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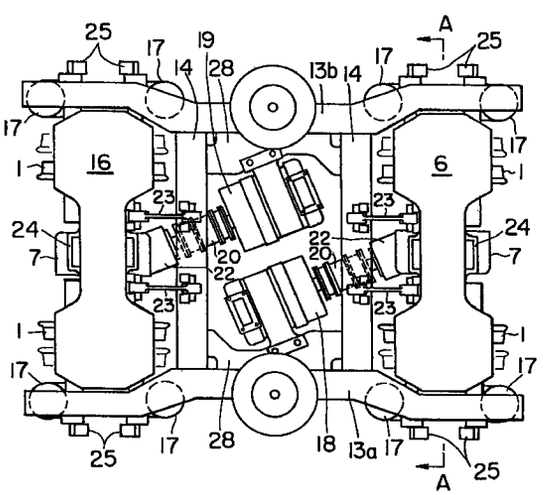
(54) Gauge-changeable bogie for railroad carbody

(57) A railroad carbody gauge-shiftable bogie is featured by providing outer axle boxes with elastic bodys to prevent jogging motion of the wheelset (30) in relation to the axle boxes, fixing the four axle boxes to axle box supporting beams disposed substantially in parallel with the axles (2) along their lengthwise direction to prevent generation of a bending moment over sliding parts in the action of gauge changing, disposing drive axle box for transmission of driving power to the wheelset (30) to cause the torsion in the transmission portion of the power to the wheelsets from the drive mechanism to be equal on both left and right sides, fixing the drive axle box to the axle box supporting beams to prevent jogging motion of the transmission partion, and substantially centered between the two, left and right, employing the drive mechanisms of a angular Cardan type to install a couple of motors (18,19) in a small space between the two, front and rear, axles (2).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

The present invention relates to a gauge-changeable bogie for railroad carbody for use in direct operation between two different gauge tracks and particularly, to a drive mechanism, a gauge changing mechanism and its support, of the gauge-changeable bogie for railroad carbody.

Common bogies for railroad carbody have axles of a definite length or gauge, each axle provided at both ends with two wheels respectively, determining the distance of contact between the wheels and the rails and allowing no train to run directly from one gauge line to another, e.g. between the conventional track and the shinkansen track.

As described, when you want to travel between the different gauge tracks of railroad, you have to change the trains one after another with each transfer consuming a considerable length of time.

For eliminating such troublesome transfer from one track to another, either bogie replacing or gauge change is broadly used. The former for bogie replacing includes exchange of the bogies at a location between two different gauge tracks and requires a length of time to be completed thus being not practical, except e.g. at a border station where a railroad carbody has stopped relatively in a long time. The latter for gauge change permits the wheels to be adjusted along their axles for running from one gauge track to another.

A variety of the gauge change methods are known; among of them are two, left and right, cylinders with wheels which are slidably fitted to an axle for positional adjustment in opposite directions to correspond to the gauge (as shown in Japanese Patent Application Laid-open No. 6-206541(1994)) and a pair of T-shaped bogie frames which are joined to each other by link mechanism for shifting the span between two, left and right, ends from one to the other (as shown in Japanese Patent Application Laid-open No. 7-52795(1995)).

The gauge change method disclosed in Japanese Patent Application Laid-open No. 6-206541(1994) allows the two cylinders to move on the axle and may cause bending moment in a sliding parts. This makes it difficult to give the operational reliability to the sliding parts. Also, the method disclosed in Japanese Patent Application Laid-open No. 7-52795(1995) incorporates a number of movement regions or movable members thus increasing the complex of the overall structure.

Moreover, one of the most practical methods in use employs Spanish Targo bogies which comprise wheels fitted to axles on frames for sliding movement to left and right directions and lock pins for setting the wheels to a predetermined gauge. In addition, a corresponding ground installation is provided at a location of gauge changing between two different gauge tracks, which includes load supporting rails for supporting the weight of a carbody during the gauge changing, lock pin guide rails for allowing the lock pins to advance and retract, and wheel guide rails for changing the span between two wheels. When the lock pin has been removed with the axles being unloaded by the action of the load supporting rails, the gauge changing is carried out before the lock pins are returned back for locking the wheels.

In such a Targo bogie, the axle is slidable between the holder of the bearing and the axle box and can be shifted between the narrow gauge and the standard gauge using guide members. The axle is then locked with the lock pins inserted from below between the narrow and standard gauge locations of the axle. For shifting the gauge, the insertion of the lock pins has to be done smoothly thus requiring possible clearance between the lock pins and the guide members. This clearance may cause jogging movement of the axles against the axle boxes, hence impairing the safety of the carbody in its running operation.

Also, various drive mechanisms for the railroad gauge-shiftable bogie have been proposed. For example, a motor for driving the wheels is mounted to a carbody and joined by a propeller shaft to a right-angle Cardan type drive unit mounted to the bogie, and the drive unit is joined to a axle by a flexible joint (Japanese Patent Application Laid-open No. 8-169338(1996)) or a motor for driving the wheels is mounted to a transom slidable to left and right in relation to the side beams of the bogie and joined by a shaft coupling to a parallel Cardan type drive unit which is in turn joined at one end to the axle by a flexible shaft and at the other end by a suspension to the transom of the bogie on the other axle (Japanese Patent Application Laid-open No. 8-216881(1996)).

In the drive mechanism for the railroad gauge-shiftable bogie depicted in Japanese Patent Application Laid-open No. 8-169338(1996), the drive unit is mounted to the bogie allowing the flexible joint to offset a displacement (namely, 30 mm to 40 mm) between the drive unit and the axle caused by change in the axle load and thus requiring as a large clearance as 1 mm on the flexible joint along its rotating direction. This clearance may however cause jogging movement of the carbody during the running and impair the safety of running.

The drive mechanism disclosed in Japanese Patent Application Laid-open No. 8-216881(1996) has the drive unit mounted directly to one axle and joined by the flexible shaft to the other axle, whereby its rigidity to torsion will be different between the left and right wheels. As the rigidity is different between the left and right sides, the two wheels may produce uneven rotation, hence impairing the stability of the carbody in the running.

BRIEF SUMMARY OF THE INVENTION

The present invention is directed towards eliminat-

ing the foregoing drawbacks and its primary object is to provide an improved railroad gauge-shiftable bogie in which jogging movement, which the constitution of the Targo bogie may cause, of the axles against the axle boxes is avoided.

A gauge-changeable bogie for railroad carbody according to the present invention is provided comprising: a pair of independent wheelsets, each unit having a wheel fitted on an axle, the wheelsets having their axles aligned with each other in their axial direction and arranged at the wheel facing to each other; bearings each fitted to respective ends of the axle; holders each mounted to the outer surface of the bearing; and outer axle boxes and inner axle boxes provided on the outer and inner sides of the facing wheels for holding and allowing respective ends of the axles to slide in the axial direction, each of said outer axle box and said inner axle box having therein, a couple of first and second guide members spaced by a distance from each other along the axial direction for guiding the holders; and a lock pin provided for detachably inserting between the first and second guide members and load press units positioned at one end inside of each the outer axle box and at the other end outside of each the outer axes box for supporting the weight of the carbody in the action of gauge changing, characterized in that each said outer axle box further has a elastic body which provides in direct contact with the first or second guide member at one side and a surface in the end axial direction of the outer axle box at the other side and which is pressed by the load press unit in the action of gauge changing, each the load press unit includes: a load support member mounted on the axial outer side of the bogie for supporting the weight of the carbody in the action of gauge changing; and a lever, each joined at one end to the load support member and directly contact at the other end with the elastic body, which presses the elastic body against its urging force while the load support member supporting the weight of the carbody.

Accordingly, the elastic body between the guide member and the inner side of the axle box remains urging and allowing no gap between the guide member and the lock pin while the gauge change is disabled, thus eliminating jogging motion of the axle in relation to its axle box. When the gauge change is enabled, the urging force of the elastic body is offset by the loading force exerted on the load support members which bear the weight of the carbody. This create a clearance between the guide member and the lock pin hence allowing the lock pin to retract with ease.

Another object of the present invention is to provide an improved gauge-changeable bogie for railroad carbody in which a bending moment occurring on the sliding parts is attenuated and its resulting tilt of the axle is eliminated to ensure the stability of the carbody in the running.

A gauge-changeable bogie for railroad carbody according to the present invention comprises: a bogie frame; a pair of independent wheelsets, each unit having a wheel fitted on an axle, the wheelsets having their axles aligned with each other in their axial direction and arranged at the wheel facing to each other; and two outer axle boxes and two inner axle boxes provided on the outer and inner sides of the facing wheels for holding and allowing respective ends of the axles to slide in the axial direction, characterized by including axle box supporting beams provided independently on the bogie frame extending substantially in parallel to the axles, to which the two outer axle boxes and the two inner axle boxes are fixed.

Accordingly, the bearing on the paired independent wheelsets are supported for sliding action along the axial direction in the axle boxes. The axle boxes are fixed to the axle box supporting beams which are mounted substantially in parallel to the independent wheel sets and separated from the bogie frame. More specifically, the axle boxes are rigidly mounted to the axle box supporting beams while the bearings are slidably but closely mounted at the outer surface to the inner faces of the axle boxes. Also, the paired independent wheel sets are aligned with each other along axial direction of their axles. Hence, regardless of the wheels located at either the narrow gauge or standard gauge location, the two axles of the paired independent wheel sets will be free from a bending moment. Any bending stress derived from the weight of the carbody is applied to the axle box supporting beams, thus permitting no bending moment between the left and right wheelsets. This prevents the independent wheelsets from being tilted ensuring the stability of the carbody in the running.

A further object of the present invention is to provide an improved gauge-changeable bogie for railroad carbody capable of shifting the gauge while it is running and increasing the stability of the carbody in the running.

A gauge-changeable bogie for railroad carbody according to the present invention is provided comprising: a pair of independent wheelsets, each unit having a wheel fitted on an axle, the wheelsets having their axles aligned with each other in their axial direction and arranged at the wheel facing to each other; outer axle boxes and inner axle boxes provided on the outer and inner sides of the facing wheels for holding and allowing respective ends of the axles to slide in the axial direction; and drive mechanisms, each arranged for transmitting power to the pair of independent wheelsets, characterized in that each said drive mechanism is of a angular Cardan type including: a motor; a first gear shaft extending diagonally to the axial direction of the bogie for transmission of power from the motor; a first bevel gear fitted to the first gear shaft; and a drive axle box disposed substantially at the center between the pair of independent wheelsets, wherein said drive axle box includes a second bevel gear meshed with the first bevel gear and gear type couplings aligned substantially with the axles and joined to the second bevel gear.

Accordingly, the bearings at both ends of each the independent wheelset are mounted in and supported by their respective axle boxes for sliding movement along the axial direction. The axle boxes are fixed to the axle box supporting beams which are mounted substantially in parallel to the independent wheelsets and separated from the bogie frame. Also, the drive axle box disposed between the paired independent wheelsets are rigidly mounted to the axle box supporting beams. The drive axle box contains the gear and its boss for transmission of power to the two, left and right, wheelsets. As the drive axle box as well as the paired independent wheelsets are fixed to the axle box supporting beams separated from the side frames and the two axles are aligned with the gear and the boss, the action of gauge change along the axial direction on the two separate axles wheels can be executed smoothly.

Also, the drive axle box is centered between the paired independent wheelsets causing the torsion rigidity to be equal on both left and right sides and hence allowing a large displacement of the axles along the axial direction in relation to the drive axle box. The independent wheelsets and the drive axle box are joined to each other by the gear type couplings with the internal tooth arrangements on the boss and the axles in the drive axle box, permitting a play for offsetting a smaller displacement (3 mm to 5 mm) to be minimized (about 0.1 mm).

The two angular Cardan type drive mechanisms are coupled to their respective front and rear axles of the bogie, hence allowing the two motors to be installed in a small space between the front and rear axles.

The above and further objects and features of the present invention will more fully be apparent from the following detailed description with accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is a plan view of a structure of a gauge-shiftable bogie according to the present invention;

FIG. 2 is a side view of the bogie of FIG. 1 seen from side;

FIG. 3 is a side view of the bogie of FIG. 1 seen from front;

FIG. 4 is a partially cross sectional side view taken along the line A-A of FIG. 1;

FIG. 5 is a traverse cross sectional view taken along the line B-B of FIG. 4;

FIG. 6 is a schematic perspective view of a gauge changing mechanism in the gauge-shiftable bogie according to the present invention;

FIGS. 7A and 7B are cross sectional views of an independent wheelset with an axle box according to the present invention;

FIG. 8 is a schematic cross sectional view of a load support member assembly in an outer axle box according to the present invention; and

FIG. 9 is a schematic plan view of a railroad gauge changing installation according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is a plan view showing a structure of the gauge-shiftable bogie according to the present invention. FIG. 2 is a side view of the bogie of FIG. 1 seen from one side. FIG. 3 is a side view of the bogie of FIG. 1 seen from the front. FIG. 4 is a partially cross sectional side view taken along the line A-A of FIG. 1. FIG. 5 is a traverse cross sectional view taken along the line B-B of FIG. 4.

As shown in FIGS. 1 to 5, a pair of left and right independent wheelsets 30 are provided, each having a wheel 1 on an axle 2 provided at both ends with bearings 3 and 5 respectively. The two bearings 3 and 5 in each of the independent wheelsets 30 separated at left and right by a drive axle box 7 are accommodated in their respective axle boxes 3a and 5a for sliding movement axially of the axle 2. The axle boxes 3a and 5a, four in total, are fixedly mounted to axle box supporting beams 6 and 16 which are provided separately of a bogie frame composed mainly of two, left and right, side beams 13a and 13b and two, front and rear, transoms 14. The axle box supporting beams 6 and 16 are substantially parallel to the axles 2 in its lengthwise direction between the two side beams 13a and 13b and have retaining members 6a, 6b, 16a, and 16b projected downwardly from the bottom thereof on which the axle boxes 3a and 5a are rigidly mounted. The axle box supporting beams 6 and 16 are arranged independent from the two side beams 13a and 13b and joined at the transoms 14 of the bogie frame by coupler links 23 so that they are fixed in the traveling direction of the bogie but movable upward and downward. The drive axle boxes 7 in center between the two, left and right, wheelsets 30 are rigidly mounted by retaining members 24 to the axle box supporting beams 6 and 16.

As best shown in FIG. 4, holders 3b and 5b are fitted on the outer surfaces of the bearings 3 and 5 and accommodated in their respective axle boxes 3a and 5a for sliding movement. Also, load support members 180 are mounted on one end of the outer axle box 3a, which can support a carbody body when resting on a load support member rail to lift up the wheel 1 in the shifting of the gauge. The axle boxes 3a and 5a are provided with lock pins which lock the wheels 2 to their narrow gauge position or standard gauge position as will be described later in more detail. Throughout FIGS. 3 to 5, the narrow gauge position is denoted by the real lines while the standard gauge position is denoted by the dotted lines.

Referring to FIG. 5, each of the two opposite axles 2 has a deep hollow bore provided in an inner end thereof with an internal tooth 4, each tooth extending axially, arranged on the inner wall of the bore. A main

gear 9 is disposed in the drive axle box 7 between the two opposite independent wheelsets 30. A outer tooth 26 meshing with an internal tooth of a boss 8 in the main gear 9 and a outer tooth 27 meshing with the internal tooth 4 of the axle 2 are mounted to both ends of a shaft 12a respectively, constituting a gear type internal joint (gear type coupling) 12.

The drive axle box 7 is located in the center of each of the two axle box supporting beams 6 and 16 for transmission of power equally to the two opposite independent wheelsets 30. A couple of motors 18 and 19 are so arranged in a small space between the front and rear wheelsets 30 that their drive shafts extend diagonally to the axial direction (the direction of the axle 2) as is slanted from the axial direction and traveling direction of the bogie.

More particularly, the drive shaft 29 of the motor 18 as well as the boss 8 in the drive axle box 7 are arranged at a predetermined angle to the axial direction of the bogie. The main gear 9 on the boss 8 is of a bevel gear and meshed with a sub gear 10 as a bevel gear. A shaft 11 of the sub gear 10 is joined by a gear type flexible joint 20 to the drive shaft 29 of the motor 19. The sub gear shafts 11 in the front and rear drive axle boxes 7 are supported by bearings 11a fitted on the drive axle boxes 7 and arranged substantially parallel to each other extending in opposite directions. In other words, the motors 18 and 19 which are hence arranged substantially parallel to each other while slanting from the axial direction of the bogie as shown in FIG. 1 are fixed to a pair of support plates 28 respectively mounted to their corresponding side beams 13a and 13b between the two transoms 14. The drive mechanism in the gauge-shiftable bogie of the present invention incorporates a angular Cardan drive unit.

As shown in FIG. 2, axle box supports 15 are provided with coil springs 17 in front and rear of the outer axle boxes 3a bottom the side beams 13a and 13b. The coil springs 17 produce upward and downward elastic forces to attenuate vertical vibration of the outer axle boxes 3a.

The gear type internal joint 12 for joining the axles 2 and the drive axle box 7 includes the outer tooth 26 meshed with the internal tooth mounted to one end of the boss 8 of the main gear 9 in the drive axle box 7 and the outer tooth 27 meshed with the internal tooth 4 of the axle 2, allowing the outer tooth 27 to shift its meshing location with the internal tooth 4 to left and right for transmission of power equally to the left and right sides on different gauge. The outer tooth 26 and 27 are fitted on the both ends of the axle 12, respectively.

The four axle boxes 3a and 5a of the two, left and right, independent wheelsets 30 are rigidly fixed to on each of the axle box supporting beams 6 and 16, preventing the two independent wheelsets 30 from being tilted by carbody load over the outer axle boxes 3a and a bending moment derived from a rail counter force of the load.

The axle box supporting beam 6 may be mounted not only horizontally but also at an angle to the horizontal direction so long as it securely holds the axle boxes.

Although the above description incorporates the bogie with the motor drive mechanism for a powered carbody, the gauge-shiftable bogie of the embodiment may be utilized as a non-powered bogie. In that case, the drive axle box, the gear type coupling, the motor, the flexible joint, the main gear and the sub gear are removed.

To shift the prescribed gauge-shiftable bogie of the embodiment from one gauge to the other, the load supports members 180 are placed on, for example, load supporting rails which are prepared at the location of gauge changing between two different gauge tracks, to lift up the axles 2 allowing the wheels 1 to move along the axles 2.

A gauge changing mechanism of the gauge-shiftable bogie and a railroad gauge changing installation for shifting the gauge from one to the other according to the present invention will now be described.

FIG. 6 is a schematic perspective view of the gauge changing mechanism of the gauge-shiftable bogie of the present invention. FIGS. 7A and 7B are cross sectional views of the independent wheelset and the axle boxes in a combination showing the present invention. FIG. 7A illustrates the wheelset 30 at its narrow gauge condition and FIG. 7B at its standard gauge condition.

As shown in FIG. 6, the holder 3b is mounted on the outer surface of the bearing fixed to one end of the axle 2. The holder 3b comprises a cylindrical body about the bearing and a couple of projections 50 extending towards the front and rear of the bogie respectively. There are two, first and second, guide members 110 and 120 spaced from each other by a distance in the axial direction of the axle 2 and elastically supported by elastic members 130 which are made e.g. of rubber blocks or laminations and seated on the inner wall of the outer axle box 3a (refer to FIGS. 7A and 7B). The first guide member 110 comprises a pair of upper and lower segments separated from each other by two, front and rear, gaps 110b and provided with a through hole 110a inbetween. The respective through holes 110a and 120a is sized to accept the cylindrical body of the holder 3b and the gaps 110b are tailored to receive the projections 50 of the holder 3b. The second guide member 120 is identical in shape to the first guide member 110 and located closer to the center of the bogie than the first guide member 110. A downward retractable lock pin 150 is provided between the first and second guide member 110, 120 for locking action.

FIG. 8 is a schematic cross sectional view of the load press unit on the outer axle box. The load press unit assembly 160 comprises the load support members 180 located on the outer end face in the axial direction of the outer axle box 3a and levers 25, each joined at one end to the load support member 180 and kept the other end in contact with a laminated rubber 140 inside

of the outer axle box 3a. The lever 25 is monolithic having a bending shape and pivotably mounted at its bend by a pivot pin 170 to an upper region of the outer axle box 3a.

As shown in FIGS. 7A and 7B, the laminated rubber 140 is located between the first guide member 110 and the inner wall of the outer side in the axial direction of the outer axle box 3a. The laminated rubber 140 has elasticity for cushioning axially and stays in direct contact with the first guide member 110 at its normal state, and is pressed in the motion of the load support member assembly 160 on the outer axle box 3a. The inner axle box 5a is identical in construction to the outer axle box 3a, except that the load press unit 160, the laminated rubber 140, and the elastic bodys 130 are removed, wherein two, first and second, guide member 90 and 100 are provided with the second guide member 100 positioned closer to the center of the bogie and a lock pin 150 is disposed between the two guide member 90 and 100. The components are identical in shape to those of the outer axle box 3a and will be explained in no more detail. Also, The identical holder is mounted to the other end of the axle 2.

As best shown in FIG. 7A, when the independent wheelset 30 is shifted to its narrow gauge condition, the cylindrical body and the projections 50 of the holder 3b are accepted in the through hole 120a and the gaps 120b of the second guide member 120 and locked by the lock pin 150 in the outer axle box 3a. At the time, the holder 3b of the inner axle box 5a is accepted in those of the second guide member 100 and locked by the lock pin 150. Accordingly, the independent wheelset 30 is securely held as prevented from shifting to the standard gauge condition.

When the independent wheelset 30 is shifted to its standard gauge condition, as shown in FIG. 7B, the lock pin 150 of the outer axle box 3a is retracted allowing the cylindrical body and the projections 50 of the holder 3b to be held in the through hole 110a and the gaps 110b of the first guide member 110 and then locked by the lock pin 150. At the time, the holder 3b of the inner axle box 5a is accepted in those of the first guide member 90 and locked by the lock pin 150. Accordingly, the independent wheelset 30 is securely held as prevented from shifting to the narrow gauge condition.

While the load press unit 160 is not activated permitting no pressing action of the lever 25, the projections 50 of the holder 3b remain urged towards the center of the bogie by the elastic force of the laminated rubber 140. This causes the lock pin 150 in the outer axle box 3a to press directly against the second guide member 120 closer to the center of the bogie. Simultaneously, the lock pin 150 in the inner axle box 5a is urged by the projections 50 to press directly against the second guide member 100 closer to the center of the track. Accordingly, the lock pins 150 is prevented at their locking position from displacement.

For shifting the wheelsets 30 from the standard gauge condition shown in FIG. 7B to the narrow gauge condition shown in FIG. 7A, the load support members 180 are placed on the load supporting rails of the railroad gauge changing installation at the shift location between the standard gauge track and the narrow gauge track and the levers 25 of the load press unit 160 are added the force from underside to be turned clockwisely in the figures to press against the laminated rubber 140 which is in turn compressed. This gives freedom of the guide member 110 and 120 from the elastic force of the laminated rubber 140 developing clearance between the guide member 110 and 120 and the lock pin 150 which then becomes retractable. Simultaneously, there is developed clearance between the two guide member 90 and 100 and the lock pin 150 in the inner axle box 5a allowing retraction of the lock pin 150.

By now, the projections 50 of the holder 3b in the outer axle box 3a stay in the gaps 120b of the second guide member 120 with the independent wheelset 30 shifted to the side closer the center of the bogie. The laminated rubber 140 remains in direct contact with and urges the first guide member 110 towards the inner side while presses against the lock pin 150 and the second guide member 120 to allow no displacement. Also, the holder 5b remains in direct contact with and holds the inner and wall in the axial direction of the inner axle box 5a while presses against the lock pin 150 and the second guide member 100 to permit no displacement.

The foregoing gauge changing in the gauge-shiftable bogie of the embodiment is carried out in addition to the railroad gauge changing installation located at the shift point between two, narrow and standard, gauge tracks. An example of the installation is shown in FIG. 9. Narrow gauge track 32 and standard gauge track 33 are laid the shift location as spaced from each other. The railroad gauge changing installation comprises two, left and right, load supporting rails 34 for lifting up the carbody to allow free load of the wheels, four lock pin guide rails 35 for engagement with the lock pins 150 for locking, and wheel guide rails 36 for guiding the wheels to determine a gauge. The load supporting rails 34 are located opposite to the load support members 180 mounted outwardly on the outer axle box 3a of the bogie.

As the bogies have moved into the railroad gauge changing installation, their load support members 180 come into direct contact with the load supporting rails 34 hence lifting up the carbody and the wheel guide rails 36 become low, consequently, the wheels are away from the rails. Next, the lock pins 150 come at their lower end in engagement with the lock pin guide rails 35 and as the lower end of the lock pins 150 are guided so as to become gradually down, the lock pins 150 are removed out. Then, as the wheels 1 run on the wheel guide rails 36, the paired independent wheelsets 30 are shifted from the narrow gauge to the standard gauge or vice versa. After the gauge changing is completed and

the lock pin guide rails 35 become up to the former level, the lock pins 150 are returned back to their locking position and depart from the lock pin guide rails 35 before the bogies advance to the narrow gauge rails 32 or standard gauge rails 33.

The jogging motion of the independent wheelsets 30 is free by the elastic force of the elastic rubbers 140 and in the gauge changing, the wheelsets 30 can be released with the elastic force being offset by the weight of the carbody through the action of the load support members 180 and can be moved to a desired gauge condition by retracting the lock pins 150.

The present invention is not limited to the previous embodiment where the wheels 1 are shifted as they run on the wheel guide rails 36. It is also possible that when the lock pins 150 have been retracted, the independent wheelsets 30 are driven by hydraulic cylinders or the like and the lock pins 150 are returned to their locking position.

Although the drive axle box 7 in the center between the two, left and right, independent wheelsets 30 is fixed to the axle box supporting beams 6 and 16 in the embodiment, they are of no laminations and may be secured to the bogie frame.

As set forth above, the present invention allows the independent wheelsets to be securely held, without displacement, by the urging force of the elastic bodys such as laminated rubbers during the running and in the gauge changing, to be released and shifted when the urging force has been offset by the weight of the carbody through the action of the load support members.

Also, the four axle boxes accommodating the bearing slidably mounted to each pair of the left and right independent wheelsets are rigidly fixed to the single axle box supporting beam, hence eliminating a bending moment on the wheelsets and thus any chance of tilting the wheelsets and contributing to the safety operation of the carbody.

The drive axle box is disposed between the two, left and right, independent wheelsets for each of the front and rear wheel axles in the bogie to have the rigidity to torsion equal on both, left and right, sides thus providing generous axial displacement between the axles and the drive axle box and permitting the transmission of power from the motors to both, left and right, sides equally regardless of the gauge change. Moreover, two sets of the angular Cardan type drive mechanisms arranged in opposite directions are used for the front and rear wheel axles in the bogie hence allowing the two motors to be installed in a smaller space between the front wheel axle and the rear wheel axle.

Claims

1. A gauge-changeable bogie for railroad carbody which can travel in different gauge tracks, comprising:

a pair of independent wheelsets (30), each unit having a wheel (1) fitted on an axle (2), the wheelsets (30) having their axles (2) aligned with each other in their axial direction and arranged at the wheel facing to each other;

bearings (3, 5) each fitted to respective ends of the axle (2);

holders (3b, 5b) each mounted to the outer surface of the bearing (3, 5); and

outer axle boxes (3a) and inner axle boxes (5a) provided on the outer and inner sides of the facing wheels (1) for holding and allowing respective ends of the axles (2) to slide in the axial direction,

each of said outer axle box (3a) and said inner axle box (5a) having therein,

a couple of first and second guide members (110, 120) spaced by a distance from each other along the axial direction for guiding the holders (3b, 5b); and

a lock pin (150) provided for detachably inserting between the first and second guide members (110, 120), and

load press units (160) positioned at one end inside of each the outer axle box (3a) and at the other end outside of each the outer axes box (3a) for supporting the weight of the carbody in the action of gauge changing,

characterized in that each said outer axle box (3a) further has a elastic body (140) which provides in direct contact with the first or second guide member (110, 120) at one side and an inner surface in the end axial direction of the outer axle box (3a) at the other side and which is pressed by the load press unit (160) in the action of gauge changing,

each the load press unit (160) includes:

a load support member (180) mounted on the axial outer side of the bogie for supporting the weight of the carbody in the action of gauge changing; and

a lever (25), each joined at one end to the load support member (180) and directly contact at the other end with the elastic body (140), which presses the elastic body (140) against its urging force while the load support member (180) supporting the weight of the carbody.

2. The gauge-changeable bogie for railroad carbody according to claim 1, wherein the holders (3b, 5b) are supported by either the first or second guide member (110, 120) corresponding to broader or narrower gauge.

3. The gauge-changeable bogie for railroad carbody according to claim 1 or 2, wherein each the holder (3b, 5b) includes a cylindrical body mounted to the outer surface of the bearing (3, 5) and two projections (50) extending from the circumferential face of the cylindrical body towards the forward and rearward directions of the bogie respectively, and

each of the first and second guide members (110, 120) includes a through hole (110a, 120a) for detachably holding the cylindrical body of the holder (3b, 5b) and gaps (110b, 120b) for detachably holding the projections (50).

4. A gauge-changeable bogie for railroad carbody which can travel operable in different gauge lines, comprising:

a bogie frame;
a pair of independent wheelsets (30), each unit having a wheel (1) fitted on an axle (2), the wheelsets (30) having their axles (2) aligned with each other in their axial direction and arranged at the wheel facing to each other; and two outer axle boxes (3a) and two inner axle boxes (5a) provided on the outer and inner sides of the facing wheels (1) for holding and allowing respective ends of the axles (2) to slide in the axial direction,

characterized by including axle box supporting beams (6, 16) provided independently on the bogie frame extending substantially in parallel to the axles (2), to which the two outer axle boxes (3a) and the two inner axle boxes (5a) are fixed.

5. The gauge-changeable bogie for railroad carbody according to claim 4, wherein the two outer axle boxes (3a) and the two inner axle boxes (5a) are fixed to retaining members (6a, 6b) of the axle box supporting beams (6, 16) projected outwardly opposite to the outer axle boxes (3a) and the inner axle boxes (5a).

6. A gauge-changeable bogie for railroad carbody which can travel in different gauge tracks, comprising:

a pair of independent wheelsets (30), each unit having a wheel (1) fitted on an axle (2), the wheelsets (30) having their axles (2) aligned with each other in their axial direction and arranged at the wheel facing to each other;
outer axle boxes (3a) and inner axle boxes (5a) provided on the outer and inner sides of the facing wheels (1) for holding and allowing respective ends of the axles (2) to slide in the axial direction; and
drive mechanisms, each arranged for transmitting power to the pair of independent wheelsets (30),

characterized in that each said drive mechanism is of a angular Cardan type including:

a motor (18);
a first gear shaft (11) extending diagonally to the axial direction of the bogie for transmission of power from the motor (18);
a first bevel gear (10) fitted to the first gear shaft (11); and
a drive axle box (7) disposed substantially at the center between the pair of independent wheelsets (30), wherein said drive axle box (7) includes a second bevel gear (9) meshed with the first bevel gear (10) and gear type couplings (8, 12a, 26, 27) aligned substantially with the axles (2) and joined to the second bevel gear (9).

7. The gauge-changeable bogie for railroad carbody according to claim 4, further comprising drive mechanisms, each arranged for transmission of power to the pair of independent wheelsets (30) and including:

a motor (18),
a first gear (11) for transmission of power from the motor (18), and
a drive axle box (7) disposed substantially at the center between the pair of independent wheelsets (30), wherein said drive axle box (7) includes a second gear (9) meshed with the first gear (10) and gear type couplings (8, 12a, 26, 27) aligned substantially with the axles (2) and joined to the second gear (9).

8. The gauge-changeable bogie for railroad carbody according to claim 6 or 7, wherein each the axle (2) has a hollow space therein in the inner side of the facing wheels (1) where a internal tooth is provided, and

wherein the gear type coupling includes a boss (8) disposed between the two axles (2) and having a internal tooth therein; and

coupling members (12a, 26, 27) having toothed portions on the outer sides thereof meshed with the internal tooth of the boss (8) and the internal tooth of the two axles (2) for coupling the boss (8) to the two axles (2).

9. The gauge-changeable bogie for railroad carbody according to claim 6, further comprising axle box supporting beams (6, 16) provided independently on the bogie frame extending substantially in parallel to the axles (2), to which the two outer axle

boxes (3a) and the two inner axle boxes (5a) are fixed,

wherein the drive axle box (7) is also fixed to the axle box supporting beams (6, 16).

10. The gauge-changeable bogie for railroad carbody according to claim 9, further comprising:

bearings (3, 5) each fitted to respective ends of the axle (2);
holders (3b, 5b) each mounted to the outer surface of the bearing (3, 5); and
load press unit (160) positioned at one end inside of each the outer axle box (3a) and at the other end outside of each the outer axes (3a) for supporting the weight of the carbody in the action of gauge changing,
wherein each the outer axle box (3a) having therein,

a couple of first and second guide members (110, 120) spaced by a distance from each other along the axial direction for guiding the holders (3b, 5b);
a lock pin (150) provided for detachably inserting between the first and second guide members (110, 120), and
a elastic body (140) provided in direct contact with the first or second guide member (110, 120) at one side and an inner surface in the end axial direction of the outer axle box (3a) at the other side, which is pressed by the load press unit (160) in the action of gauge changing, and
wherein each the inner axle box (5a) having therein,
a couple of first and second guide members (110, 120) spaced by a distance from each other along the axial direction for guiding the holders (3b, 5b);
a lock pin (150) provided for detachably inserting between the first and second guide members (110, 120), and

wherein each the load press unit (160) includes:
a load support member (180) mounted on the axial outer side of the bogie for supporting the weight of the carbody in the action of gauge changing; and
a lever (25), each joined at one end to the load support member (180) and directly contact at the other end with the elastic body (140), which presses the elastic body (140) against its urging force while the load support member (180) supporting the weight of the carbody.

FIG. 1

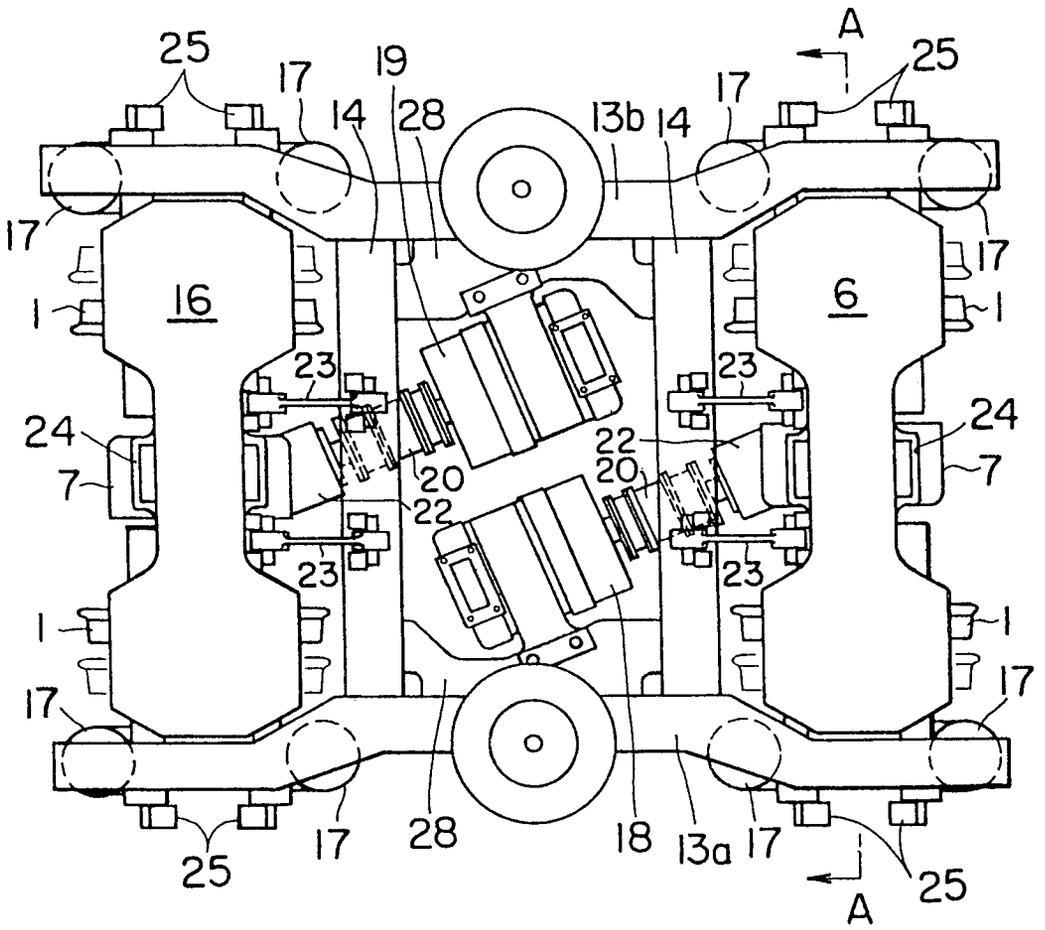

A
25
17
19
14
28
13b
14
17
25
17
16
6
1
23
24
7
20
22
18
13a
17
28
25
A

FIG. 2

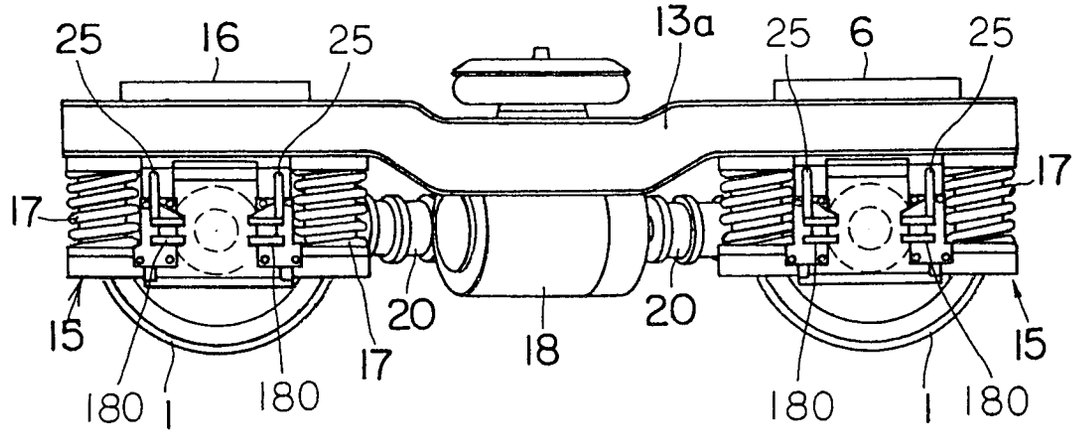
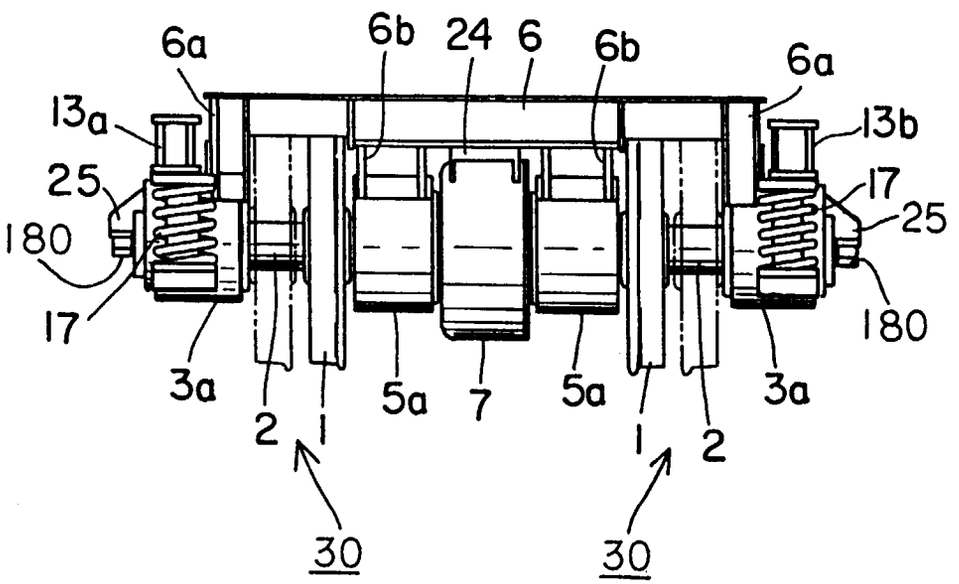

25
16
25
13a
25
6
25
17
17
15
180
1
180
20
17
18
20
180
1
180
15

FIG. 3



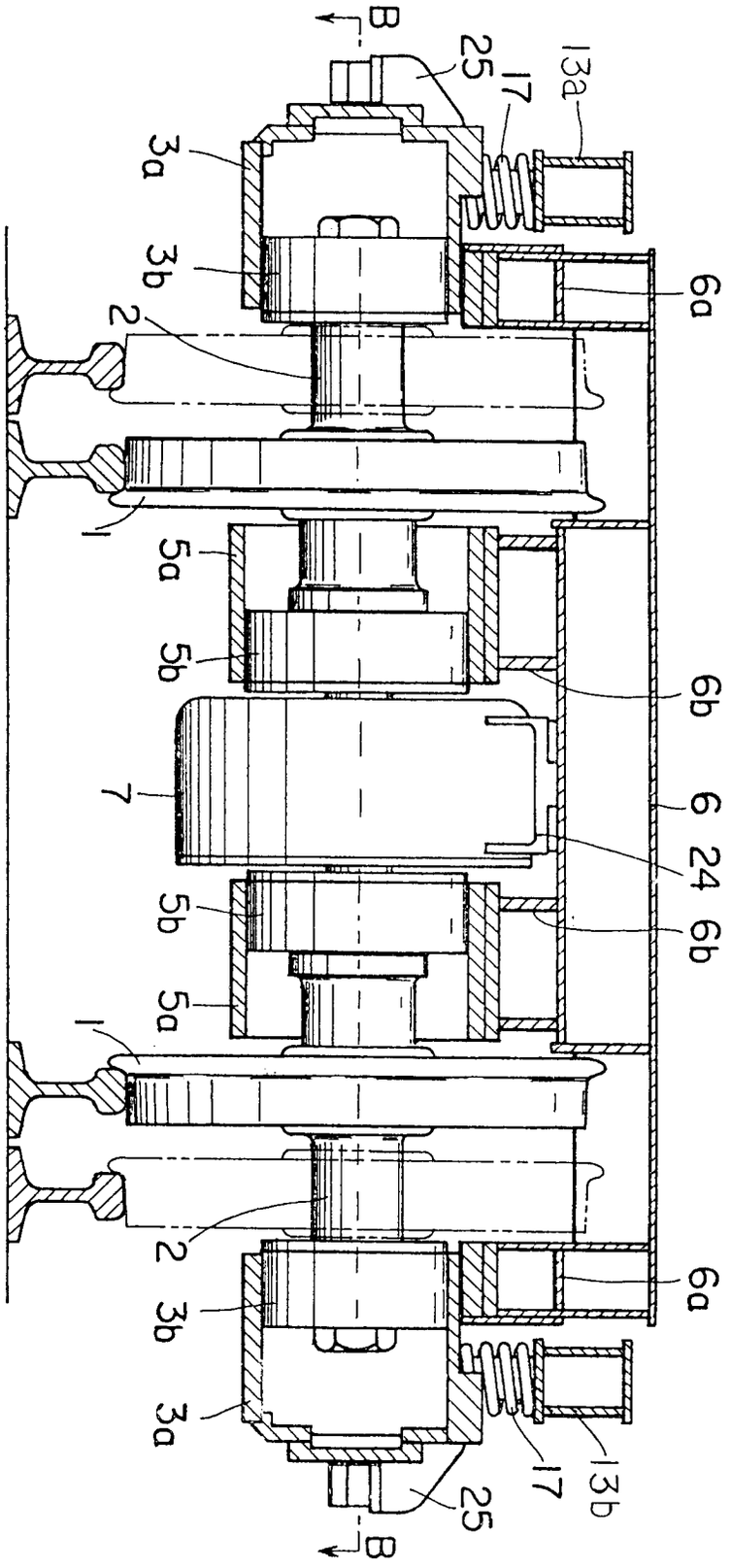


FIG. 4

FIG. 5

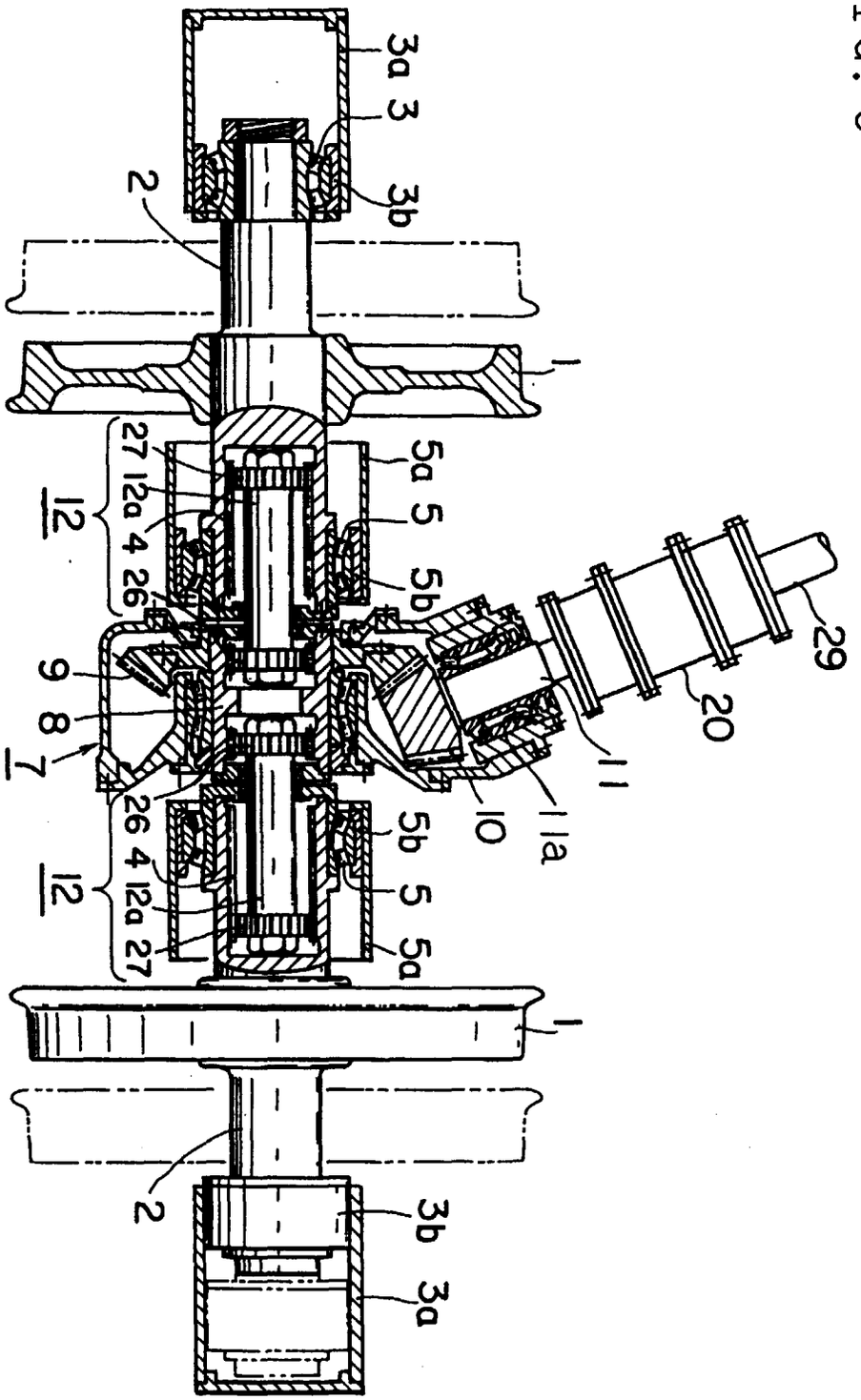

3a
3
3b
2
1
27
12a
4
26
12
5a
5
5b
29
20
11
11a
10
9
8
7
26
4
12a
27
12
5b
5
5a
1
2
3b
3a

FIG. 6

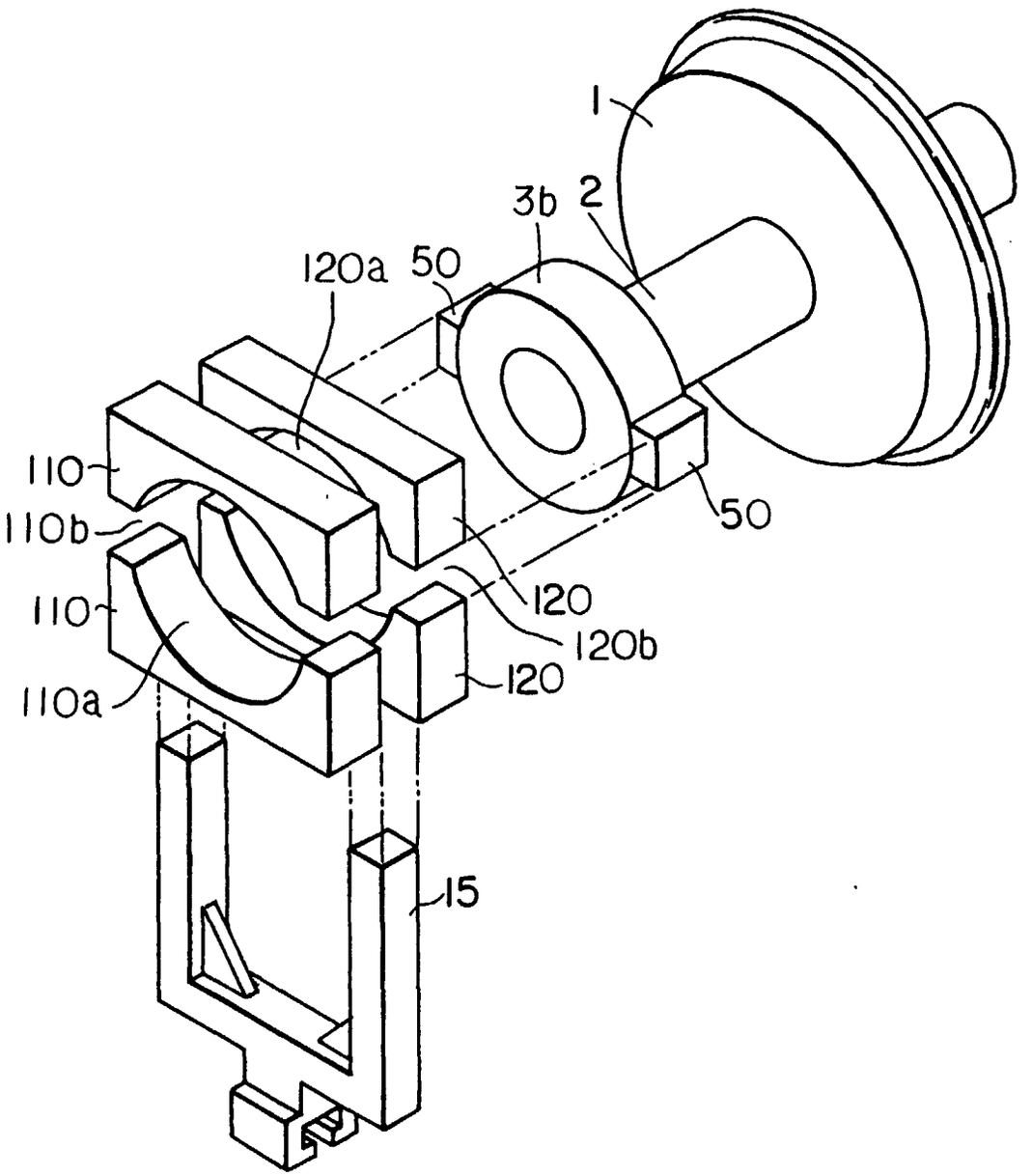


FIG. 7A

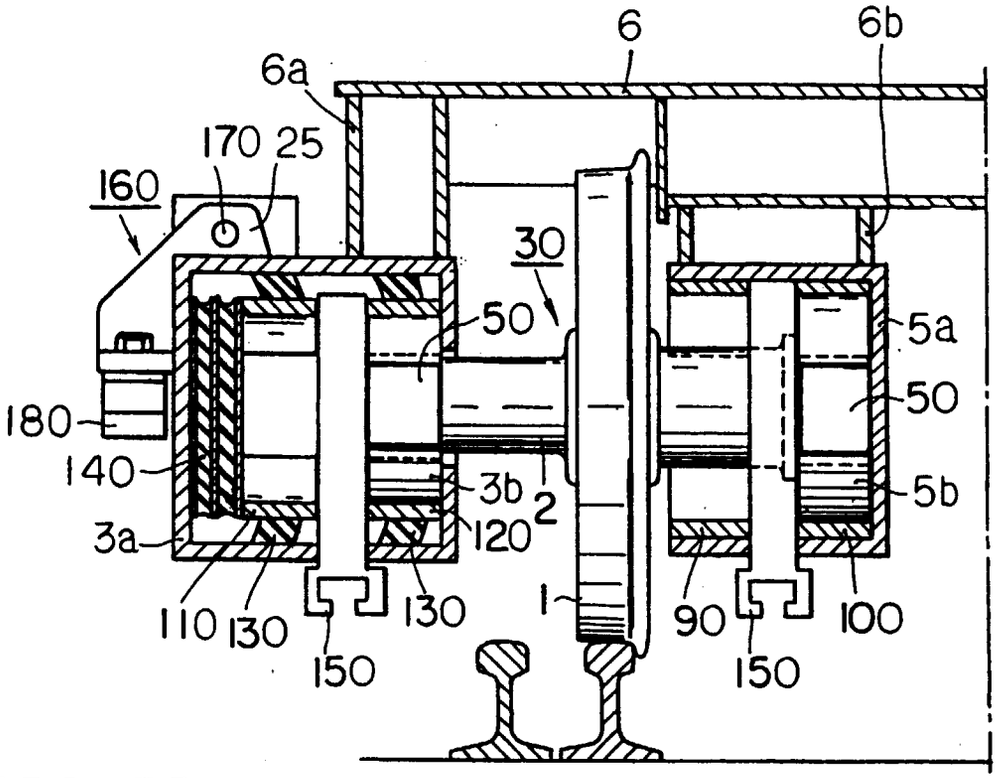

6
6b
6a
170 25
160
30
50
5a
50
180
140
3b
2
5b
3a
120
110 130
130
1
90
100
150
150

FIG. 7B

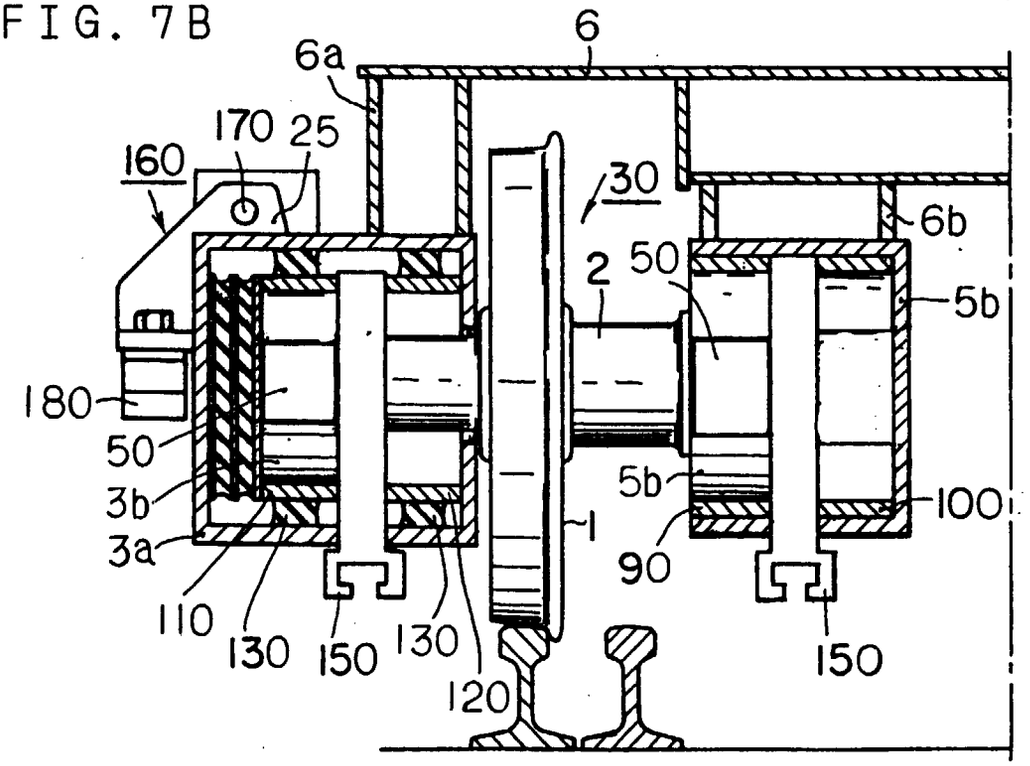

6
6a
170 25
160
30
6b
2
50
5b
180
50
3b
5b
100
3a
1
90
110
130
150
130
150
120

FIG. 8

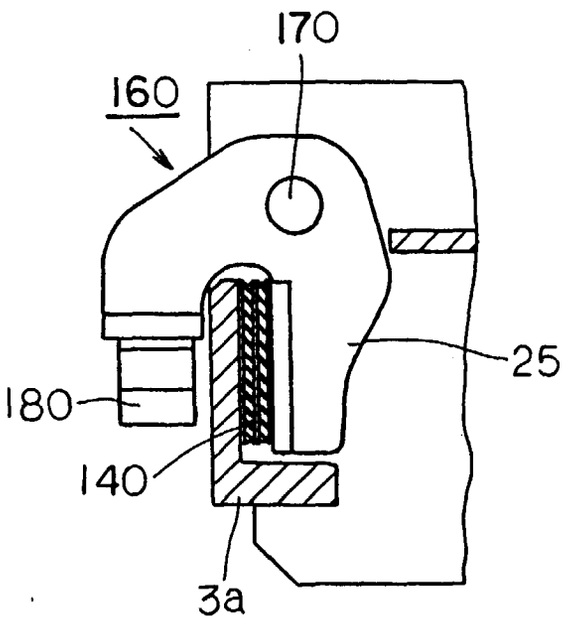


FIG. 9