



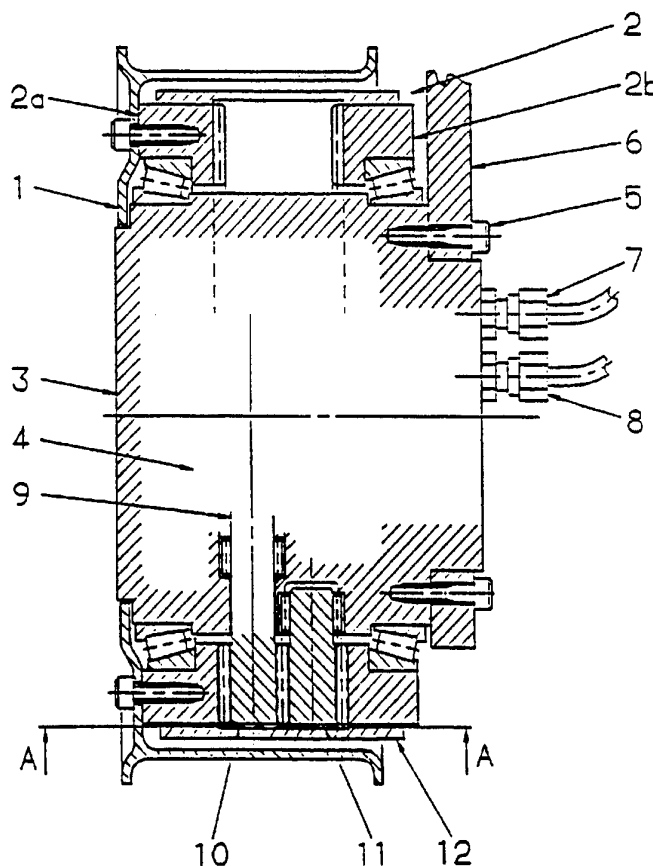
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(54) Title: GEAR DEVICE

(57) Abstract

The present invention refers to a gear device comprising a first crown wheel (2a) and a first pinion (10) meshing therewith as well as a second crown wheel (2b) opposed to and coaxial with said first crown wheel (2a) and a second pinion (11) meshing directly with said second crown wheel (2b). In order to provide for an improved driving situation of the crown wheels and the pinions of said device the invention suggests that a second pinion (11) is arranged in parallel with the first pinion (10) and adapted to mesh therethrough with the first crown wheel (2a), said pair of crown wheels (2a, 2b) rotating in the same direction and tooth play therebetween, if any, being eliminated by a common play-accommodating suspension (12) thereof.



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Gear device

The present invention refers to a gear device comprising a first crown wheel and a first pinion meshing therewith as well as a second crown wheel opposed to and coaxial with said first crown wheel and a second pinion meshing directly with said second crown wheel.

A device of this kind is previously known from US-5,233,886. The advantage of this gear device is that several power outputs may be arranged from a common driving power shaft. The device also provides for a doubling of the power which can be transferred compared to other designs having only one crown wheel. This known gear device therefore is particularly well suited to be used in connection with power transmissions in helicopters.

Plane crown wheels or face wheels of the kind which can be used in gear devices according to said aforementioned US patent specification are known from e.g. EP 0,227,152. DE-A-1 450 829 is an example of a previously known angle gearing including a cylindrical pinion and a face gear.

Recently a design problem has arisen, in which relatively great momentum with relatively great gearing ratio has to be transferred in a very restricted space to a driven means, particularly a wheel. The desired gear ratio has to be of the order of 1:8 to 1:10 and therefore the use of a planetary gear device can not be advantageously utilized because the optimum gear ratio of planetary gearings in one stage is limited to about 1:6.

However, a gear ratio of the order of about 1:8 - 1:10 may be obtained by means of a crown wheel device, particularly a device of plane type. Calculations have shown, however, that about only one half of the desired driving moment can be transferred with such a gear ratio to the

driven means or wheel by means of a single crown wheel and one single pinion meshing therewith. By means of two crown wheels according to the aforementioned US patent specification this will be possible, however, only while providing a counter rotating motion of the two crown wheels which in many cases makes the design complicated and also is non-desirable from other points of view.

The main object of the invention now is to suggest a crown wheel device of the above-stated kind which allows a transfer of such a double driving moment without suffering from the drawbacks of prior designs. This is achieved according to the invention substantially in that the second pinion is arranged in parallel with the first pinion and adapted to mesh therethrough with the first crown wheel, said pair of crown wheels rotating in the same direction and toothplay therebetween, if any, being eliminated by a common play-accommodating suspension thereof.

A disadvantage of prior crown wheel constructions having only one pinion on the output shaft of a driving motor is that bending deformations of the shaft cause load variations since the pinion operates one-sidedly loaded from the crown wheel. This is entirely eliminated in twin-crown wheel designs and by having the second pinion operating under the intermediation of the first pinion an advantageous operation situation to the entire construction is obtained. Through the first pinion mounted to the drive shaft and meshing directly with the first crown wheel the power of the driving moment is transferred whereas the second pinion has a supporting function and relieves loads occurring from the above-stated bending moment. This functional division of the two pinions now makes it possible to optimize each of them to the respective function, particularly in that the second pinion is mounted on a shaft having an intentionally dimensioned journalling for accommodating the bending forces.

By way of example the invention will be further described below with reference to the accompanying drawing, in which Fig. 1 is a diametrical section through the inventive

gear device and Fig. 2 is an end view taken in the plane of the line A-A of Fig. 1.

In the drawing is illustrated the present invention as applied to the driving of a vehicle wheel having a wheel rim 1 which is secured to one of the crown wheels 2a of an inventive gear device generally designated 2. Said first crown wheel 2a, which in the present case is of plane type, i.e. a face gear, is rotationally supported by the casing 3 of a drive motor 4 mounted substantially within the free space in the wheel. Through said casing 3 and by suitable bolt connections 5 the motor 4 is rigidly secured to a portion 6 of the lower part or chassis of a vehicle not further illustrated. The driving motor 4 in the present case is thought to be a hydraulic motor and therefore comprises suitable hydraulic connections 7, 8 to a hydraulic system within the vehicle comprising a hydraulic pump. However, the motor 4 also might be an electric motor of suitable kind having corresponding electric connections 7 and 8 to a generator or an accumulator in the vehicle.

At its free end the output shaft 9 of the driving motor 4 is provided with a gear or pinion 10 which in this case is constituted by a cylindrical gear adapted to cooperate with the face gear 2a. The shaft 9 thereby lies on a line which is parallel to a radius of the face gear 2a and at a suitable spacing from the tooth surface of the face gear in order to mesh with the teeth thereof.

Coaxially with and opposed to said first crown wheel or face gear 2a a second face or crown wheel 2b is rotatably journaled on the drive motor casing 3 and meshes with the first pinion 10 through an intermediary second pinion 11 which, of course, also is a cylindrical gear in the present case and mounted on an axis which is parallel to the shaft 9 and is freely rotatably journaled in the casing 3.

Owing to the fact that the crown wheel 2b is driven under the intermediation of the intermediary pinion 11 from the first pinion 10 the two crown wheels 2a, 2b will rotate in the same direction contrary to prior constructions. This

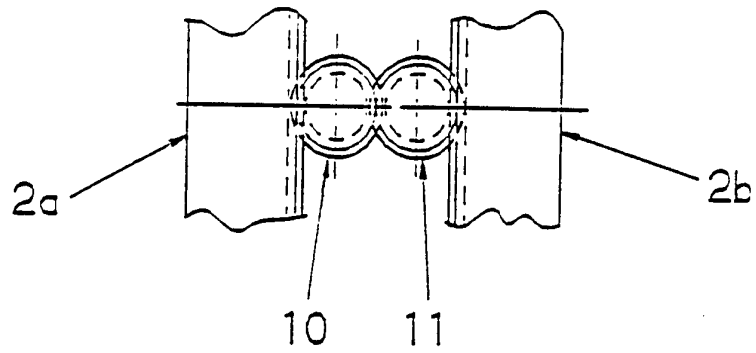
implies improved driving conditions to the two pinions 10 and 11, which increase their service life. The meshing of the pinions 10, 11 and crown wheels 2a, 2b also will be improved.

5 The tooth play which may arise in the meshing between the two crown wheels 2a, 2b and the respective pinion 10, 11 in some cases might need to be eliminated or accommodated in some way and this may be obtained, as indicated in Fig. 1, by supporting the two crown wheels 2a, 2b in a common suspension device 12 which allows a small mutual angular
10 adjustment between said pair of crown wheels.

In Fig. 2 it has been illustrated an end view of the mutual meshing of the crown wheels 2a, 2b and the pinions 10, 11.

C l a i m s

1. A gear device comprising a first crown wheel (2a) and a first pinion (10) meshing therewith as well as a second crown wheel (2b) opposed to and coaxial with said first crown wheel (2a) and a second pinion (11) meshing directly with said second crown wheel (2b), characterized in that said second pinion (11) is arranged in parallel with the first pinion (10) and adapted to mesh therethrough with the first crown wheel (2a), said pair of crown wheels (2a, 2b) rotating in the same direction and tooth play therebetween, if any, being eliminated by a common play-accomodating suspension (12) thereof.
2. A device according to claim 1, characterized in that the crown wheels (2a, 2b) are of plane type, i.e. so-called face gears, and the pinions (10, 11) are cylindrical.



A - A

FIGURE 2

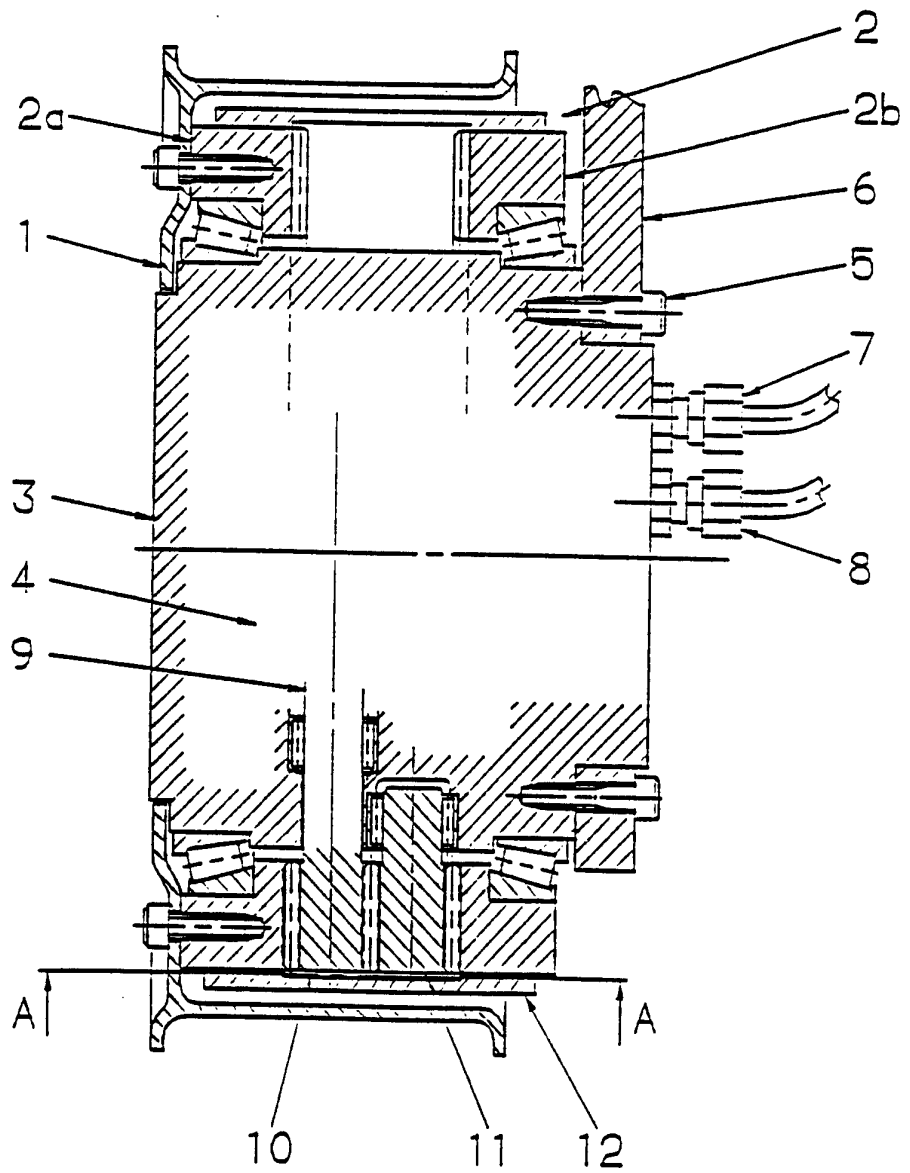


FIGURE 1

SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 93/01052

A. CLASSIFICATION OF SUBJECT MATTER		
IPC : F16H 1/20, B60K 17/14 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 : F16H, B60K		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 5233886 (BOSSLER, JR.), 10 August 1993 (10.08.93) --	1-2
A	US, A, 4983153 (LUIJTEN), 8 January 1991 (08.01.91) --	1-2
A	EP, A1, 0227152 (KUIKEN N.V.), 1 July 1987 (01.07.87) --	1-2
A	DE, A1, 2826022 (WGW WESTDEUTSCHE GETRIEBE- UND KUPPLUNGSWERKE GMBH), 20 December 1979 (20.12.79) -- -----	1-2
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International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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DE-A1- 2826022	20/12/79	US-A- 4266436	12/05/81