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(54) Variable-gauge wheelset for a railway vehicle with independent drive wheels directly coupled to coaxial motors

(57) Variable-gauge wheelset (1) for railway vehicle with independent drive wheels (4,4') directly coupled to coaxial traction motors (7), comprising a frame (2), at least one axle consisting of two sets of independent wheels, each one with a wheel (4,4') mounted in a short axle (5,5') supported at the ends in respective bearer boxes (6a,6b;6a',6b') displaceable in said frame, and an electric traction motor (7) for each one of the said wheels, mounted coaxially with each one of said short axles (5,5') and provided with a stator (8,8') attached to said frame (2) and a rotor (9,9') inside which a telescopic transmission shaft (10,10') is housed and is connected with said rotor (9,9') and said short axle (5,5') with interposition of respective flexible couplings.

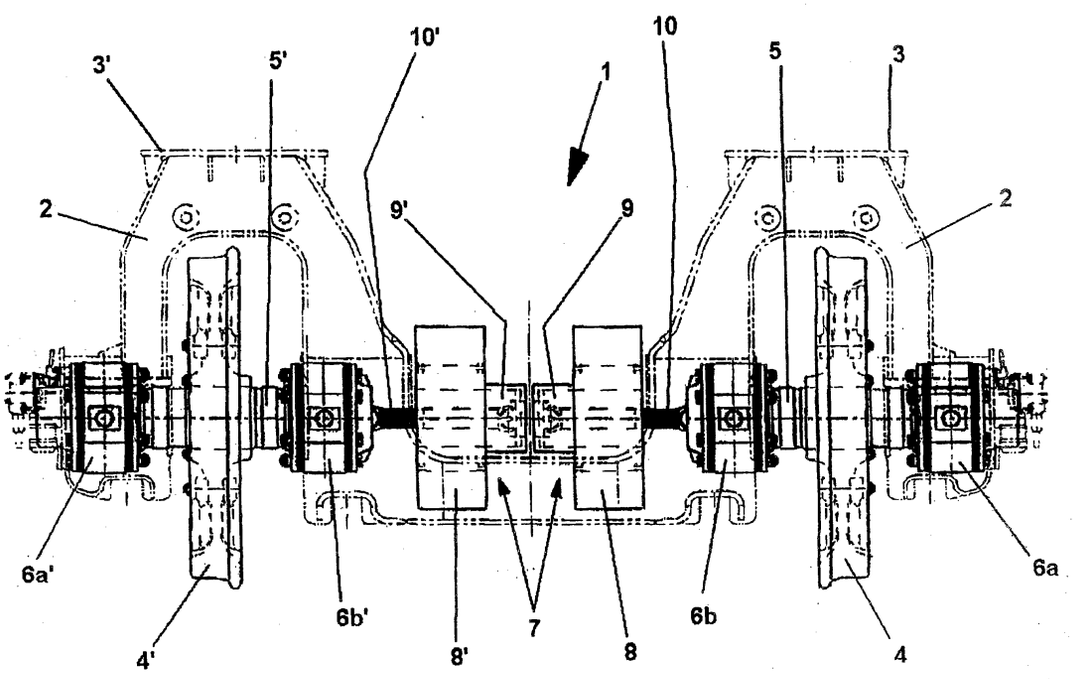

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a novel drive wheelset and, more particularly, to a single-axle wheelset with movable independent drive wheels, for a railway vehicle, that can be used on different gauges, with direct coupling between each drive motor and the driven wheel. Specifically, the invention is applicable to TALGO® wheelsets of variable gauge, or others of similar design.

[0002] As is known, TALGO® wheelsets consist of a pair of wheels, each one of them fixed on a short axle housed via its ends in separate bearings positioned one on the inside and the other on the outside with respect to the wheel and movable by sliding with respect to the frame of the wheelset in a direction perpendicular to the direction of travel of the train. These wheelsets are incorporated in the connection between two railcars.

BACKGROUND OF THE INVENTION

[0003] The present system is an additional development of the work done by the applicant in the field of the construction of rolling-stock for travelling at high speed and equipped with movable independent wheels so that it can be adapted to different gauges.

[0004] An example of this technology is Patent FR-A-1 558 329 of the applicant, in which a description is given of a single-axle bogie with variable separation between the wheels, which solves the problem of it being possible to use one and the same bogie for travel on two different gauges, for example the gauge usually found in Spain and the gauge usually found in France and other European countries.

[0005] In document EP-A-0 802 101, a description is given, moreover, of a railway axle assembly provided with automatic gauge change and capable of being fitted to conventional bogies with a fixed distance between their wheels, with the result that a conventional railway vehicle, suitable for travelling on a single gauge, becomes capable, after having had said railway axle assembly fitted to it, of travelling on another, different gauge, for example passing from the Spanish to the French railway network, and vice versa.

[0006] Furthermore, experience has demonstrated that in order for a formation to achieve high speeds (in excess of 300 km/h) it is necessary to have high drive potential. Equally, for vehicles travelling at such speeds not to generate unacceptable damage on the track, it is necessary for their weight per axle to be a maximum of 17 MT. Because of this, it is not easily possible for the drive axles to be only those corresponding to the driving cars, since customary concentrated drive does not offer sufficient adhesion weight, which requires recourse to what is known as "spread drive", i.e. to all or most of the axles being drive axles.

[0007] This solution means that all or practically all the weight resting on the wheels of the vehicle is adhesion weight, which will make it possible to have not only a markedly greater power but also a significant total force on the wheel rims without running the risk of the wheels skidding.

[0008] In accordance with this approach, there are already known attempts in the prior art aimed at the drive applied to a train not originating solely from the locomotive but also from drive axles incorporated in the train cars. An example of this is described in document EP-A-0 825 085, which refers to a drive bogie equipped with a toothed extendable axle mounted between each pair of opposite wheels and to which the torque generated by a motor is transmitted in order to thus rotate the wheels.

[0009] According to the known prior art, the spread drive applied to single-axle railway wheelsets equipped with independent wheels comprises, for each wheel, an electric drive motor associated with each wheel that transmits its actuation indirectly to the associated wheel, i.e. with the intervention, in addition to the corresponding transmission shaft, of an assembly of a gearwheel (integral with said transmission shaft) and ring gear (integral with the axle of the wheel in question). In a known alternative embodiment, there may be an intermediate toothed wheel meshed between said gearwheel and said ring gear.

[0010] Said gearwheel may be a bevel gear and said ring gear may be a crown wheel that meshes directly with the gearwheel and is mounted on the inside face of the wheel, with the result that the drive developed by the motor is applied to the inside end of the wheel axle.

[0011] In another solution of the prior art, the gearwheel is a spur pinion and the ring gear is a spur crown that meshes with the gearwheel via an intermediate spur wheel and is mounted on the outside face of the wheel, with the result that the drive developed by the motor is applied to the outside end of the wheel axle.

[0012] In both spread-drive solutions of the prior art just considered, the drive motor is suspended from the car body, with the result that, although a reduction in the suspended weight is achieved, this is in return for an increase in the losses through friction in the transmission of the actuation of each motor to its associated wheel and, in addition, for an increase in the possibilities of failure upon introducing said transmission assembly into the rolling gear.

SUMMARY OF THE INVENTION

[0013] In its two preferred embodiments, the present invention offers a system for direct coupling of an electric drive motor to a movable independent drive wheel, eliminating the speed-reducing and/or transmission mechanisms customary in this type of drive, which system is characterized by the electric drive motor for actuating its associated wheel being mounted directly in a

coaxial position with respect to the geometric axis of the axle carrying the wheel, in an extension of said axle and towards the inside of the railway vehicle, such that a TALGO®-type wheelset of the kind to which the invention relates will be formed by independent separate wheels, each one of these mounted on a short axle supported in rotation, in turn, via its ends, in a pair of bearings that can move relative to the frame of the wheelset in a direction transverse to the direction of travel of the train, it being possible to immobilize said bearings by means of at least one locking bolt (in a manner similar to how this is achieved in the TALGO system with movable independent wheels) in selected positions in accordance with the gauge, each drive motor being mounted at the inner end of said axle carrying the wheel such that the two motors of one and the same axle are arranged one beside the other, the stator of each one of said drive motors being mounted in a fixed manner on said frame of the wheelset and being connected to the rotor of each one of said drive motors in direct take-off to the inner end of each one of said wheel-carrying axles by means of a short, telescopic transmission shaft.

[0014] Said short, telescopic transmission shaft is in a retracted position, housed completely inside an axial cavity defined in the rotor of the drive motor when the wheelset is adapted in order to run on a narrower gauge, whilst it is in an extended position, partially outside the above-mentioned cavity of said rotor when said wheelset is adapted in order to run on a wider gauge.

[0015] The coupling of said short, telescopic transmission shaft, both at one of its ends to the inside of the rotor and at the other to the end of the axle carrying the wheel, is achieved by means of corresponding universal joints.

[0016] This spread-drive system with direct coupling between drive motor and wheel may be mounted on the two types of TALGO® wheelset currently in use, in the first of which the frame has the general form of a yoke, with the wheels housed in the inverted U-shaped cavities of the frame on which the elastic suspension elements of the car body are mounted, and in the second of which the frame of the wheelset is flat, defining a substantially rectangular framework with the wheels arranged near its ends. For this, it is necessary only to vary the mounting configuration in order to fix the electric motors to said frame of the wheelset.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention is illustrated in the attached drawings, in which:

Fig. 1 is a diagrammatic front elevation of the novel spread-drive system with direct coupling according to a first embodiment of the invention;

Fig. 2a is a diagrammatic plan view, partially in section and on a larger scale, of the drive system shown in Fig. 1, showing only the motor/axle/wheel assembly of the right-hand part of said Fig. 1 prepared for travelling on a first gauge;

Fig. 2b is a view similar to that in Fig. 2a, but with the motor/axle/wheel assembly moved in order to travel on a second gauge;

Fig. 3 is a diagrammatic plan view of the novel spread-drive system with direct coupling according to a second embodiment of the invention;

Fig. 4 is a diagrammatic plan view, partially in section, on a larger scale, of the drive system shown in Fig. 3, showing only the motor/axle/wheel assembly of the right-hand part of said Fig. 3 prepared for travelling on a first gauge; and

Fig. 4b is a view similar to that in Fig. 4a, but with the motor/axle/wheel assembly moved in order to travel on a second gauge.

DESCRIPTION OF THE INVENTION

[0018] With reference, firstly, to Figs. 1, 2a and 2b, a description will be given below of a first preferred embodiment of the present invention.

[0019] In the figures, 1 generally indicates a wheelset of a type to which the invention relates, consisting, in this case, of a frame 2, substantially in the form of a yoke, on the end upper platforms 3, 3' of which the suspension elements (not shown) of the railway car body are intended to be mounted.

[0020] At each end, this wheelset 1 has an independent rolling assembly consisting of a wheel 4 (4'), an axle 5 (5') and respective outer and inner bearings 6a, 6b (6a', 6b'). Each one of said rolling assemblies is of the type that can be moved with respect to the frame 2 of the wheelset 1 in a direction transverse to the direction of travel of the railway vehicle, and the fixed operating positions of each one of said rolling assemblies with respect to said frame 2 are secured in the usual manner in wheelsets of this type by means of vertically movable bolts (not shown).

[0021] Given that this wheelset with independent, movable rolling assemblies that can be immobilized has been the subject of a number of patents in the name of the applicant, it will not be described in detail in this specification, but only as much as is necessary in order to facilitate understanding of the present invention.

[0022] Fig. 1 shows the arrangement of the two drive motors 7, very close together and one on either side of the central longitudinal plane of the railway vehicle, each one of said motors consisting of an outer stator 8, 8' integral with the frame 2 of the wheelset 1 and a rotor 9, 9' mounted rotatably inside said stator 8, 8 '. This rotor 9, 9' has a special configuration, with an axial cavity 20 of large diameter (see Figs. 2a and 2b) that is open at

one of its ends and in the back part of the blind end of which is coupled, internally, by means of a first universal joint 14, one end of a short telescopic transmission shaft 10, 10', the other end of which is coupled to the inside end of the axle 5, 5', respectively, by means of a second universal joint 14'. Both the specific configuration of each drive motor 7 and the arrangement of the telescopic transmission shaft 10, 10' that connects said motor to the axle 5, 5' of the associated wheel 4 of the wheelset will be understood better by referring with greater detail below to Figs. 2a and 2b.

[0023] With reference, now, to Fig. 2a, this shows, on a larger scale, a detailed view, in partial section, of the rolling assembly 4, 5 and 6a, 6b of the right-hand side of Fig. 1. The elements shown in this figure, which are common with those of Fig. 1, have the same reference numerals as in that figure.

[0024] This Fig. 2a shows the configuration of a rolling assembly that comprises a wheel 4 mounted on an axle 5 supported rotatably in outer and inner bearings 6a, 6b such that said assembly can move by sliding on the frame 2 of the wheelset in a direction transverse to the direction of travel of the train, the bearing 6b being shown in partial section in order to illustrate the installation bearings 12 of the axle 5 that support the inner end 11 of the latter, on whose outer face is mounted, at 16, for example by means of screws, a universal joint 14' integral with one end of the telescopic transmission shaft 10, the other end of which, provided with another universal joint 14, is secured at 15 to the back of the cavity 20 defined inside the rotor 9 of an electric drive motor 7 whose stator 8 is secured to the frame 2 of the wheelset 1 by any known means (not shown).

[0025] In the situation shown in Fig. 2a, the rolling assembly is located in the position in which the wheel 4 is further away from the central plane of the railway vehicle, i.e. that which would correspond to a wider gauge like that customary in the Spanish National Network. In this case, the telescopic transmission shaft 10 is extended, housed only partially inside the rotor 9.

[0026] In the situation of the rolling assembly shown in Fig. 2b, in which the same reference numerals are reproduced, corresponding to the position the wheel 4 would adopt when the vehicle travels on a European gauge, it is possible to see that the transmission shaft 10 is withdrawn, housed completely inside the rotor 9 of the drive motor 7. It may be observed in this figure that the assembly consisting of the wheel 4, the axle 5 and the bearings 6a, 6b has moved towards the left as compared with the situation illustrated in Fig. 4a. As a consequence, the telescopic shaft 10 has withdrawn, at all times maintaining its direct actuation transmission relationship from the drive motor 7 to the axle 5.

[0027] The coupling of said transmission shaft 10 by means of universal joints 14, 14' to the inner end of the axle 5 of the wheel 4 and the rotor 9 of the drive motor 7, respectively, allows absorption of possible misalignments that might arise during high-speed travel of the wheelset 1, with the result that any forces to which said transmission would be subjected in the absence of said flexible couplings are eliminated.

[0028] We refer, now, to Figs. 3 and 4a, 4b in order to explain the arrangement of the novel spread-drive system in accordance with the present invention in a horizontal, flat-frame wheelset, in accordance with a second preferred embodiment of the invention. In said figures, and for the purposes of simplification, where possible the same reference numbers as in Figures 1, 2a and 2b above have been retained.

[0029] Fig. 3, which is a diagrammatic plan view of a wheelset 100 with a flat frame 200, shows the rolling assemblies 4, 4'; 5, 5'; 6a, 6b and 6a', 6b' and their associated motors 7, all of which are similar to those described in connection with the first embodiment above, in the situation of travel on a gauge of the Spanish National Network type, with the transmission shafts 10, 10' extended. In this case, the drive motors 7 are arranged in the central opening provided in the frame 2 by way of framework, in which said rolling assemblies are mounted slidably in the manner described above.

[0030] This same situation is illustrated in greater detail in Fig. 4a, which shows, also, the mounting cantilevers 30 that, in the example illustrated, fix the stator 8 of the drive motor 7 to the frame 200 of the wheelset 100, for example by means of screws.

[0031] Lastly, Fig. 4b shows a view similar to that in Fig. 4a, showing the rolling assembly in the situation adapted for travel on a European gauge, with the telescopic transmission shaft 10 totally withdrawn and housed completely inside the rotor 9 of the drive motor 7.

[0032] The process of the rolling drive assembly's passage from one gauge to another would take place on a changer of the type currently in existence and would include the customary operations of:

- unweighting the wheels 4, the axle resting on the sliding shoes;
- lowering of the bolts and axial unlocking of the wheels;
- translation of the wheels 4 to the other gauge, with extension or withdrawal of the transmission shafts 10, 10';
- axial immobilization of the wheels by means of the raising of the bolts;
- supporting of the wheels on the rolling rails.

[0033] Given the sequence of operations just described, it will be obvious that the axial movement of each rolling assembly and the consequent withdrawal or extension of the telescopic transmission shaft takes place without, at any time, the drive motor according to the invention ceasing to rotatably actuate the associated wheel, thanks to the arrangement just described.

[0034] Experts in the field will understand that, in the above description of the currently preferred embodiments of the invention, provided solely for illustrative

purposes, modifications may be made that will not constitute a departure from the scope of the present invention as defined by the content of the attached claims.

Claims

1. Drive wheelset for a railway vehicle with movable independent drive wheels, comprising:

a frame of the wheelset;
at least one axle consisting of two independent rolling assemblies arranged coaxially in opposition, each one of which comprises a wheel mounted on a short wheel-carrying axle supported rotatably at its ends in separate bearings able to move slidably in said frame such that each one of said rolling assemblies can move as a whole in a direction transverse to the direction of travel of the railway vehicle in order to be immobilized in one of at least two operating positions; and
an electric drive motor for each one of said wheels;

characterized in that

each electric drive motor is mounted coaxially with respect to each one of said short wheel-carrying axles, at the end thereof that is arranged towards the inside of said railway vehicle;

the stator of each electric drive motor is secured to said frame of the wheelset;

the rotor of said electric drive motor has a core of large diameter that defines a central cavity that is coaxial with respect to said rotor and open at its end that faces said short axle, inside which is housed a telescopic transmission shaft integral, via one of its ends, with said rotor of the drive motor and connected, via its other end, to said inner end of said wheel-carrying short axle; and

in that said transmission shaft is connected to said rotor and to said wheel-carrying short axle with the interposition of respective flexible couplings.

2. Wheelset according to Claim 1, **characterized in that** the electric drive motors that actuate the two short axles carrying the wheels of one and the same wheelset are arranged very close together, one on either side of the central longitudinal plane of said railway vehicle.

3. Wheelset according to Claim 1 or 2, **characterized in that**, in the withdrawn situation, said telescopic transmission shaft is completely housed inside the cavity of the rotor of said electric drive motor.

4. Wheelset according to Claim 1 or 2, **characterized in that**, in the extended situation, said transmission shaft partially extends beyond said cavity of the rotor of said electric drive motor.

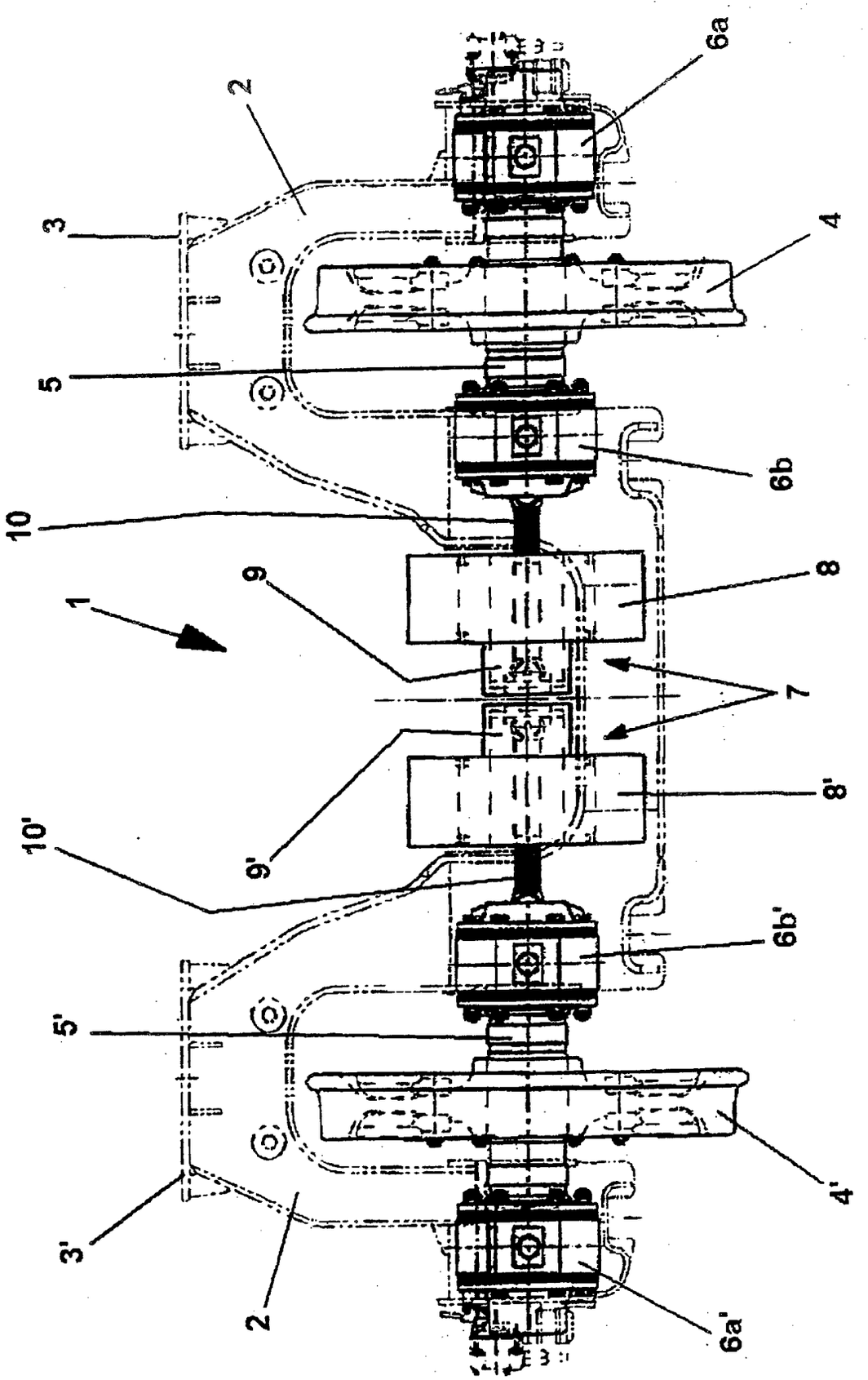

Fig. 1

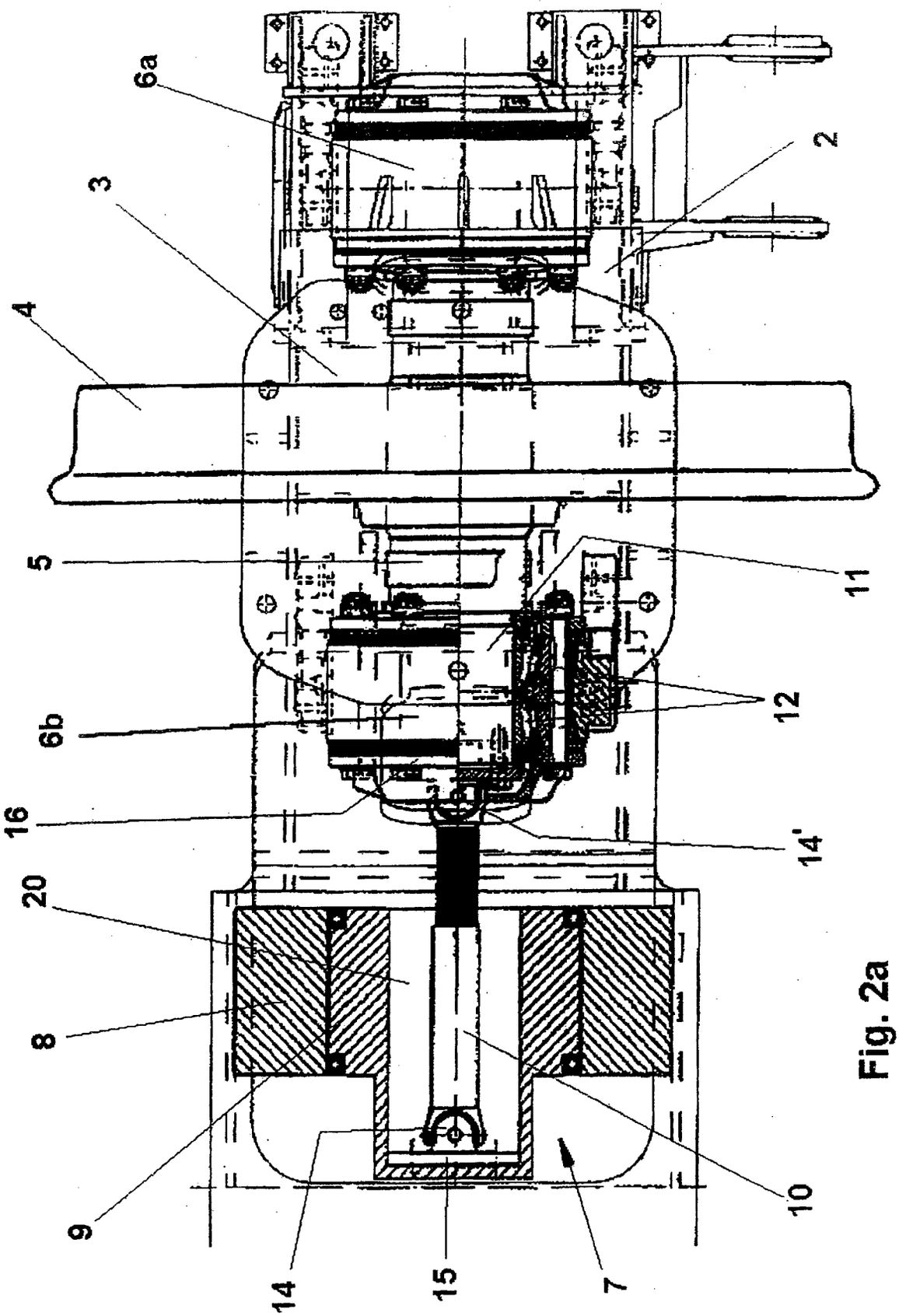

Fig. 2a

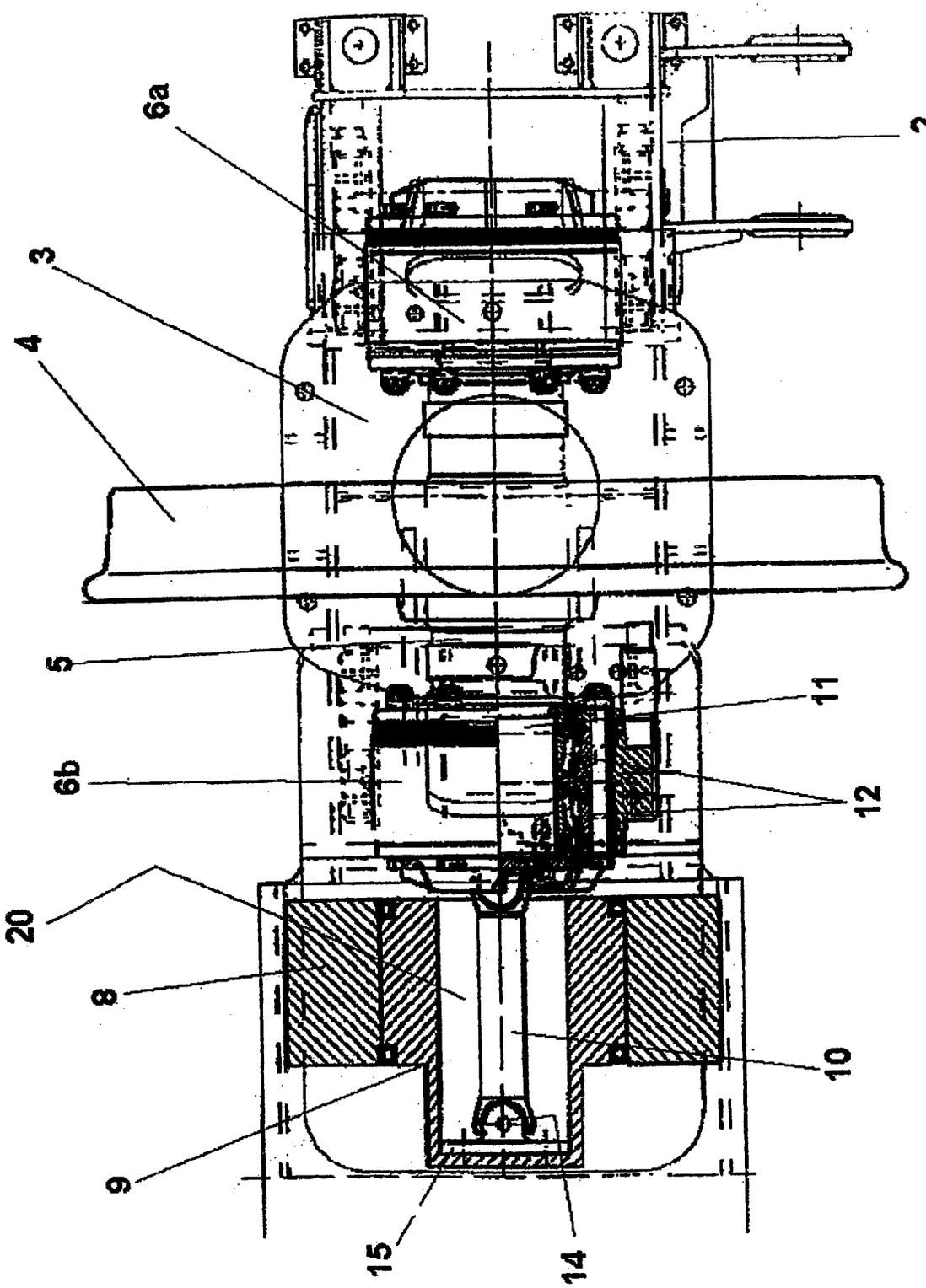

Fig. 2b

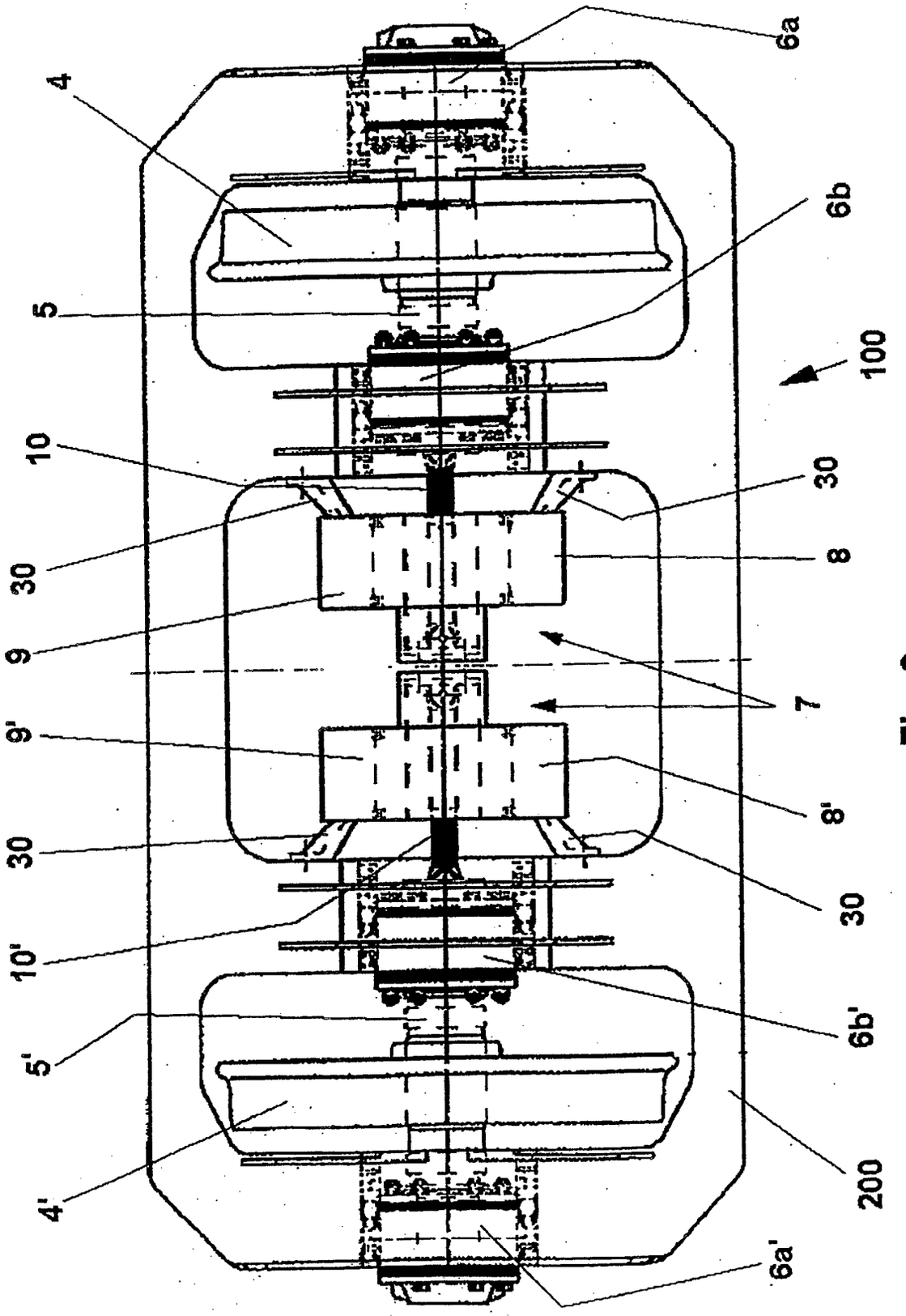

Fig. 3

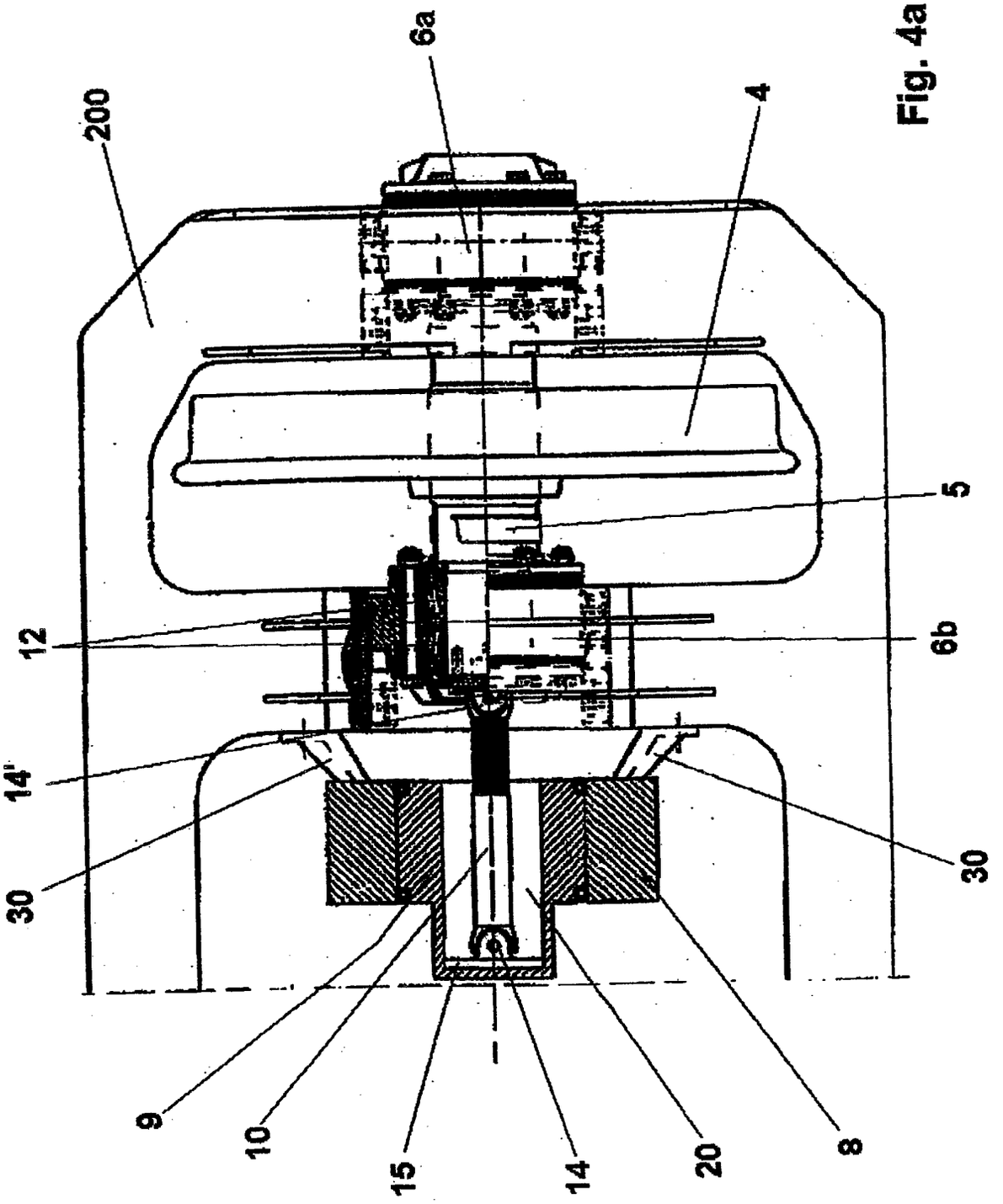

Fig. 4a

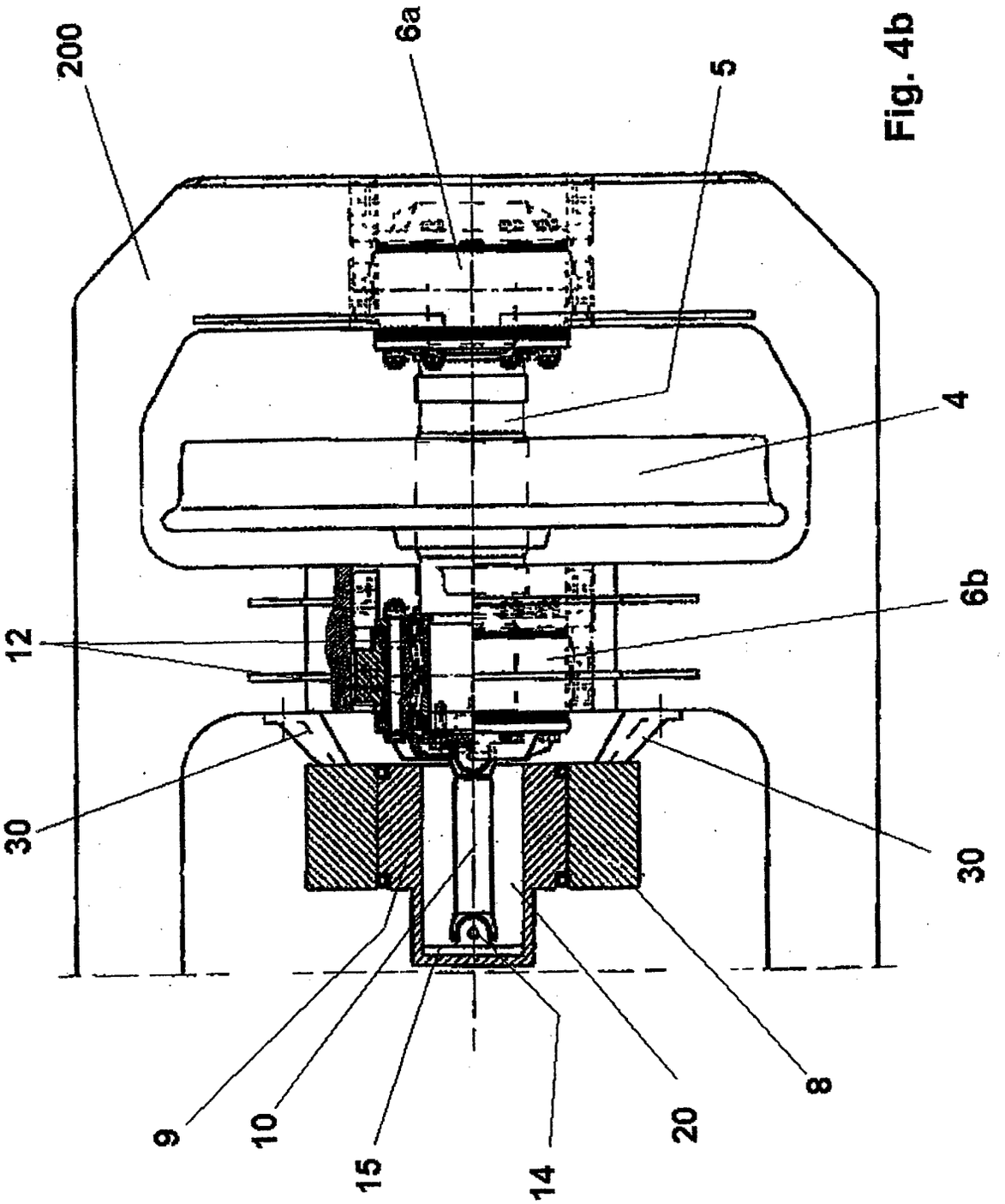

Fig. 4b

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EUROPEAN SEARCH REPORT

Application Number
EP 02 38 0258

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	28 March 2003	Ferranti, M

CATEGORY OF CITED DOCUMENTS

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