(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 357 564 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **89830275.7**

(51) Int. Cl.[5]: **B 61 C 9/44**

(22) Date of filing: **20.06.89**

(30) Priority: **04.08.88 IT 6773888**

(43) Date of publication of application:
07.03.90 Bulletin 90/10

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

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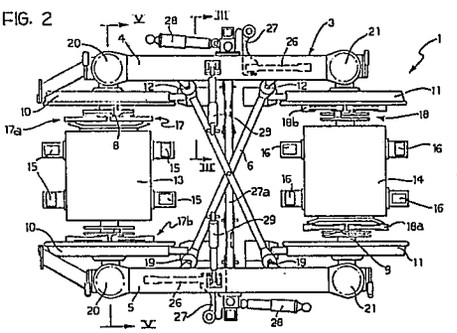
(54) A motor bogie for railway vehicles.

(57) A motor bogie (1) for railway vehicles includes a load-bearing structure (3) constituted by a pair of side members (4,5) braced by transverse members (6) and connected to a pair of axles (8,9), by respective bushes (7), a pair of motors (13,14) for rotating the wheels (10,11) of the axles (8,9), and vertical and transverse suspension means (20,21) between the load-bearing structure (3) and the body (2) of the railway vehicle. The motors (13,14) are supported directly by the body (2) of the vehicle and also drive the respective axles (8,9) directly; the suspension means (20,21) are interposed between the frame of the body (2) of the vehicle and the bushes (7) of the axles (8,9).

FIG. 2



EP 0 357 564 A2

Description

A motor bogie for railway vehicles

The present invention relates in general to motor bogies for railway vehicles.

The invention is more particularly concerned with a motor bogie of the type including a load-bearing structure constituted by a pair of side members braced by transverse members and connected to a pair of axles by respective bushes, motor means for rotating the wheels of the axles, and vertical and transverse suspension means between the load-bearing structure and a railway vehicle body.

The progress of studies in railway dynamics has for some time indicated that the way to improve vehicle-track coupling under given conditions, and thus to increase the standard of the service (higher speed, greater safety, less maintenance), is to reduce the weight of the bogies.

The beneficial effect of this reduction on all the dynamic functions must obviously be achieved by a structure such as to ensure that, in service, the safety parameters and above all derailment prevention, remain within prudent limits.

The object of the present invention is to produce a motor bogie of the type defined above, which is able to achieve the objective of a drastic weight reduction with a high degree of safety.

According to the invention, this object is achieved by means of a motor bogie for railway vehicles of the type defined above, characterised in that the motor means are provided with attachments for their support by parts of the vehicle body and drive the respective axles directly, and in that the suspension means are interposed directly between the frame of the body and the bushes of the axles.

By virtue of this concept, the two side members of the load-bearing structure of the bogie which connect the busnes of each side fulfil the sole functions of transmitting the longitudinal traction and braking forces and the transverse guiding forces, and of supporting the braking units and the other auxiliary equipment. In fact, the weight of the vehicle body to which the bogie is fitted is borne directly by the bushes whilst the weight of the motor is supported by the body, and the motive power and the resultant forces and torques act directly between the body and the axles without in any way involving the load-bearing structure of the bogie. The reduction of the load-bearing and strength functions of the bogie obviously enables it to be lighter and to have a considerably simpler structure, which enables an appreciable improvement in vehicle-track coupling and thus results in the achievement of the objectives of higher travelling speeds, greater safety and less maintenance.

The transverse members for interconnecting the two side members are conveniently adapted to allow the load-bearing structure to deform in the vertical plane but not in the horizontal plane.

These transverse members may comprise, for example, a cross with ends articulated to the side members, a pair of resilient plates which can deform under flexion and torsion, or even a pair of cross members each of which is fixed rigidly at one end to one of the side members and articulated at the opposite end to the other side member.

In all cases, the transverse members ensure that the load-bearing structure can deform in order to overcome twisting and that it is rigid in the horizontal plane to ensure the correct position of the base quadrilateral.

The bushes are connected to the side members in such a way as to achieve the required longitudinal and transverse rigidity; for example, this connection may be constituted by rubber-bonded metal elements for supporting the side members on the bushes and by rubber-bonded metal or other joints which connect the bushes to the bogie frame.

The motor means normally drive the axles by means of dual hollow shaft transmissions coaxial with the axles. This type of transmission, which is normally of the type described and illustrated in the document EP-A-193,500 in the name of the same Applicant, is constituted by two hollow shafts whose end flanges are connected by two pairs of connecting rods to the rotor of the motor on one side and to one of the wheels on the other side. This transmission allows all the relative movements between the motors and the axles due to the vertical and transverse suspensions and to bends.

The structure of the bogie also includes means for transmitting traction and braking forces between the two side members of the bogie and the body of the vehicle, constituted, for example, by articulated systems of connecting rods and levers.

The vertical and transverse suspension means between the bushes and vehicle body are conveniently constituted by helical springs and may also include torsion bars.

The invention will now be described in detail with reference to the appended drawings, provided purely by way of non-limiting example, in which:

Figure 1 is a schematic, partially-sectioned, side elevational view of a bogie for railway vehicles, according to a first embodiment of the invention,

Figure 2 is a plan view of Figure 1 from above,

Figure 3 is a cross-section taken on the line III-III of Figure 2, on an enlarged scale,

Figure 4 is a section taken on the line IV-IV of Figure 3,

Figure 5 is a cross-section taken on the line V-V of Figure 2,

Figure 6 is a view similar to Figure 1, of a first variant of the bogie according to the invention,

Figure 7 is a plan view of Figure 6 from above,

Figure 8 is a cross-section taken on the line VIII-VIII of Figure 7, and

Figures 9 to 11 are three schematic plan views from above of further variants of the bogie.

With reference initially to Figures 1 to 5, a motor bogie for railway vehicles is generally indicated 1 and is intended to be connected, in generally known

manner, to the body 2 of the vehicle.

The bogie 1 includes a load-bearing structure 3 constituted by a pair of side members 4, 5 which are interconnected near their central regions by a cross-shaped transverse member 6.

The ends of the two side members 4, 5 support two axles 8, 9 with respective wheels 10, 11 by means of respective bushes 7.

The transverse connecting cross 6 is connected at its ends to the two side members 4 by means of respective articulations 12, 19 which enable the load-bearing structure 3 to deform in the vertical plane to overcome twisting but give it rigidity in the horizontal plane to ensure the correct position of the base quadrilateral identified by the attachments of the bushes 7 to the side members 4 and 5.

Two drive motors of generally known type, for rotating the axles 8, 9, are indicated 13, 14. The two motors 13, 14 are provided with respective attachments 15, 16 for fixing them to the body 2 of the vehicle so that their weight does not bear on the load-bearing structure 3. In the embodiment of Figures 1 to 5, the two motors 13, 14 are coaxial with the axles 8, 9 and drive the latter directly through respective dual hollow shaft transmissions, generally indicated 17, 18, of the type described and illustrated in the document EP-A-193,500, the description of which should be understood as incorporated herein for the sake of brevity. For the purposes of the present invention, it is sufficient to state that each transmission 17, 18 includes two hollow shafts having end flanges which are connected by means of pairs of connecting rods 17a, 17b and 18a, 18b to the rotor of the motor on one side and to one of the wheels 10, 11 on the opposite side. The two transmissions 17, 18 do not make use of gears, casings with bearings, or lubrication systems, but enable all the movements between the motors 13, 14 and the axles 8, 9 due to the vertical and transverse suspensions of the bogie and to bends.

The vertical and transverse suspensions include two pairs of helical springs 20, 21 whose ends react, with the interposition of rubber elements, against the body 2 of the vehicle at the top and directly on the bushes 7 of the axles 8, 9 at the bottom. The vertical and longitudinal characteristics of the suspension are achieved by the suitable dimensioning of the springs 20, 21 and the respective rubber elements whilst the transverse characteristics are achieved by supplementing the lateral characteristics of the springs and rubber elements with other devices having helical or rubber springs, not illustrated, or with torsion bars or equivalent systems. The torsion bar system is schematically illustrated in Figures 3 and 4 and, for each side of the bogie, includes a pair of transmission connecting rods 22, 23 which are articulated to each other and of which the first is pivoted on the respective side member 4, 5 and the second is connected rigidly to a torsion bar 24 fixed at 25 to the body 2 of the bogie.

The transmission of the traction and braking forces takes place between the bushes 7 and the side members 4, 5 by means of conventional rubber elements, not illustrated, whilst articulated systems of connecting rods and levers are provided between the side members 4, 5 and the structure of the body 2. One example of this connection may be constituted by two longitudinal connecting rods 26 connected at one end to the two side members of the bogie and at the other to two right-angled levers 27 connected to the body; these two right-angled levers are connected together by a transverse rod 27a so as to form a unit which ensures the transmission of the longitudinal traction and braking forces between the body and the bogie, whilst retaining freedom of transverse, vertical and rotary movement between the body and the bogie. Other equivalent systems will be described below with reference to the variants of the bogie.

The suspension between the bogie 1 and the body 2 also has longitudinal shock-absorbers 28, transverse shock-absorbers 29 and vertical shock-absorbers 30.

By virtue of the configuration described above, and particularly of the fixing of the motors 13 and 14 to the body 2 of the vehicle and the direct support of the weight of the latter by the bushes 7 of the axles 8 and 9, the load-bearing structure 3 fulfils the sole functions of transmitting the longitudinal traction and braking forces and the transverse guiding forces and of supporting the braking equipment (schematically indicated 35 in Figure 1) and any other auxiliary equipment. The motive power passes directly from the shafts of the motors 13, 14 to the axles 8, 9 and does not in any way involve the load-bearing structure 3, which has reduced weight to the benefit of the vehicle-track coupling. As a result, therefore, it is possible to achieve a higher travelling speed and greater safety with reduced maintenance, other conditions being the same. Moreover, the fixing of the motors 13 and 14 to the body 2 means that the motors are subject to reduced dynamic stress, to the benefit of their reliability in operation.

The variants of the bogie illustrated in Figures 6-8 and 9, 10 and 11 are generally similar to the embodiment described above and only the differences will be described in detail with the same reference numerals being used for identical or similar parts.

The embodiment of Figures 6 to 8 differs from that described with reference to Figures 1 to 5 only in that the motors 13 and 14 drive the axles 8 and 9 through respective reduction units 31, 32. The motors 13 and 14 are still arranged to be fixed to the body 2 and to drive the axles 8, 9 through the reduction units 31 and 32 by means of dual hollow shaft transmissions 33, 34 exactly the same as the transmissions 17 and 18. The concept of the bogie 1 according to this variant remains unaltered from that described above, even though the solution adopted for the transmission of the motive power includes gears, bearings and related lubrication systems.

The three variants illustrated schematically in Figures 9 to 11 differ from the embodiments described above only in the different conformations of the transverse members for interconnecting the side members 4 and 5 and of the members for transmitting the traction and braking forces between the bogie 1 and the body 2.

In the case of Figure 9, the transverse connection between the side members 4 and 5 is achieved by means of two cross members 36 and 37 of which the first is connected rigidly at one end to the side member 5 and is articulated at the other end to the side 4 at 38, and the second is fixed rigidly at one end to the side member 4 and is articulated at the opposite end to the side member 5 at 39. In this case, instead of the articulated systems of connecting rods and levers 26, 27, the traction members between the bogie 1 and the body 2 include equivalent central rubber elements 45 in a counter-parallel arrangement.

In the case of Figure 10, the connection between the side members 4 and 5 is identical to that described with reference to Figure 9, whilst the elements for transmitting the traction and braking forces are constituted by a central Z-shaped system formed by a pair of connecting rods 44 interconnected by a diagonal lever 40.

In the case of Figure 11, the transverse members for interconnecting the side members 4 and 5 are constituted by a pair of resilient plates or spring leaves 41 whi h are fixed at their ends to the side members 4 and 5, at 42 and 43 respectively, and are resiliently deformable under flexion and torsion.

Claims

1. A motor bogie for railway vehicles, including a load-bearing structure constituted by a pair of side members braced by transverse members and connected to a pair of axles by respective bushes, motor means for rotating the wheels of the axles, and vertical and transverse suspension means between the load-bearing structure and a railway vehicle body, characterised in that the motor means (13, 14) are provided with attachments (15, 16) for their support by the body (2) of the vehicle and drive the respective axles (8, 9) directly, and in that the suspension means (20, 21) bear on the bushes (7) of the axles (8, 9).

2. A bogie according to Claim 1, characterised in that the transverse connection members (6; 36, 37; 41) are adapted to allow the load-bearing structure (3) to deform in the vertical plane but not in the horizontal plane.

3. A bogie according to Claim 2, characterised in that the transverse members comprise a cross (6) with ends articulated to the side members (4, 5).

4. A bogie according to Claim 2, characterised in that the transverse members comprise resilient plates (41) which can deform under flexion and torsion.

5. A bogie according to Claim 2, characterised in that the transverse members comprise a pair of cross members (36, 37), each of which is fixed rigidly at one end to one of the side members (4, 5) and is articulated at the opposite end (38, 39) to the other side member (4, 5).

6. A bogie according to any one of the preceding claims, characterised in that each motor (13, 14) drives the respective axle (8, 9) by means of a dual hollow shaft transmission (17, 18; 33, 34) coaxial with the axle (8, 9).

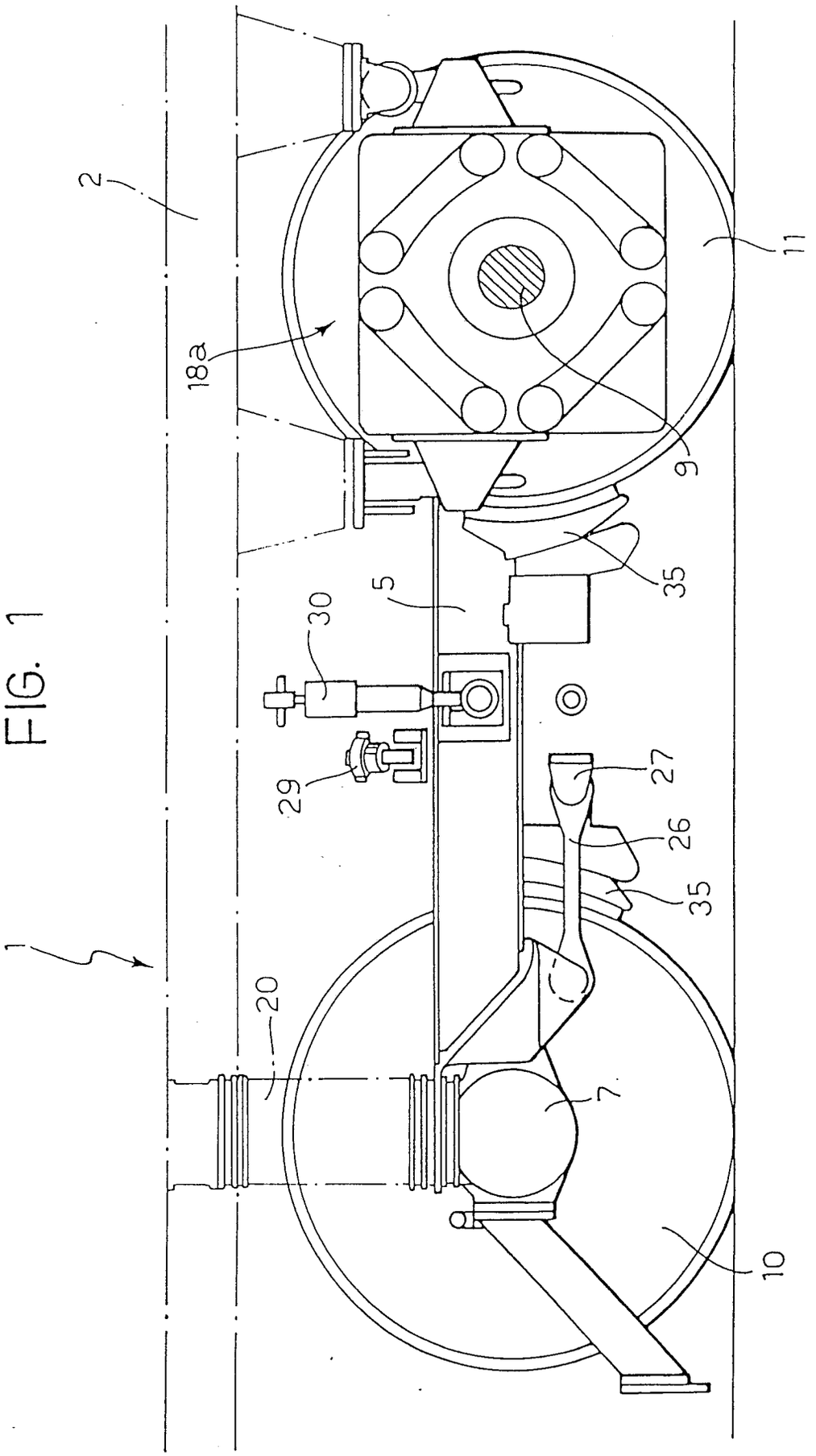
7. A bogie according to Claim 6, characterised in that a reduction unit (31, 32) is interposed between each motor (13, 14) and the respective axle (8, 9).

8. A bogie according to one or more of the preceding claims, characterised in that it also comprises articulated systems of connecting rods and levers (26, 27; 39, 40) for transmitting the traction and braking forces between the load-bearing structure (3) and the body (2) of the vehicle.

9. A bogie according to one or more of the preceding claims, characterised in that the vertical and transverse suspension means include helical springs (20, 21).

10. A bogie according to Claim 9, characterised in that the transverse suspension means also include longitudinal torsion bars (24) associated with the body (2) of the vehicle.

FIG. 1



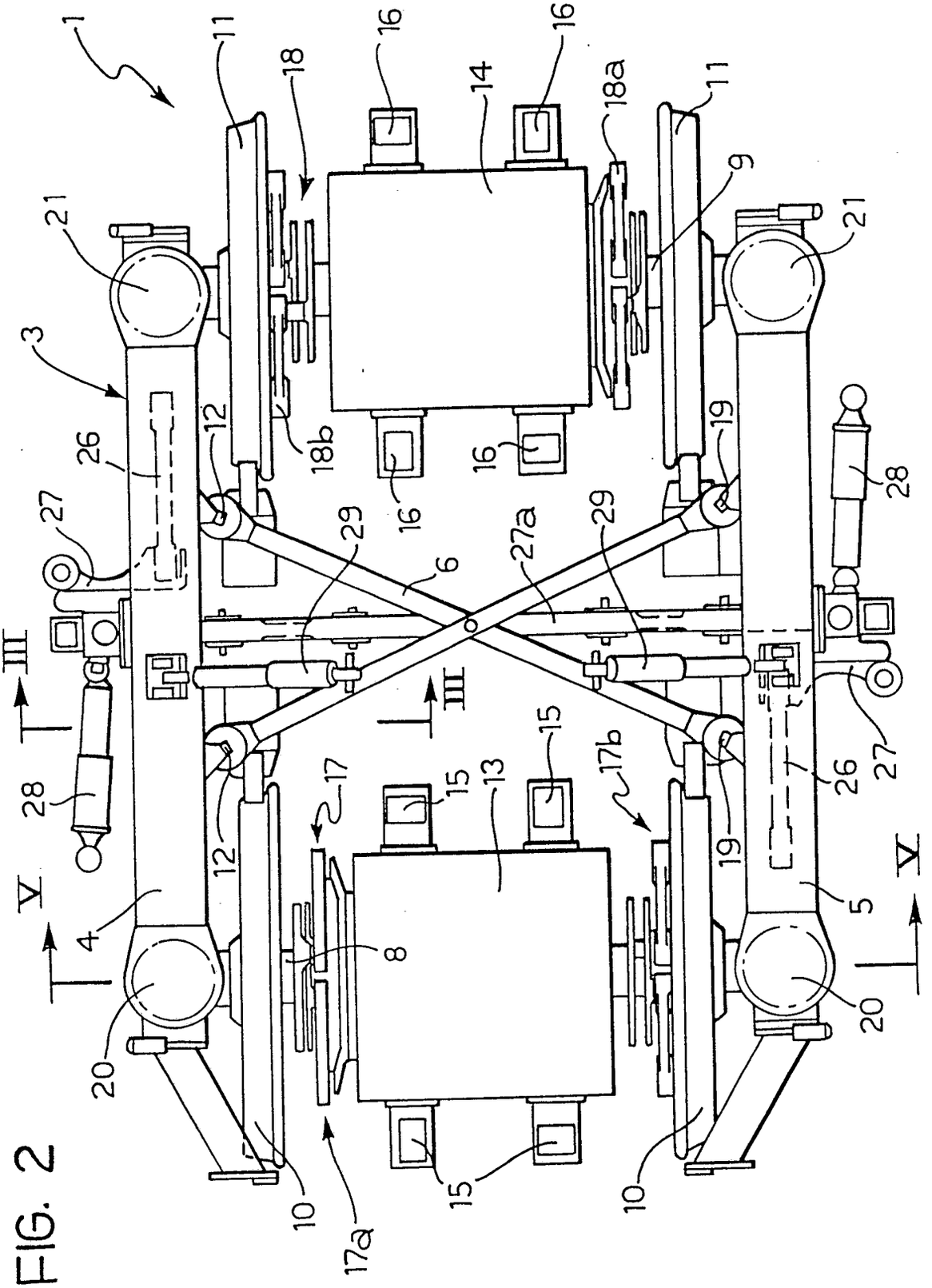

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FIG. 2

FIG. 4

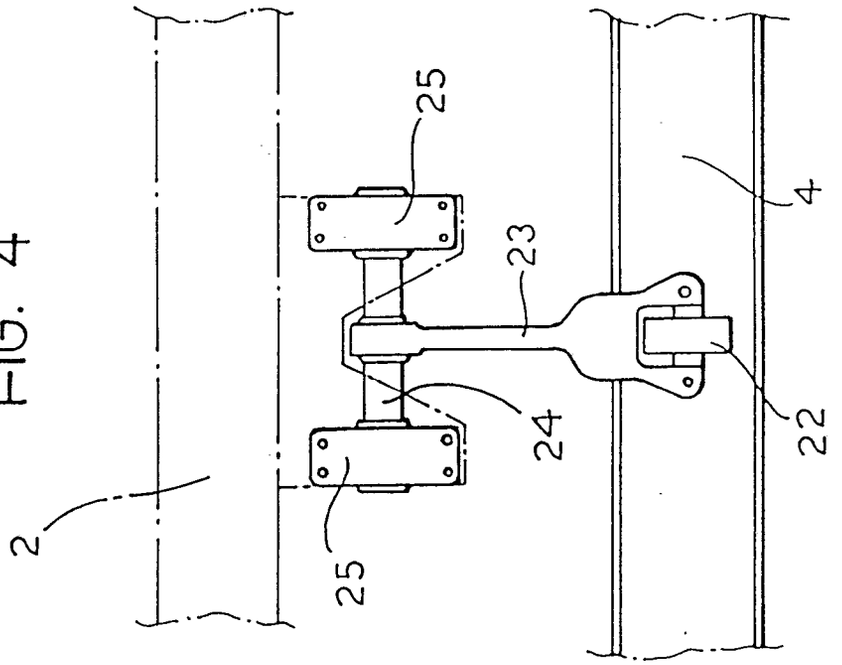


FIG. 3

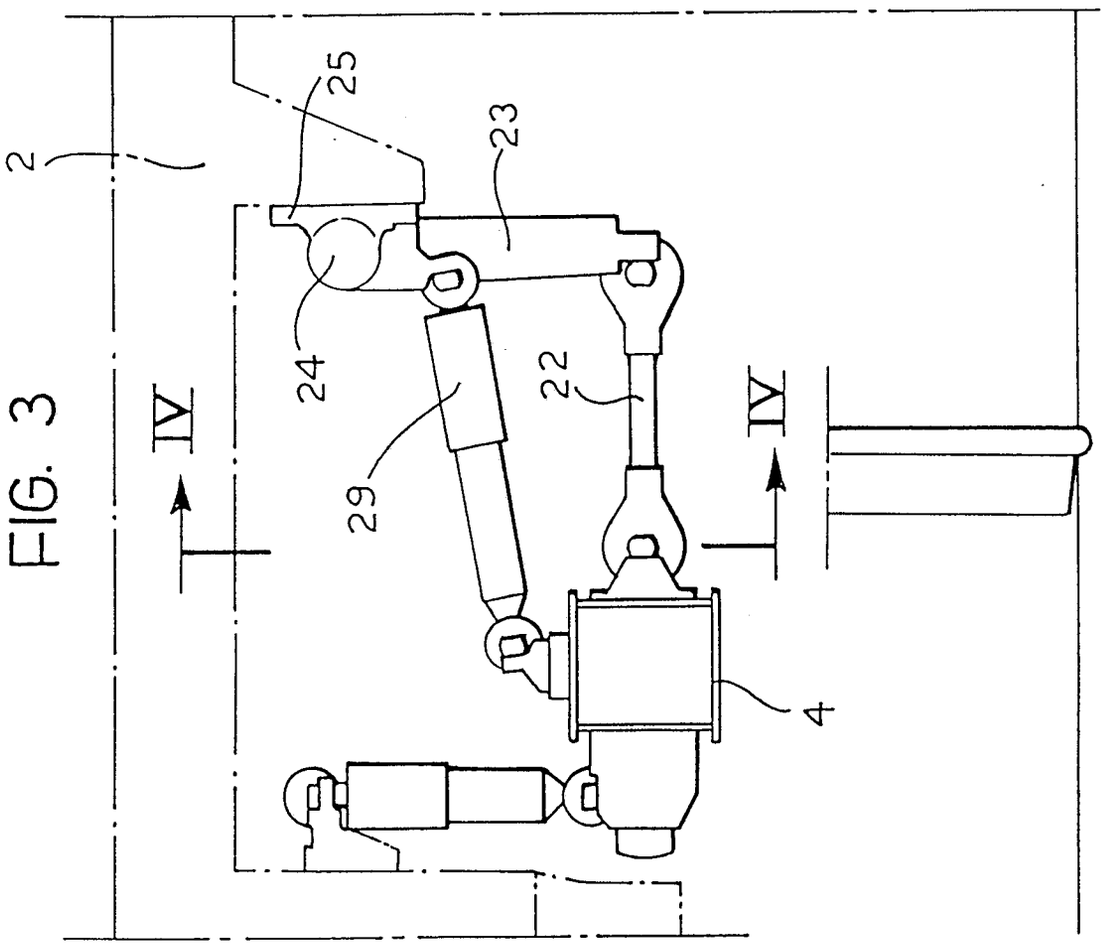


FIG. 5

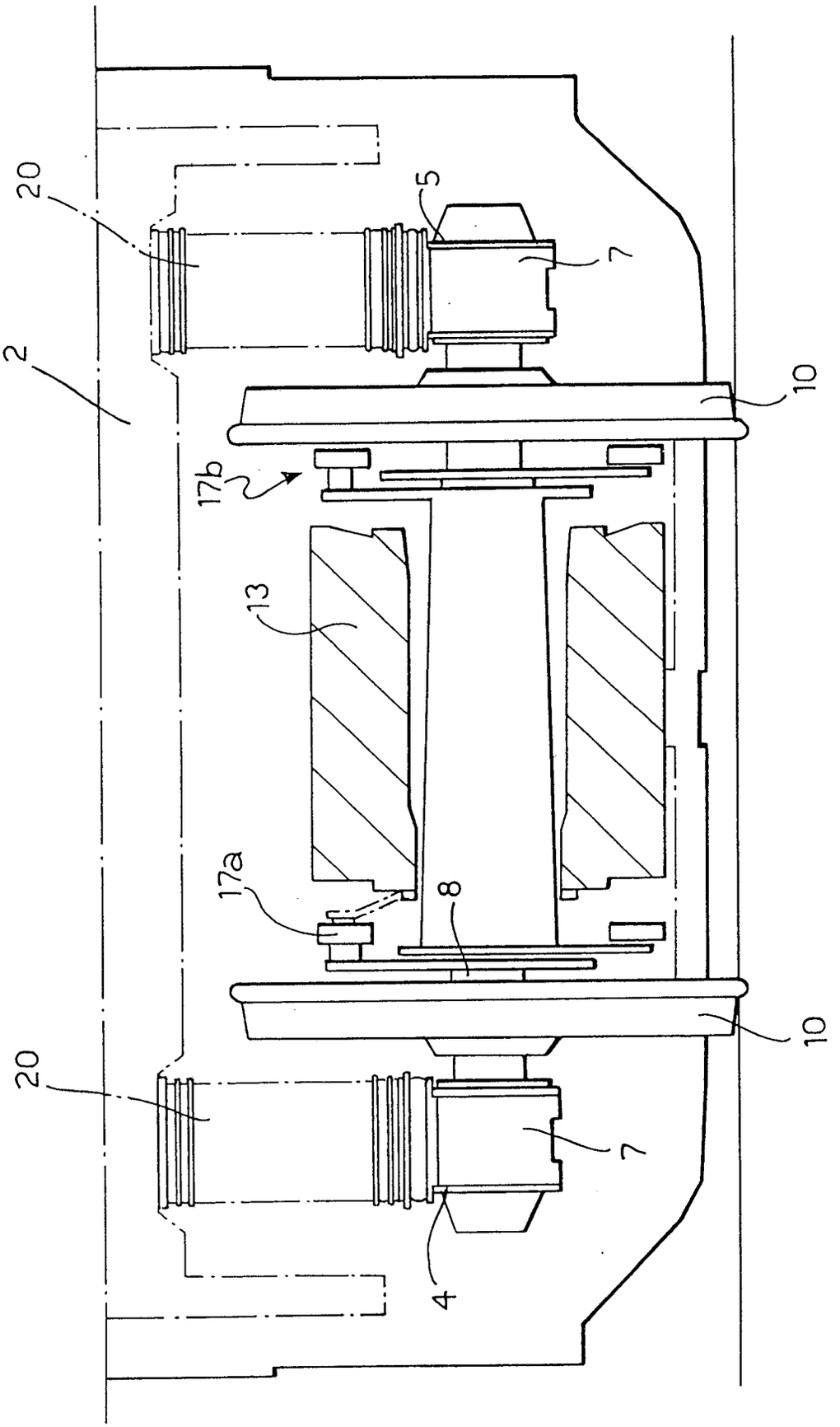
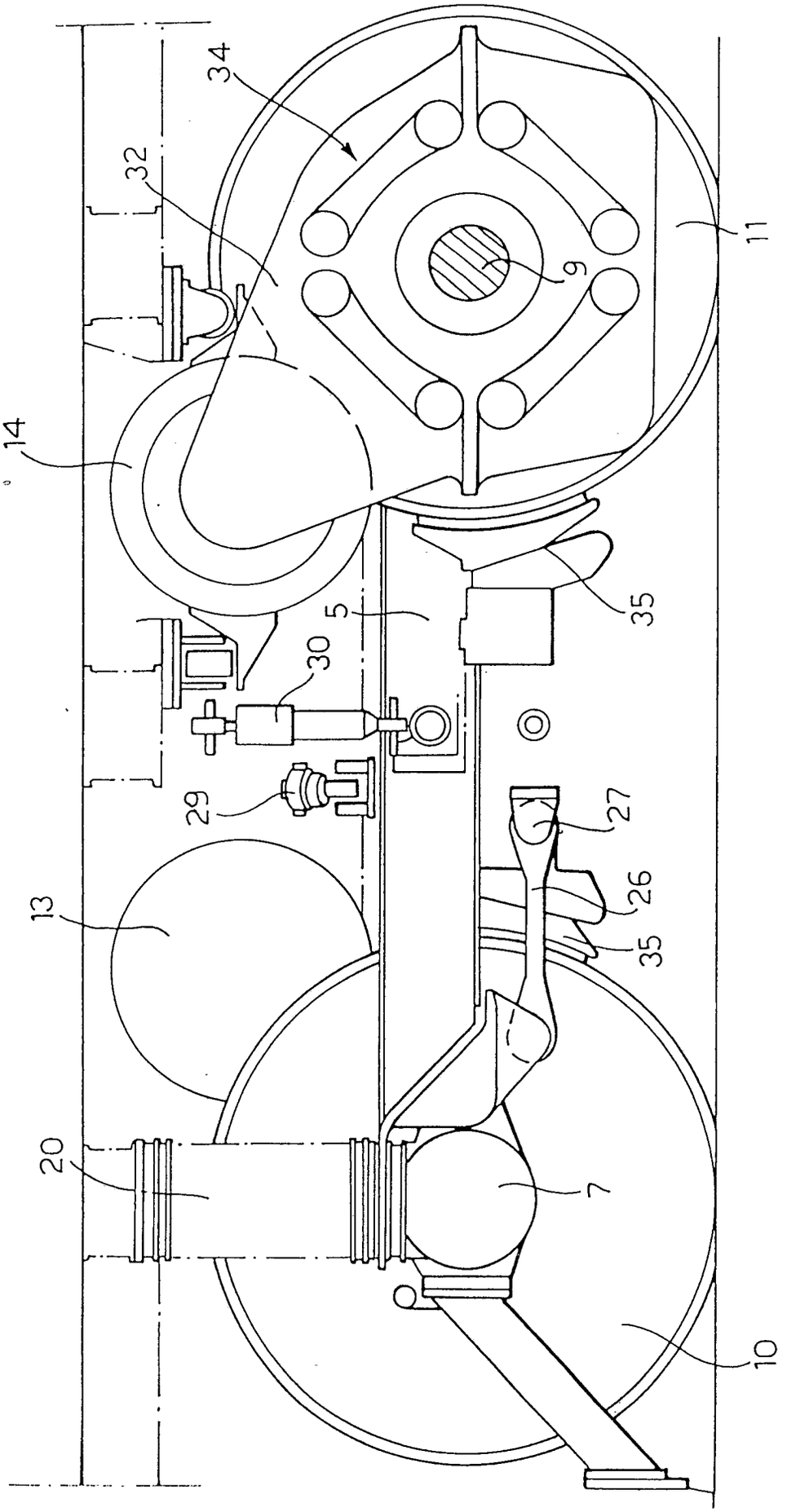
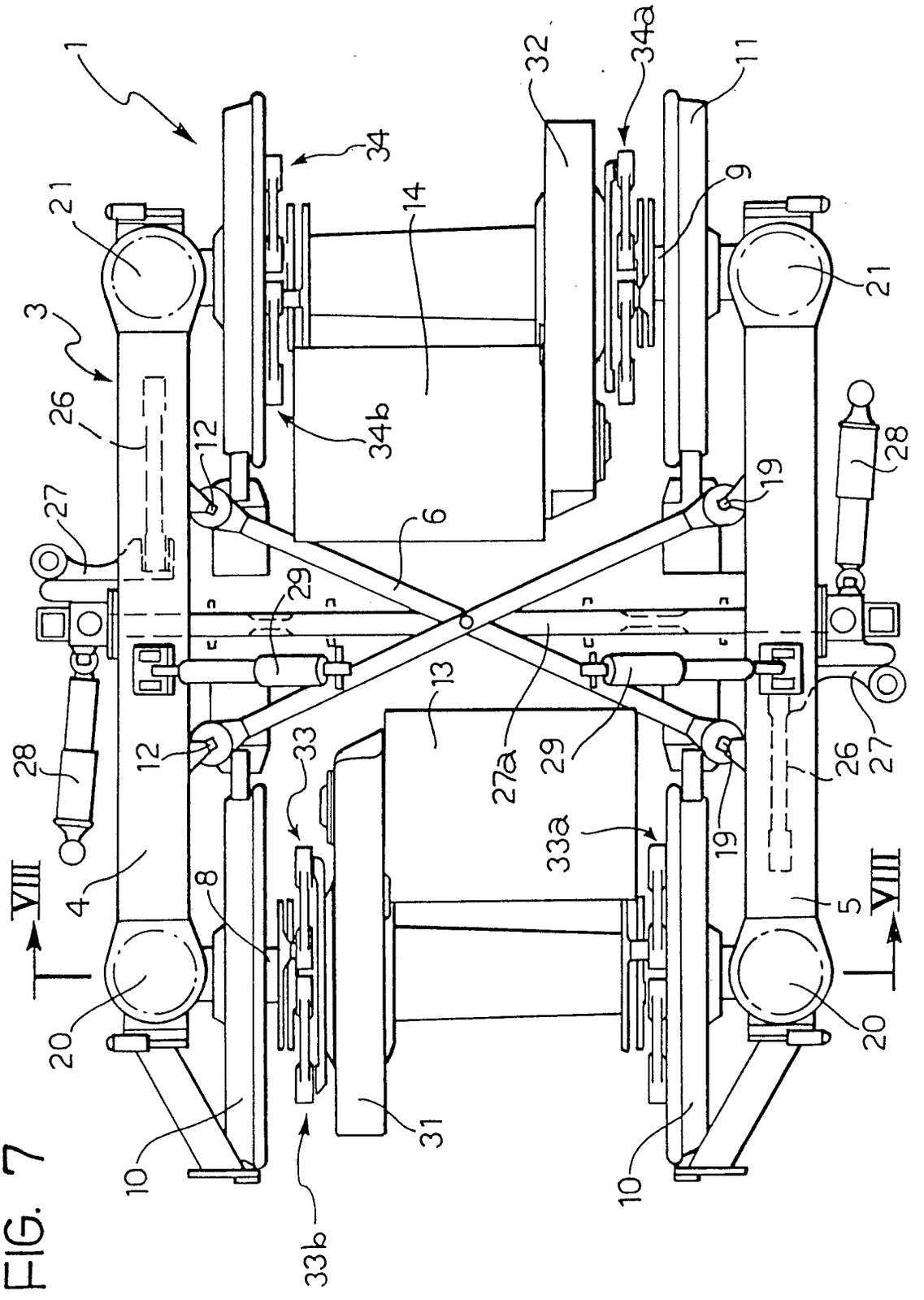


FIG. 6

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34b
VIII
VIII

FIG. 7

FIG. 8

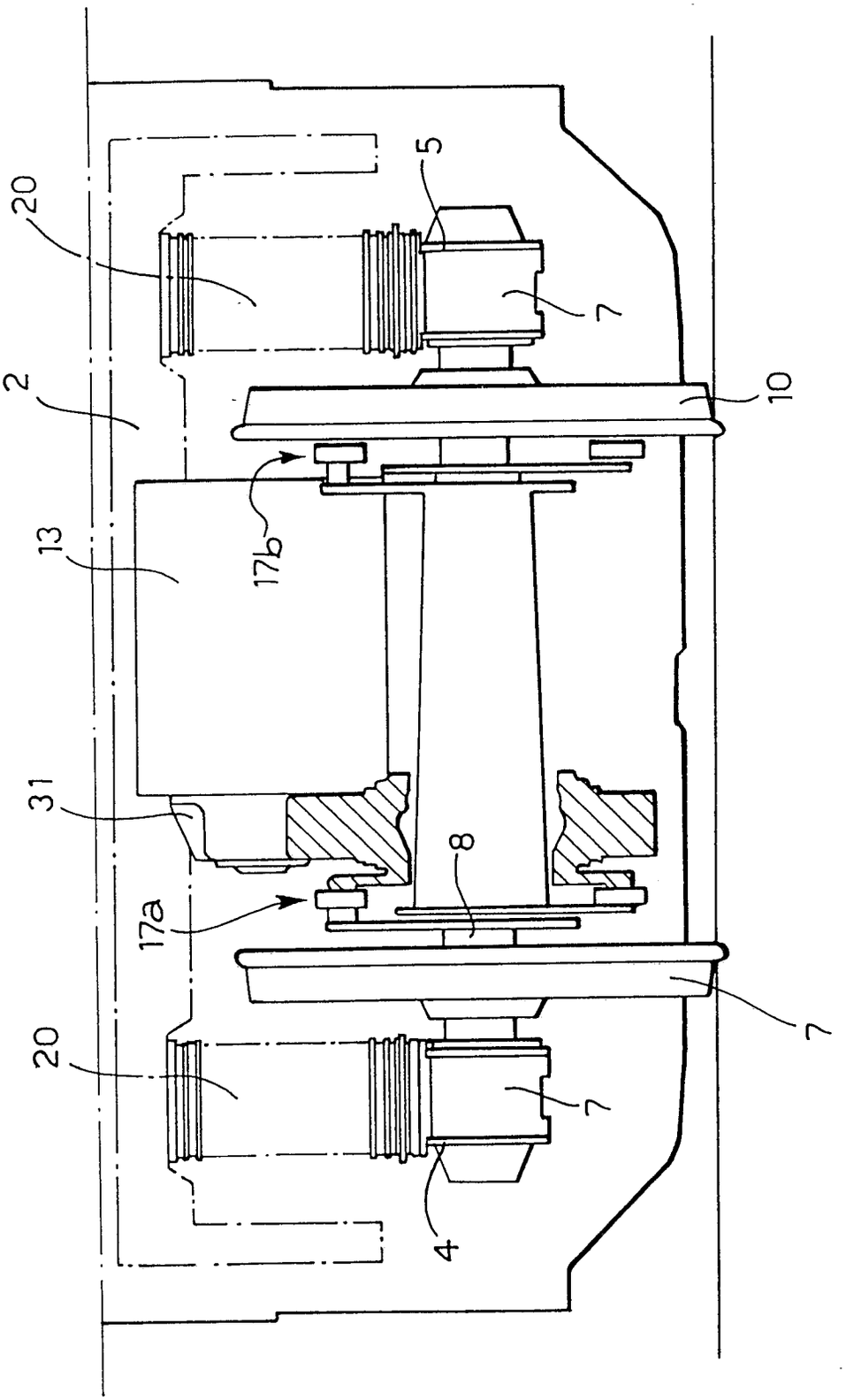

FIG. 9

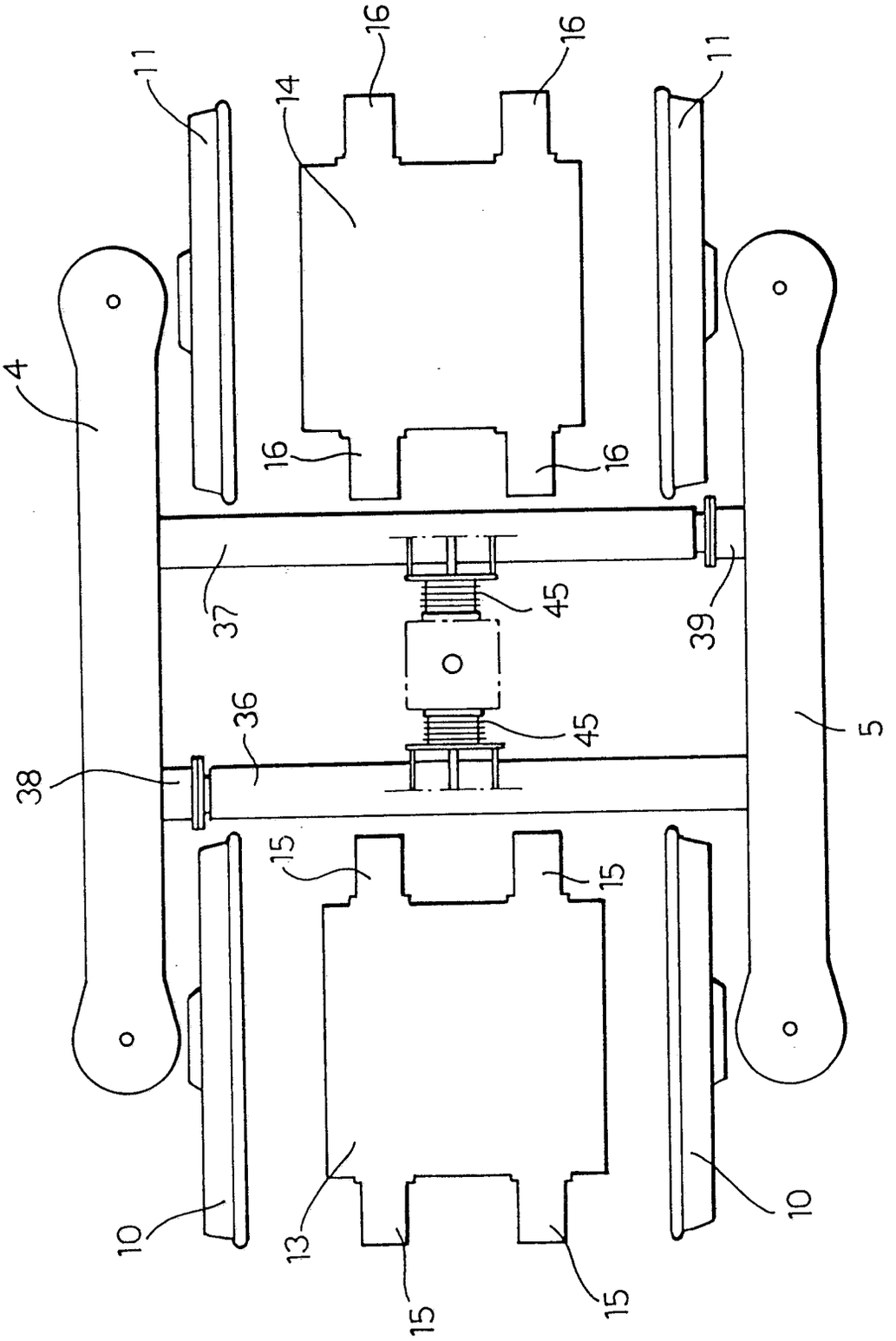

FIG. 10

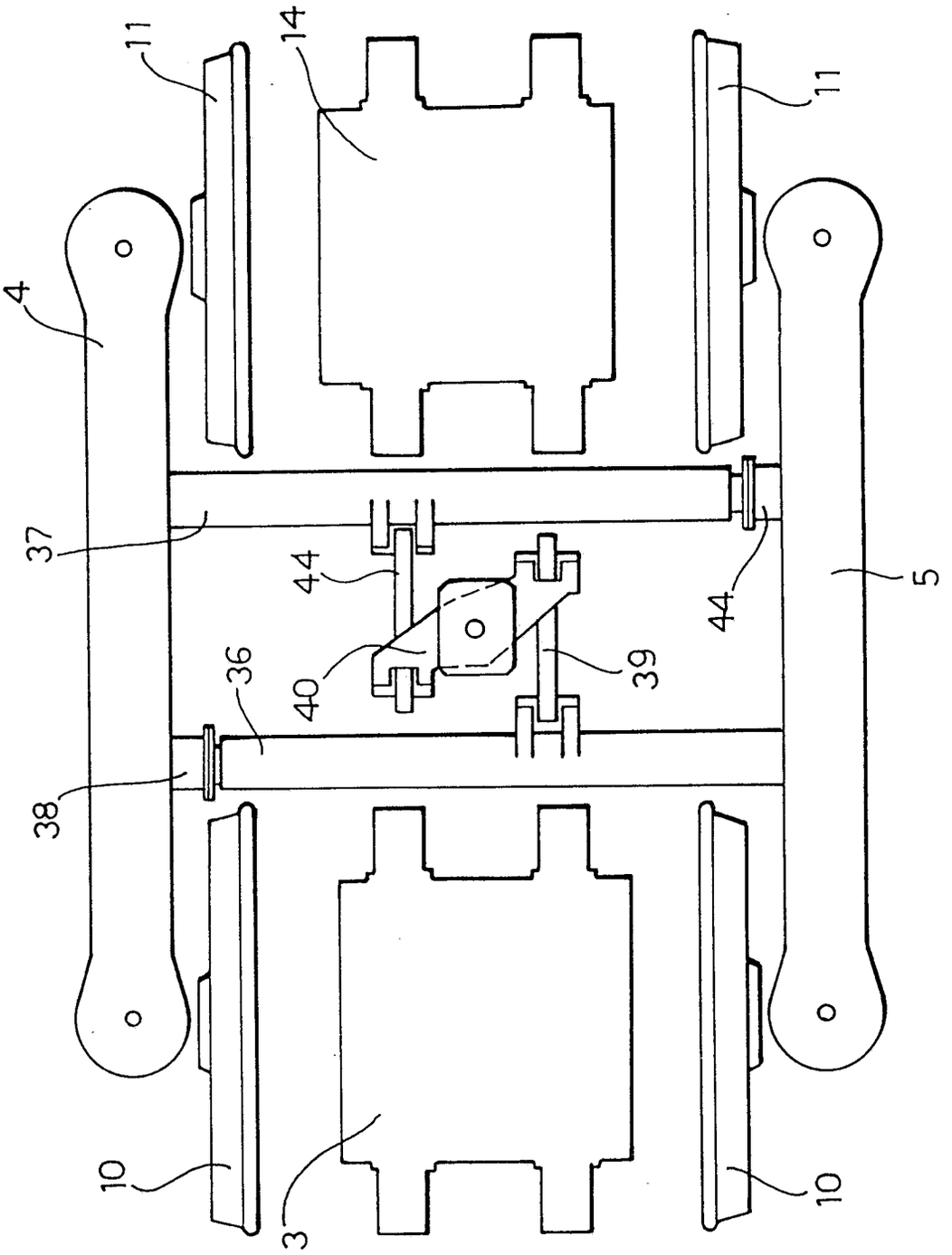

FIG. 11