehicle
A, B, C, D, E	axes of rotation

Patent Claims

1. A wheel hub drive (1) for a motor vehicle (16), having a drive part (2) arranged on the vehicle body side and a drive part (3) on the wheel hub side, which comprises an angular drive (9) for driving a wheel hub (7), which is held by a hub carrier (8), characterized in that a transmission element (13) of a steering gear is arranged on the hub carrier (8).
2. The wheel hub drive (1) as claimed in claim 1, characterized in that the angular drive (9) is accommodated inside the hub carrier (8).
3. The wheel hub drive (1) as claimed in claim 1 or 2, characterized in that the transmission element (13) of the steering gear is embodied in the form of a gearwheel rotationally locked to the hub carrier (8).
4. The wheel hub drive (1) as claimed in one of the preceding claims, characterized in that the steering gear is embodied as a worm gear and the transmission element (13) meshes with a worm (14), which can be driven by an electrical machine (15).
5. The wheel hub drive (1) as claimed in one of the preceding claims, characterized in that the angular drive (9) comprises two bevel gears (9a, 9b), which are arranged at an angle to one another and intermesh with one another.
6. The wheel hub drive (1) as claimed in one of the preceding claims, characterized in that a coupling (10), which is arranged on the output side of an electrical machine (4) and a transmission (5), is provided between the drive part (2) arranged on the vehicle body side and the drive part (3) on the wheel hub side.

7. A motor vehicle (16) having at least one wheel hub drive (1) as claimed in one of claims 1 to 6.
8. The motor vehicle (16) as claimed in claim 7, characterized in that a wheel hub drive (1) is provided for each wheel of the motor vehicle (16).

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/001481

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60K7/00 B60K17/04 B62D5/04

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)

B60K B62D

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 260 108 A (VINTEN GROUP PLC [GB]) 7 April 1993 (1993-04-07) page 4, lines 18-23; figure 1	1-3, 5-8
X	JP 61 285129 A (SHINKO ELECTRIC CO LTD) 15 December 1986 (1986-12-15) abstract; figure 1	1-3, 5, 7, 8
X	FR 952 655 A (LEMARCHAND, HENRI) 22 November 1949 (1949-11-22) page 3, lines 45-51 page 4, lines 24-30, 65-68 figures 3, 4	1-5, 7
X	EP 1 658 764 A (DEERE & CO [US]) 24 May 2006 (2006-05-24) paragraph [0022]; figure 2	1, 2, 5, 7, 8
	-/-	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

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X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

7 July 2009

Date of mailing of the international search report

15/07/2009

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/001481

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2009/001481

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