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(54) Title: MECHANICAL TRANSMISSION GROUP FOR TRANSMITTING MOTION FROM A CENTRAL AXIS TO FOUR DRIVE WHEELS OF A LARGE VEHICLE

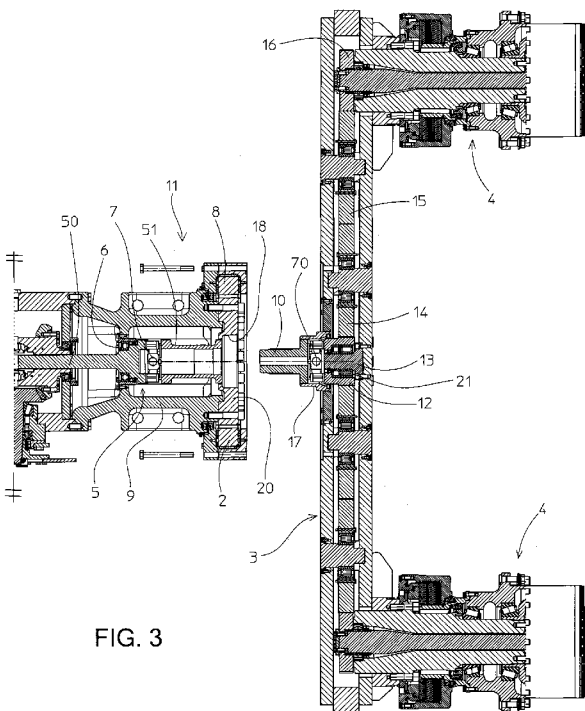


FIG. 3

(57) Abstract: A mechanical transmission group for transmitting motion from a central axis to four drive wheels of a large vehicle, in which the central axis is composed of two half-axes and has two drive half-shafts which transmit the motion to the wheels via appropriate mechanical transmissions. Each axle shaft (1) is connected in an oscillating or tilting way to a bearing structure that supports the wheels (3) by means of a slewing ring coupling (2). Each drive half shaft (5) is divided into several, mechanically connected, parts locked for rotation by means of sliding couplings and joints.



## **MECHANICAL TRANSMISSION GROUP FOR TRANSMITTING MOTION FROM A CENTRAL AXIS TO FOUR DRIVE WHEELS OF A LARGE VEHICLE**

### DESCRIPTION OF THE INVENTION

The present invention relates to a mechanical transmission group for transmitting motion from a central axis to four drive wheels of a vehicle.

Specifically, but not exclusively, it is advantageously used in groups for transmitting motion of big dimensions and power, which must not only assure a transmission of motion characterized by high torques, but also fulfil a bearing task and support very heavy loads and outer stresses.

For example, this is the case of huge operating machines for earthmoving, such as motor levelling machines or graders, which are usually equipped with four drive wheels, two at each side, usually situated in a rear position, and with a pair of wheels provided at the front. A blade aimed at working on the ground is situated in an intermediate position between the pair of front wheels and the four drive wheels.

The four rear drive wheels are usually operated into rotation by a single motor, which feeds a central drive, from which two half-axles originate and supply the motion to the two drive wheels at each side.

In this case, the single drive wheels are subjected to strong stresses, which do not allow the axles of the wheels to easily maintain a correct orthogonal position with respect to the drive axles. Consequently, in most existing embodiments, the rotation motion is transmitted to the drive wheels by chain transmissions from each central half shaft, in such a way as to exploit the resilience and the shift possibility of the same chains. Obviously, the use of chains to transmit motion from the central shaft to the drive wheels allows the transmission to function with light inevitable shifts, but on the other side, its

drawback derives from the fact that it causes a certain wear and consequently, the chain transmission has a limited duration and requires rather frequent maintenance. Moreover, such a type of transmission limits the vehicle speed due to the limitation of the speed of the roller chains, especially when they are strongly loaded.

There are moreover embodiments that use gear transmissions, in which the gears, set in cascade, are housed in boxes called also *guitars* or *banjos*, in which however the transmission group, known all in all as *bogie*, is used only for groups of limited dimensions, which allow the absorption of limited shifts facilitated by the use of narrow gears characterized by strongly bevelled teeth.

Therefore, in practice, beyond a given power limit, the use of chain transmissions is required. However, due to their nature, the chain transmissions must be substituted frequently.

The object of the present invention is to overcome the above mentioned limits, drawbacks and disadvantages of the prior art.

In particular, the invention proposes a system or transmission group, which is not affected by the shifts and misalignments, that cannot be eliminated in big articulated structures of the above described type.

Such a transmission system or group is provided with wheels supporting boxes of considerable length, which house robust mechanical wheelworks. In order to transmit high powers, the wheelworks must operate while being perfectly in alignment and/or orthogonal with the central shaft, which transmits motion to both sides of the machine.

An advantage of the present invention derives from the fact that the group is structured so that its main components can be easily dismantled without spilling oil and without particular interventions on the internal parts of the mechanism.

This offers also the advantage of an easy reduction of the machine dimensions, so that it can be transported on-road, once disassembled in several parts or subgroups.

These objects and advantages are obtained by the present invention, as it is claimed, described and illustrated hereinafter.

—The characteristics of the present invention will appear more evident from the —

following description of some of its embodiments, illustrated by way of not limiting example, with the help of the enclosed figures, in which:

- Figure 1 is a schematic perspective view of the invention;
- Figure 2 shows the whole transmission group in enlarged scale and schematic cross-section, taken along a horizontal middle plane, referred to a symmetrical half, with respect to a vertical middle plane;
- Figure 3 shows the same cross-section of Figure 2 in a configuration, in which a lateral component is disassembled from the respective central axle shaft.

The above mentioned Figures represent a mechanical transmission group for transmitting motion from a central axis 1 to four drive wheels of a large vehicle. Only the hubs 4 of the drive wheels comprising braking devices and planetary gears are shown.

The group includes a central axis 1, which consists of two half-axes 11 and houses a transmission with no-spin bevel gear, from which originate two drive half-shafts 5. The motion is transmitted from the drive half-shafts to the hubs 4 of the wheels by means of suitable mechanical transmissions. Each axle shaft 11 is constrained in an oscillating or tilting way to a wheels' bearing structure 3 by means of a slewing ring coupling 2.

The wheels bearing structures 3 include boxes called also guitars or banjos and support the load.

Each axle shaft 11 is connected at its end, in an oscillating or tilting way, to the bearing structure that supports the wheels 3 by means of a slewing ring coupling 2.

Each drive half shaft 5 is divided into several, mechanically connected, parts locked for rotation by means of sliding couplings and joints, which allow easy separation, without spilling oil, of the most important structural parts.

Actually, each half shaft 5 includes a first central portion 50, which originates, at its first end, from a differential group. The first central portion 50 is fastened to a first articulated joint 7 by means of its second end.

The articulated joint 7 is adapted to transmit the rotation motion to a second portion of the shaft 51, which is likewise contained inside a hollow carrier body 9 together with a part of the first central portion 50.

In particular, in proximity of its second end, the first central portion 50 of each half shaft 5 is supported by a bearing 6 and isolated from the inside of the hollow carrier body 9. The hollow carrier body 9 contains, downstream of the bearing 6 with reference to the direction of the transmission of the motion to the hubs 4, the articulated joint 7 and the shaft portion 51.

This latter shaft portion 51 is provided with grooved means or longitudinal grooves, which allow its free, but locked for rotation, coupling with a first end of a grooved shaft or pin 10.

The first end of the grooved portion of the shaft or pin 10 is situated outside of the containment box or guitar, which constitutes the bearing structure that supports the wheels 3, as well as of the device for transmitting the motion to the wheels, not shown, which are mounted on the hubs 4.

The portion of the grooved shaft or pin 10 has its second end fastened to a second articulated joint 70, which is locked for rotation with a pinion 12, aimed at controlling the mechanical transmission of the motion to the hubs 4.

In this case, the pinion 12 has a hollow shape in order to house, with the interposition of bearings 21, a bearing pin 13, which is integral with the containment box or guitar that constitutes the bearing structure that supports the wheels 3.

The slewing ring coupling 2 between each axle shaft 11 and the wall facing it of the box or guitar constituting the bearing structure 3, is carried out between a flange 8, located at one end of the hollow carrier body 9, and a wall of the containment box or guitar forming the bearing structure that supports the wheels 3. The projecting portion of the grooved shaft or pin 10 is situated in correspondence to the bearing structure 3, and, as shown in Figure 3, it protrudes at least along the grooved part.

The obtained coupling allows a relative mobility for rotation between the two fastened parts.

The drive device for transmitting motion from the pinion 12 to the hubs 4 of the wheels includes a series of gear wheels 14,15,16 coupled in cascade one after another.

A collar 17 is located in the proximity of the base of the grooved shaft or pin 10 to interact and couple coaxially with the surface 18 that is formed in a ring 20 fastened to the end of the hollow carrier body 9, in order to facilitate the coupling in the axial direction of the grooved portion of the shaft or pin 10 with a corresponding grooved portion of the second shaft portion 51.

In the illustrated embodiment, the second shaft portion 51 is hollow and is equipped with longitudinal grooved means, made in correspondence to its inner cylindrical surface. The grooved means allow a free, but locked for rotation, coupling with a first end of the portion of the grooved shaft or pin 10, which features the grooves at its outer cylindrical surface.

In a second embodiment, not shown in the enclosed Figures, a second shaft portion is provided, which is locked for rotation to the first articulated joint 7 and is equipped with grooved means, made at its outer cylindrical surface, which allow an axially free, but locked for rotation, coupling with a first end of a first grooved portion of a shaft or pin, which is connected to the second articulated joint 70, is hollow and has grooves on its inner cylindrical surface.

The invention makes it possible to transmit correctly the motion to the hubs of the wheels.

Furthermore, various types of articulated joints can be used and planetary gears can be easily be mounted at the hubs of the wheels, so as to allow the transmission means to work correctly also at high speed.

A considerable advantage derives from the possibility to easily dismantle the group also on site without spilling oil and without necessity of experienced technicians.

## CLAIMS

1). A mechanical transmission group for transmitting motion from a central axis to four drive wheels of a large vehicle, in which the central axis is composed of two half-axes and has two drive half-shafts which transmit the motion to the wheels via appropriate mechanical transmissions, each half-axle (11) is constrained in an oscillating or tilting way to a bearing structure that supports the wheels (3) and is connected to said supporting structure that supports the wheel (3) in oscillating or tilting fashion, by means of a slewing ring coupling (2); each drive half-shaft (5) being divided into several, mechanically connected parts locked for rotation by means of sliding couplings and joints **characterized in that** each half-shaft (5) includes a first central portion (50), which originates, with a first end, from a differential unit and which has a second end, through which it is bound to a first articulated joint (7); said articulated joint (7) being adapted to transmit the rotation motion to a second shaft portion (51) that is contained within a hollow carrier body (9); said first central portion (50) of each half-shaft (5) being supported by a bearing (6) in proximity of said second end and isolated from the inside of the hollow carrier body (9), with said articulated joint (7) and said shaft portion (51) being contained therein; said shaft portion (51) being equipped with grooved means, which allow a coupling axially free but locked for rotation, with a first end portion of a grooved shaft (10).

2). A group according to claim 1, characterized in that the first end portion of the grooved shaft (10) is placed outside the containment box or guitar, which forms the supporting structure that supports the wheels (3) as well as the device for transmitting the motion to the same wheels; said grooved shaft portion (10) having its second end connected to a second articulated joint (70), which is locked for rotation with a pinion (12), which controls the mechanical transmission of the motion to the hubs 4.

3). A group according to claim 2 characterized in that the pinion (12) is hollow in order to accommodate inside a bearing pin (13) integral with the containment box or guitar and forming the supporting structure that supports the wheels (3).

4). A group according to claim 2 or 3, characterized in that said slewing ring coupling (2) is implemented between a flange (8), located at one end of said

hollow carrier body (9), and a wall of the containment box or guitar forming the supporting structure that supports the wheels (3), the projecting portion of the grooved shaft (10) being situated in correspondence thereto.

**5).** A group according to claim 2 to 4, characterized in that the drive device for transmitting motion from the pinion (12) to the hubs (4) of the wheels consists of a set of gear wheels (14,15,16) set in cascade..

**6).** A group according to claim 2 to 4, characterized by comprising a collar (17), which is located in the proximity of the base of the grooved shaft or pin (10) to interact with the surface (18) that is formed coaxially in a ring (20) fastened to the end of the hollow carrier body (9) in order to facilitate coupling in the axial direction of the grooved portion of the shaft or pin (10) with a corresponding grooved portion of the second shaft portion (51).

**7).** A group according to claim 2 to 6, characterized in that the second shaft portion (51) is hollow and is equipped with grooved means provided in its inner cylindrical surface, which allow a free, but locked for rotation, coupling with a first end of the of a grooved shaft portion (10), which is a shaft having grooves on the outer cylindrical surface.

**8).** A group according to claim 2 to 6, characterized in that a second shaft portion is provided, which is locked for rotation to the first articulated joint 7 and is equipped with grooved means, which allow an axially free, but locked for rotation, coupling with a first end of a first grooved portion of shaft or pin, which is connected to the second articulated joint 70, is hollow and has grooves on the inner cylindrical surface.



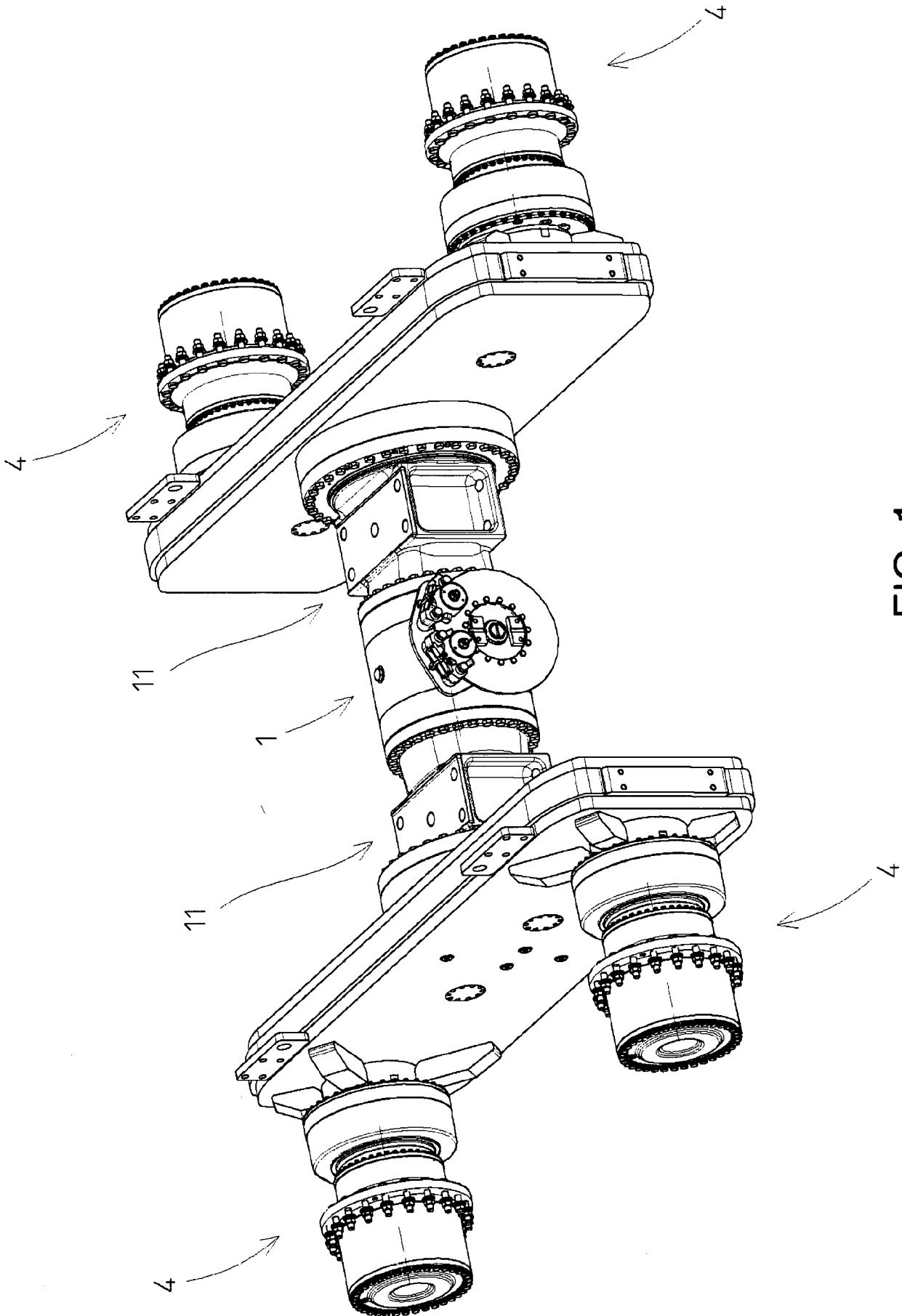


FIG. 1

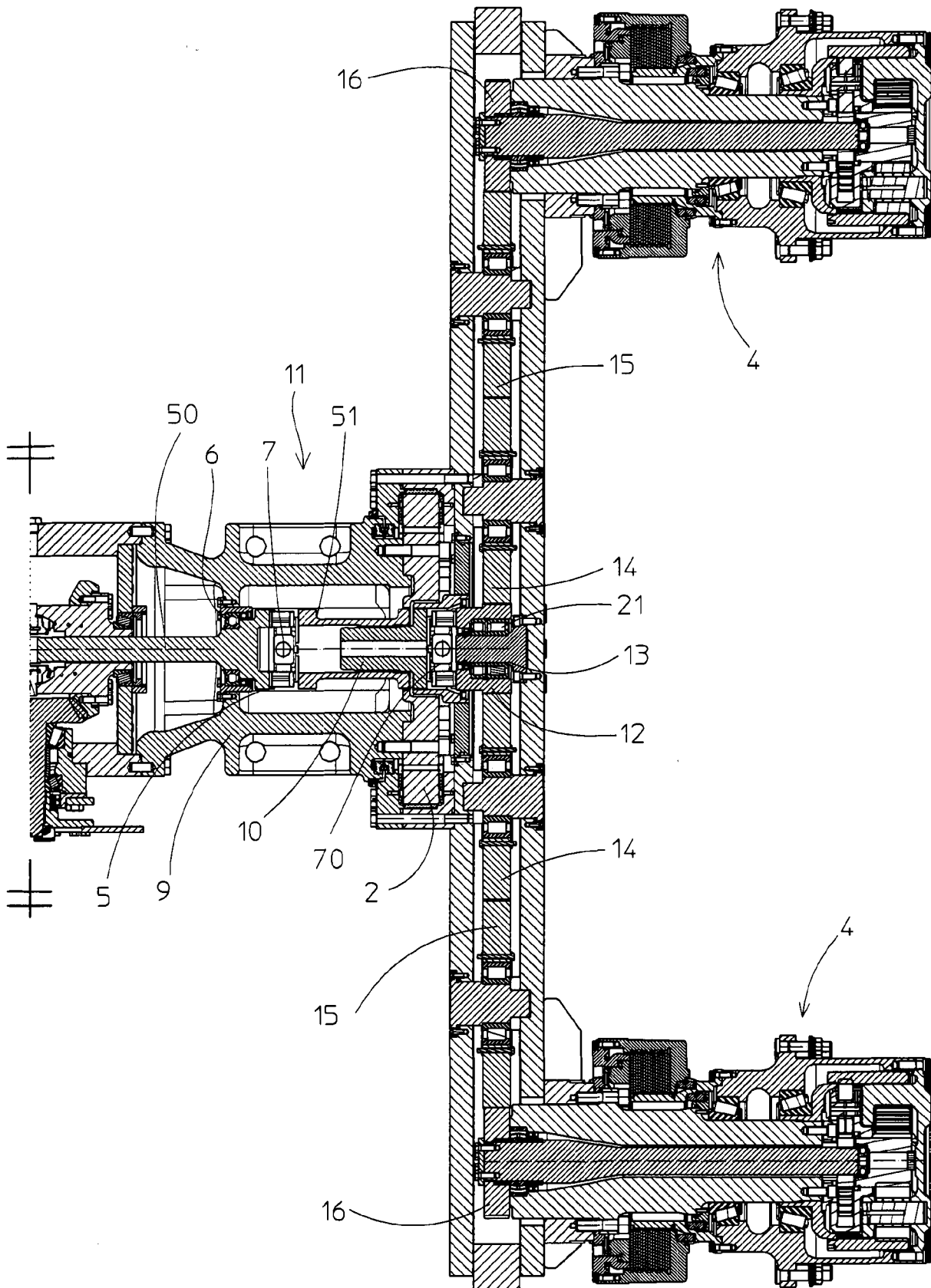


FIG. 2

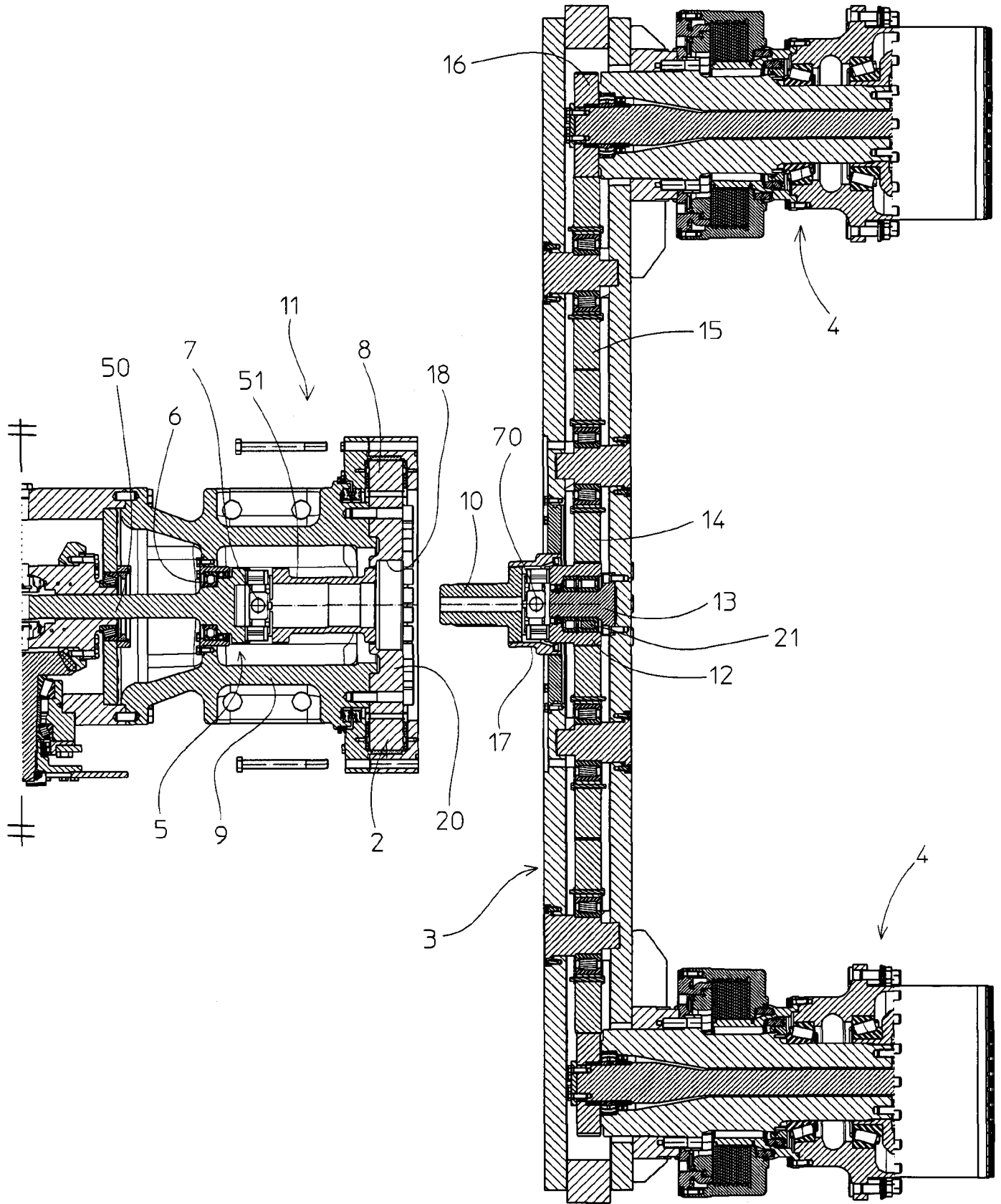


FIG. 3

# INTERNATIONAL SEARCH REPORT

International application No  
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**A. CLASSIFICATION OF SUBJECT MATTER**

INV. B60B35/12 B60K17/32 B60K17/36 B60B35/14 B60B35/18  
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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)  
B60B B60K

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 practicable, 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.
A	WO 2004/098938 A1 (EQUIP NOKAMIC INC [CA]; JOBIN GINO [CA]; POTVIN DAVID [CA]; NAULT LOUI) 18 November 2004 (2004-11-18) page 12, line 7 - page 13, line 5; figures 2-8	1-8
A	----- US 5 290 201 A (TESKER HENRY L [US]) 1 March 1994 (1994-03-01) column 8, line 49 - column 9, line 28; figures 2,3,14	1-8
A	----- EP 0 180 585 A1 (CATERPILLAR TRACTOR CO [US]) 14 May 1986 (1986-05-14) column 4, line 53 - column 8, line 22; figures 1,2,4 -----	1-8

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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