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(54) **Railway car for transport particularly for railway car trains downstream ballast cleaner machines**

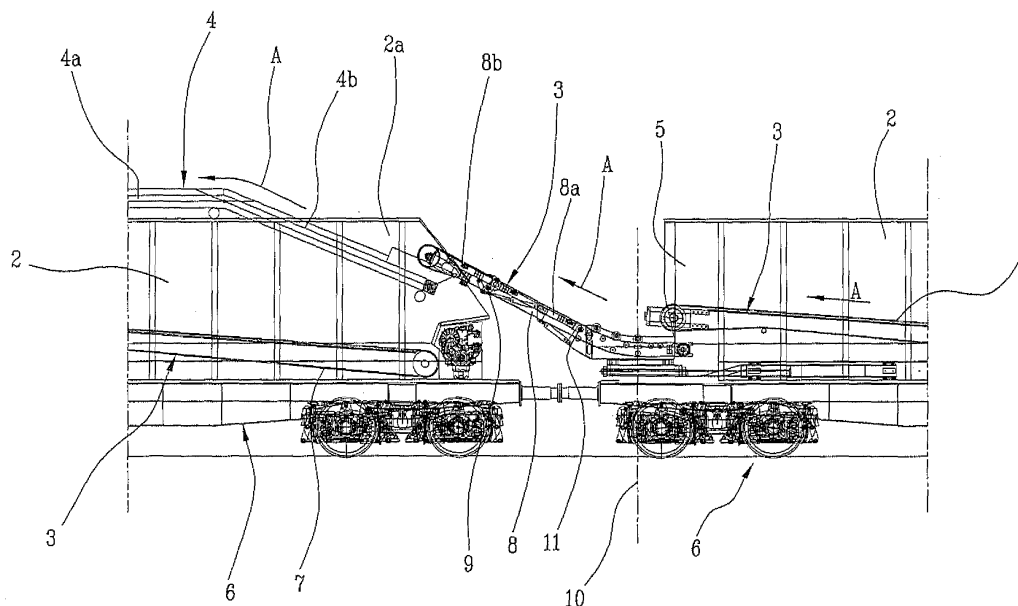
(57) A railway car for transport, intended for ballast cleaner machines, in which a holding body (2) prevalently extends along a predetermined direction "X". Main transport means (3) mounted on the support structure (6) conveys incoherent material along the predetermined direction (A) between a loading region (2a) of the support structure (6) and an unloading region (2b) of said structure.

Auxiliary transport means (4) is movable relative to the support structure (6) between at least two operating configurations, a first inactive configuration in which the

main transport means (3) carries the incoherent material from the loading region (2a) to the unloading region (2b) and a bypass configuration in which said auxiliary transport means (4) receives the incoherent material in the inlet region (2a) instead of the main transport means (3), and conveys said material to the outlet region (2b) by-passing the main transport means (3).

In case of malfunction of the main transport means (3), the auxiliary transport means (4) can be such configured as to intervene and restore full operation of the car.

FIG 7



Description

[0001] The present invention relates to a railway working machine intended for transport of crushed stones and other incoherent material and particularly suitable for working with ballast cleaner machines for ballast cleaning operations.

[0002] The present invention falls within the sector of the railway industry and in particular applies to the technical field of the machines intended for construction, servicing and dismantling of railway lines.

[0003] It is known that, for the purpose of renovating long track sections, removal of the incoherent material interposed between and under the sleepers, typically crushed stones and gravel, and replacement of same with new material is to be carried out.

[0004] This operation relies on known machines named ballast cleaner machines that, travelling at low speed on the track to be cleaned, continuously remove the crushed stones and convey them through proper conveyor belts towards suitable cars hitched on at the back of said ballast cleaner machines.

[0005] In the light of the above, a plurality of cars, usually about twenty cars or more, are associated with each ballast cleaner machine and they form a true railway car train.

[0006] In one of the presently known embodiments, each of the cars for ballast cleaners of known type comprises a holding body provided with wheels having a rail gauge corresponding to that of the track to be cleaned.

[0007] Installed at the body bottom is a conveyor mat or belt formed with mutually hinged stiff plates capable of supporting the weight of the debris material collected by the cleaner machine.

[0008] The conveyor belt of the car that is the closest to the cleaner machine receives the crushed stones and carries them, by means of the conveyor belt, to the following car, so as to first fill the last car in the row and then all the other cars in succession.

[0009] For accomplishing pouring out of the crushed stones from one body to the other, each car further comprises an auxiliary conveyor belt projecting in cantilevered fashion from the rear region of each of the bodies.

[0010] The auxiliary mat receives the crushed stones from the mat contained in the body and raises it until it falls down into the following car.

[0011] Disadvantageously, the servicing operations carried out with the above described car trains have a serious and important drawback. It is in fact to be noted that malfunction of even one alone of the cars forming the car train generally involves a great number of problems for the company in charge of servicing.

[0012] Generally, the time dedicated to servicing of a railway line section is very limited and in case of failure of one of the cars there is not enough time for transferring the car train to a place where the damaged car can be removed from the train and/or replaced with another one, so as to start servicing work again. This means that gen-

erally each car failure brings about interruption of the work for the whole day, which obviously involves costs for the workers that can no longer operate during that day, as well as the impossibility of undertaking a new work.

[0013] In addition it is well apparent that if failure takes place in one of the cars that are the closest to the ballast cleaner machine the problem is still more serious because the cleaning operation cannot even start.

[0014] It is also to be pointed out that problems connected with malfunction of the cars are not uncommon. First of all breaking of only one of the motor, the main belt, the auxiliary belt or any other component inhibiting operation of the car always involves interruption of the work. In addition, since the cars have to carry many quintals of debris material that is poured out onto the car in an incoherent manner, there are often situations in which the crushed stones, and sometimes also ferrous waste or other material, become embedded along the advancing direction of the belt thus cutting and shearing said belt and therefore making the car unusable.

[0015] Under this situation, particularly felt in this sector is the requirement of finding a solution to the serious problem highlighted above. In particular, the present invention aims at allowing the damaged car to be set working again in a simple and quick manner, so as to enable the ballast cleaning operations to be continued without losing the working day.

[0016] A further aim of the invention is to enable quick restarting of the works without being obliged to intervene in situ directly on the damaged car element for restoring operation of said car.

[0017] It is an auxiliary aim of the invention to make available a railway car train that is as efficient as possible, enabling both removal of the debris material and transport to the use place of the new crushed stones for ballast renovation.

[0018] The technical task mentioned and the aims specified are achieved by a railway car particularly for railway car trains downstream of ballast cleaner machines having the features set one in one or more of the appended claims.

[0019] Description of a preferred but not exclusive embodiment of a working machine suitable for ballast cleaner machines is now given hereinafter by way of nonlimiting example and illustrated in the accompanying drawings, in which:

- Figs. 1 to 6 illustrate a railway car train in accordance with the present invention in a successive sequence of operating steps for restoring operation of one of said cars;
- Fig. 7 shows an enlarged detail of the car train seen in Fig. 6;
- Figs. 8A-8D show a second embodiment of a car train in accordance with the present invention during the successive steps for ballast cleaning in a railway track section;

- Fig. 9 shows an enlarged detail of the car train seen in Fig. 8A;
- Fig. 10 shows an operating restoration configuration of a car of the car train referred to in Figs. 8A-8D in which the upper conveyor belt is bypassed; and
- Fig. 11 shows an operating condition of the car train seen in Fig. 8A in which the lower conveyor belt is bypassed.

[0020] With reference to the drawings, a railway car for transport of crushed stones or other incoherent materials, preferably for car trains 100 downstream of ballast cleaner machines 200 in accordance with the present invention is generally denoted by reference numeral 1.

[0021] The car train 100 downstream of the ballast cleaner machine 200 is preferably made up of a plurality of railway cars 1 in turn having a support structure 6 mainly extending along a predetermined direction X.

[0022] In particular, the support structure 6 comprises at least one holding element 2 defined by a body having a bottom and at least two side walls emerging from said bottom and extending along said predetermined direction X.

[0023] By way of example, the holding element 2 can be of the type described and illustrated in the applicant's prior invention No. PCT/IB2005/003229.

[0024] The support structure 6 further comprises a rest platform provided with moving away means, so that it can travel on the railway track.

[0025] The holding element or body 2 can be made so as to be integrated into the structure of the rest platform or also be made as a self-supporting structure, again as described in the above mentioned prior invention, in such a manner that it can structurally resist filling with the incoherent material and subsequent transport of same in a self-governing manner.

[0026] As shown in Fig. 1 and in Fig. 8a, the car train will be made up of a plurality of cars 1 coupled to each other in succession so that they can co-operate during transport of the incoherent material such as crushed stones and gravel that are removed from the ballast for replacement.

[0027] Referring to the car train 100 shown in Fig. 1, a ballast cleaner machine not shown will be positioned at the right-hand end of the car train so that it will be able to send the material removed from the ballast close to an inlet region 2a of the first car 1.

[0028] In the embodiment shown, the ballast cleaner is able to send the material close to an inlet conveyor 20 emerging from a front region of the first one of the railway cars 1.

[0029] In particular, the inlet conveyor will convey the incoherent material along the direction A shown to take it towards a loading region 2a of the first car where it is dropped into the holding body 2.

[0030] During the transport step of the car train in which the same is not used for conveying the incoherent material, the inlet conveyor 20 will be disposed in an inactive

position being moved, by means of a pneumatic actuator 21 for example, in a horizontal position over the car itself, due to the presence of a slide guide 21.

[0031] As can be seen, the railway car for transport in accordance with the present invention is provided with main transport means 3 mounted on the support structure 6, which is capable of transporting the incoherent material along the predetermined extension direction X of the support structure itself, i.e. along the advancing direction A indicated in the accompanying figures.

[0032] In particular, the main transport means 3 is able to carry the incoherent material from a loading region 2a of the support structure 6 to an unloading region 2b of the support structure of the same car. It is to be noted that generally the unloading region 2b of a car is coincident with the loading region 2a of the subsequent car, along the advancing direction of the material.

[0033] With reference to Figs. 1 to 7, it is possible to see that the main transport means 3 comprises at least one first conveyor 7 mounted in the holding body 2 and adapted to move the incoherent material along the predetermined direction X inside the holding body 2 between an inlet, actually coincident with the loading region 2a, and an outlet 5 of the holding body 2.

[0034] The main transport means 3 further comprises a second conveyor 8 in engagement in a movable manner with said holding body 2 in the vicinity of the outlet 5 of same for carrying the incoherent material received from the first conveyor 7 away from said outlet region 5 towards the unloading region 2b. In other words, co-operation of said two conveyor belts 7, 8 enables the incoherent material received in the loading region 2a to reach the unloading region 2b and then the loading region 2a of the immediately following car 1 along the advancing direction A of the material according to the arrows shown in Fig. 1.

[0035] By operating in this manner it is possible to remove the crushed stones from the ballast and then load them onto the cars, conveying them until they reach the last holding body 2 and then filling the structures from the last to the first one.

[0036] It is to be noted that the first conveyor 7 is placed at the bottom of the holding body and confined between the side walls of the latter.

[0037] The first conveyor 7 comprises a conveyor belt passing over at least one first and one second roller of known type and therefore not further described in the following of the present application.

[0038] Generally the first conveyor belt has a supporting surface for the debris material that also constitutes the bottom wall from the sides of which the opposite side walls of the holding body 2 extend. The supporting surface is preferably inclined from bottom to top starting from the loading region 2a towards the outlet 5.

[0039] The first conveyor 7 like the second conveyor 8 are actuated by a motor 23 advantageously positioned on the support structure 6 in the vicinity of the loading region 2a.

[0040] The second conveyor 8 is movable between a first operating position at which it protrudes in cantilevered fashion from the support structure 6 and a second operating position at which it is disposed backwards against the holding body 2.

[0041] Looking at Fig. 1 it is possible to see that the second conveyor 8 is in the first operating position with reference to the two first cars downstream of the ballast cleaner machine, while it is in the second operating position on the last car of the car train 100.

[0042] In particular, the second conveyor 8 is provided with at least two consecutive stretches 8a, 8b and with an articulated joint 9 interposed between them which enables the consecutive stretches to be folded upon themselves at the second operating position (see Figs. 1, 2 and 7).

[0043] While the first operating position is the work position, in the second operating position generally transfer of the car train occurs.

[0044] It is also to be noted that the second conveyor 8 is movable in rotation around a substantially vertical axis 10 (see Fig. 7) located at the outlet 5 of the holding body 2. Due to rotation around axis 10, car 1 is allowed to unload the material also alongside the ballast, i.e. to compensate for possible bending of the car train following the track.

[0045] In addition, the second conveyor 8 is movable in rotation around a substantially horizontal axis 11 also located at the outlet 5 of the holding body 2. Rotation around this second axis 11 allows correct vertical positioning of the outlet end of the conveyor belt 8 from which the conveyed material falls.

[0046] Also provided is a further rotation around an axis substantially coincident with the extension axis of conveyor 8 so that conveyor 8 can be rigidly tilted or also twisted, thus avoiding falling of the incoherent material under particular situations of transport and unloading of the material.

[0047] The railway car in accordance with the invention also comprises auxiliary transport means 4 movable relative to the support structure 6 between at least two operating configurations, a first inactive configuration at which the main transport means takes the incoherent material from the loading region 2a to the unloading region 2b and a bypass configuration at which said auxiliary transport means 4 receives the incoherent material in the loading region 2a instead of the main transport means 3 and carry the material to the unloading region 2b bypassing the main transport means 3.

[0048] Turning back to Figs. 1 to 7, if anyone of the actuating members of anyone of the cars of the car train 100 should breakdown, it would be possible to restore operation of the car train by means of said auxiliary transport means 4. The latter can first of all be moved relative to the support structure 6 in at least one horizontal direction 13. For instance, the same can be provided with suitable supporting members 24 adapted to move the auxiliary transport means 4 in said direction 13. In particular,

the supporting members 24 can co-operate with the upper end of the holding body 2 and can consist of suitable wheels, tracked wheels or the like.

[0049] In an alternative embodiment not shown, the auxiliary transport means 4 can be provided with supporting members 24 directly movable on guides made on the rest platform of the support structure 6 to take the auxiliary transport means close to the car, operation of which is to be restored.

[0050] Assuming that the broken or damaged car is the central car of Figs. 1-6 (note that said failure can involve the motor 23, first conveyor 7, second conveyor 8), first of all the auxiliary transport means 4 at said broken car (Figs. 1 and 2) are actuated. Then, as shown in Fig. 3, the two consecutive stretches 8a, 8b of the second conveyor 8 are folded upon themselves (Fig. 3), then the second conveyor is at least partly retracted under the holding body 2 (Fig. 4). Afterwards, the auxiliary transport means 4 having at least two stretches 4a, 4b for advancing of the material, which can be configured in a predetermined number of different mutual angular positions are activated, and in more detail one of said stretches (4b), which is an end stretch, rotates around the substantially horizontal axis 12, as shown in Fig. 5.

[0051] Then the second conveyor 8 is first pulled out and then the two stretches 8a and 8b are brought back to the operating configuration, as shown in Fig. 6.

[0052] Then the auxiliary transport means 4 is connected to a motor, which can be that of the car to be bypassed or that of the subsequent car, and said means is driven in order to bypass the damaged car.

[0053] As shown in Fig. 6, in fact, the debris material coming from the prior or preceding car is carried by the second preceding conveyor to the loading region 2a where it is positioned the end stretch 4b of the auxiliary transport means, above the main transport means 3, so that said end stretch 4b can receive the incoherent material coming from the main transport means of the preceding car and unload it onto the subsequent car, also bypassing the second conveyor 8.

[0054] It is apparent that the auxiliary transport means can be used for bypassing anyone of the cars in the car train. Said means can take a suitable structure; for instance they can include a conveyor belt, but alternatively (or in combination) also one or more Archimedean screws adapted to move the material forward.

[0055] Generally, the car train will be equipped with a plurality of auxiliary transport means 4 so as to be able to possibly deal with one or more failures.

[0056] Advantageously, an alternative car train configuration 100 is provided which is shown in Figs. 8 to 11. In this configuration the main transport means 3 further comprises a third conveyor 14 located above the first conveyor 7 and second conveyor 8 to allow a simultaneous transport of incoherent material.

[0057] In particular, this third conveyor 14 will have two end portions, one disposed to a lower position relative to the unloading end portion of the material from the third

conveyor 14 of the preceding car, the other disposed to an upper position relative to the inlet region of the material on the third conveyor 14 of the subsequent car, as shown in the figures. Generally, the third conveyor 14 moves the material along the predetermined direction X preferably in the opposite way relative to the movement way of the first conveyor 7.

[0058] By operating in this manner, with reference to Figs. 8a-8d, the car train reaches the position at which work is started for loading new crushed stones (Fig. 8a). The ballast cleaner machine 200 starts working by loading the debris material onto the third conveyors 14, which material is transported along direction A on the upper part, towards the last car of the car train, and filling of same starts. Simultaneously, the first and second conveyors 7, 8 of each car move forward the new crushed stones that are suitably distributed on the ballast (see Fig. 8b). In this case too auxiliary transport means of the previously described type is provided.

[0059] It is to be noted that except for the third conveyor 14, the cars shown in Figs. 8 to 11 can be substantially identical with those seen in Figs. 1 to 7.

[0060] Fig. 9 is a diagrammatic and partly enlarged view of the car train in Fig. 8 in a condition of normal operation of the main transport means 3. Should the third conveyor 14 of one of the cars fail or be damaged, the auxiliary transport means can be moved along a horizontal direction and through said supporting members, until said means reaches a location close to the third conveyor 14 to be bypassed (Fig. 10).

[0061] Under this situation the auxiliary transport means will be configured in the operating bypass position at which the end stretch 4b is positioned above the third conveyor 14 (and in particular an end 14b thereof) so as to receive the incoherent material coming from the respective third conveyor 14 of the preceding car and unload the material onto the conveyor 14 of the subsequent car.

[0062] In order to reach this bypass configuration, the auxiliary transport means must be not only movable in the horizontal direction, but also preferably in the vertical direction.

[0063] If, on the contrary, the first or second conveyor belt 7, 8 were damaged, the auxiliary transport means 4 would take the previously mentioned configuration shown in Fig. 10, bypassing the third conveyor 14 of car 4.

[0064] As shown in Fig. 11, the third conveyor 14 will be moved at least in a horizontal direction in such a manner that from the configuration of normal operation in which it received the material from the third conveyor 14 of the preceding car and carried it to the third conveyor 14 of the subsequent car, it takes a configuration in which it bypasses the first and second conveyors 7, 8 having at least one end stretch 14c placed above the first conveyor 7 of the car itself at the loading region 2a, so that it can receive the incoherent material coming from the corresponding second conveyor 8 of the preceding car 1; a second end stretch 14b on the contrary will be placed

above the second conveyor 8 at the unloading region 2b of the car for unloading the material onto the first conveyor 8 of the subsequent car.

[0065] By operating in this manner any failure of the cars can be obviated, either if said failure concerns the lower belts or if it concerns the upper conveyor belt.

[0066] The invention achieves important advantages.

[0067] In fact, due to adoption of the auxiliary transport means, operation of a car that should breakdown can be restored very quickly without being obliged to directly intervene on the damaged element of the car in order to restore it.

[0068] In addition, it is not necessary to transfer the car train to a servicing area, but it is possible to directly intervene in situ.

[0069] It is also to be noted that the auxiliary transport means can intervene on anyone of the cars forming the car train and that therefore provision of an auxiliary belt 4 for each of the cars of the car train is not necessary.

[0070] The bypass method can be adopted both with reference to cars exclusively equipped with a first and a second conveyor 7, 8 and with reference to cars for dual transport of the new material and the debris material, replacement of anyone of the transport sections being possible.

Claims

1. A railway car for transport, particularly for car trains downstream of ballast cleaner machines, comprising:

- a support structure (6) prevailing extending along a predetermined direction "X";
- main transport means (3) mounted on the support structure (6) for conveying the incoherent material along the predetermined direction "X" between a loading region (2a) of the support structure (6) and an unloading region (2b) of the support structure (6) itself,

characterised in that it further comprises auxiliary transport means (4) movable relative to the support structure (6) between at least two operating configurations, a first inactive configuration in which the main transport means (3) carries the incoherent material from the loading region (2a) to the unloading region (2b), and a bypass configuration in which said auxiliary transport means (4) receives the incoherent material in the loading region (2a) instead of the main transport means (3), and conveys said material to the unloading region (2b) bypassing the main transport means (3).

2. A car as claimed in claim 1, **characterised in that** the auxiliary transport means (4) has at least two stretches (4a, 4b) for advancing of the material,

which can be configured in a predetermined number of different mutual angular positions.

3. A car as claimed in the preceding claim, **characterised in that** at least one of said stretches (4b) is an end stretch adapted to rotate around an axis (12), which is preferably substantially horizontal, transverse to the advancing direction of the material on the auxiliary transport means (4).
4. A car as claimed in the preceding claim, **characterised in that** in its operating bypass configuration the end stretch (4b) is positioned in the loading region (2a) above the main transport means (3) so that it can receive the incoherent material coming from the respective main transport means (3') of the preceding car (1'), the auxiliary transport means (4) unloading the incoherent material onto the subsequent car (1'').
5. A car as claimed in anyone of the preceding claims, **characterised in that** the auxiliary transport means (4) comprises at least one conveyor belt and/or at least one Archimedean screw having subsequent stretches (4a, 4b) articulated on each other.
6. A car as claimed in anyone of the preceding claims, **characterised in that** the auxiliary transport means (4) can be actuated relative to the support structure (6) in at least one horizontal direction (13) and preferably also in a vertical direction.
7. A car as claimed in anyone of the preceding claims, **characterised in that** the auxiliary transport means (4) comprises two end stretches placed on opposite sides relative to a central stretch, said end stretches being able to rotate about an axis transverse to the advancing direction of the material on the auxiliary transport means (4).
8. A car as claimed in anyone of the preceding claims, **characterised in that** the main transport means (3) further comprises a third conveyor (14) located above the first conveyor (7) to enable simultaneous transport of incoherent material, the third conveyor (14) moving the material along the predetermined direction (X), preferably in the opposite way relative to the movement way of the first conveyor (7).
9. A car as claimed in the preceding claim, **characterised in that** the third conveyor (14) has at least two stretches (14a, 14b) for advancing of the material, which can be configured in a predetermined number of different mutual angular positions, preferably at least one of said stretches (14b) being an end stretch adapted to rotate about an axis (15), that is preferably substantially horizontal, transverse to the advancing direction of the material on the third conveyor (14).

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10. A car as claimed in claim 8, **characterised in that**, in the operating bypass configuration, the auxiliary transport means (4) can be activated for bypassing the third conveyor (14) of the car, the end stretch (4b) being positioned above the third conveyor (14) so that it can receive the incoherent material coming from the respective third conveyor (14'') of the preceding car (1'), the auxiliary transport means (4) unloading the material onto the third conveyor (14') of the subsequent car (1').
11. A car as claimed in anyone of the preceding claims, **characterised in that** the third conveyor (14) comprises at least two subsequent stretches (14a, 14b) articulated on each other.
12. A car as claimed in claim 8, **characterised in that** the third conveyor (14) is movable from the configuration of normal operation in which it transfers the material from the corresponding third conveyor (14'') of the preceding car to the third conveyor (14') of the subsequent car, to a bypass configuration for bypassing the first and second conveyors (7, 8), in which it has at least one end stretch (14c) located above the first conveyor (7) at the loading region (2a) for receiving the incoherent material coming from the corresponding second conveyor (8') of the preceding car (1'), and a second end stretch (14b) located above the second conveyor (8) at the unloading region (2b) of the car for unloading the material onto the first conveyor (8'') of the subsequent car (1'').
13. A car as claimed in claim 8, **characterised in that** the third conveyor (14) can be moved relative to the support structure (6) in at least one transverse, preferably horizontal, direction (13) and, more preferably, also in a vertical direction.
14. A railway car as claimed in anyone of the preceding claims, **characterised in that** the support structure (6) comprises at least one holding body (2), the main transport means (3) comprising at least one first conveyor (7) mounted in the holding body (2) for conveying incoherent material along the predetermined direction "X" inside the holding body (2) between an inlet and an outlet (5) of said holding body (2), the car preferably comprising a second conveyor (8) linked to said holding body (2) in the vicinity of the outlet (5) thereof for conveying the incoherent material received from the first conveyor (7) away from said outlet (5) towards the unloading region (2b), the second conveyor (8) being more preferably movable between a first operating position at which it protrudes in cantilevered fashion from the support structure (6) and a second operating position at which it is retracted against the holding body (2).
15. A car as claimed in claim 14, **characterised in that**,

in the operating bypass configuration, the auxiliary transport means (4) can be activated for bypassing the first (7) and second (8) conveyors of the car (1), the end stretch (4b) being positioned above the first conveyor (7) at the loading region (2a) to enable it to receive the incoherent material coming from the second conveyor (8') of the preceding car (1') along the material advancing direction (A), the auxiliary transport means (4) unloading the material onto the first conveyor (7'') of the subsequent car (1'') at the unloading region (2b),

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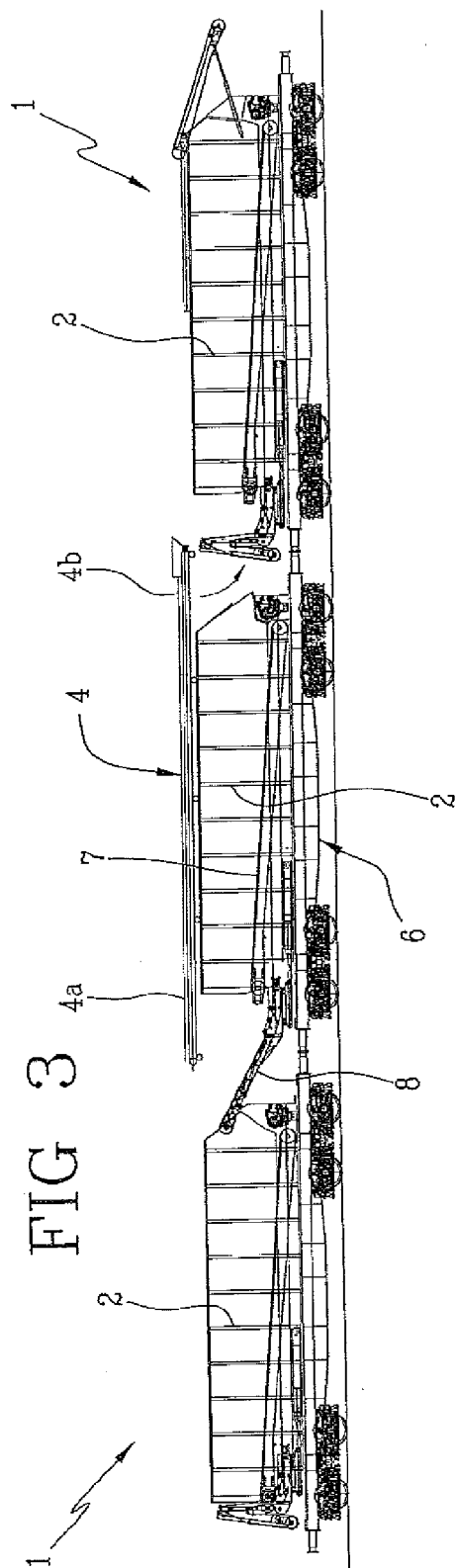


FIG 4

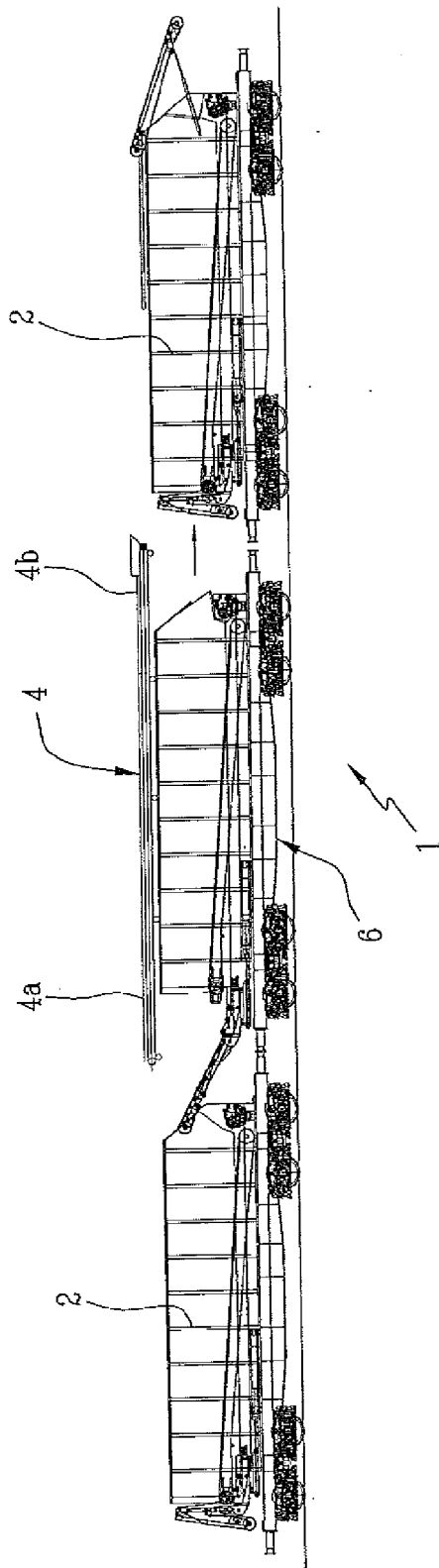


FIG 5

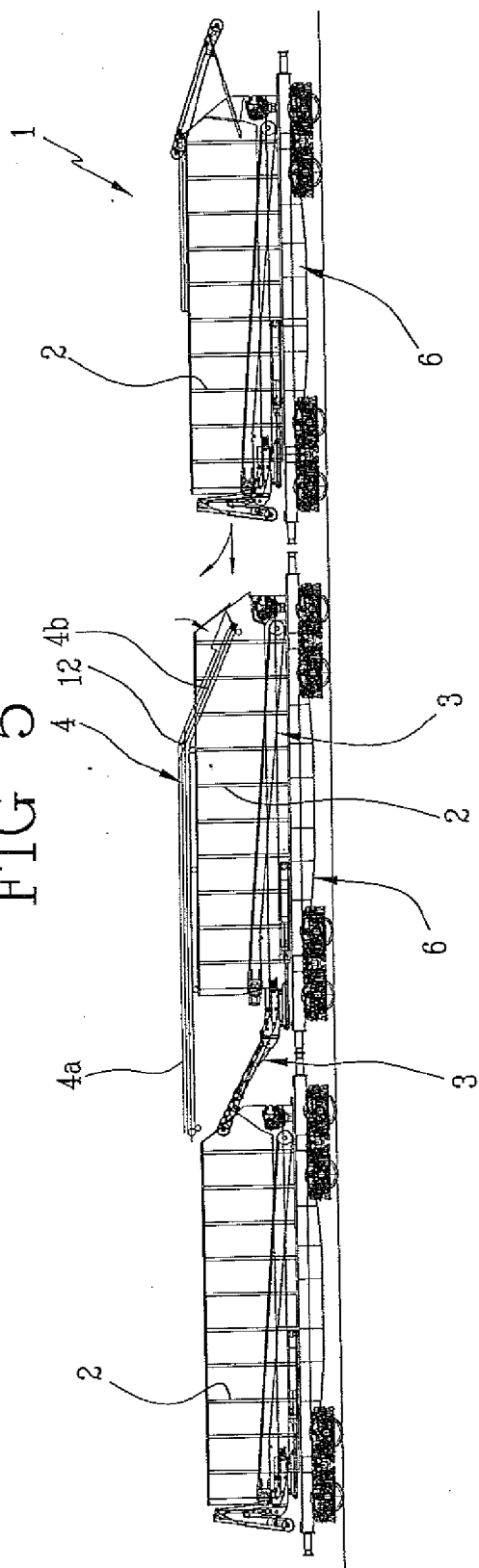


FIG 6

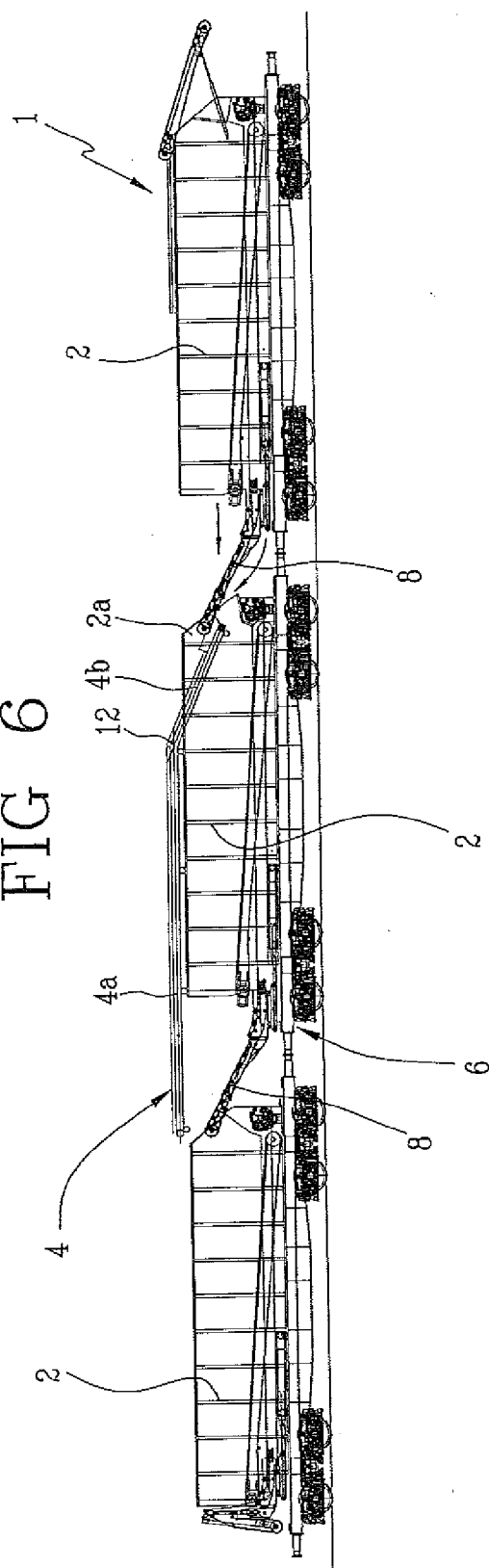
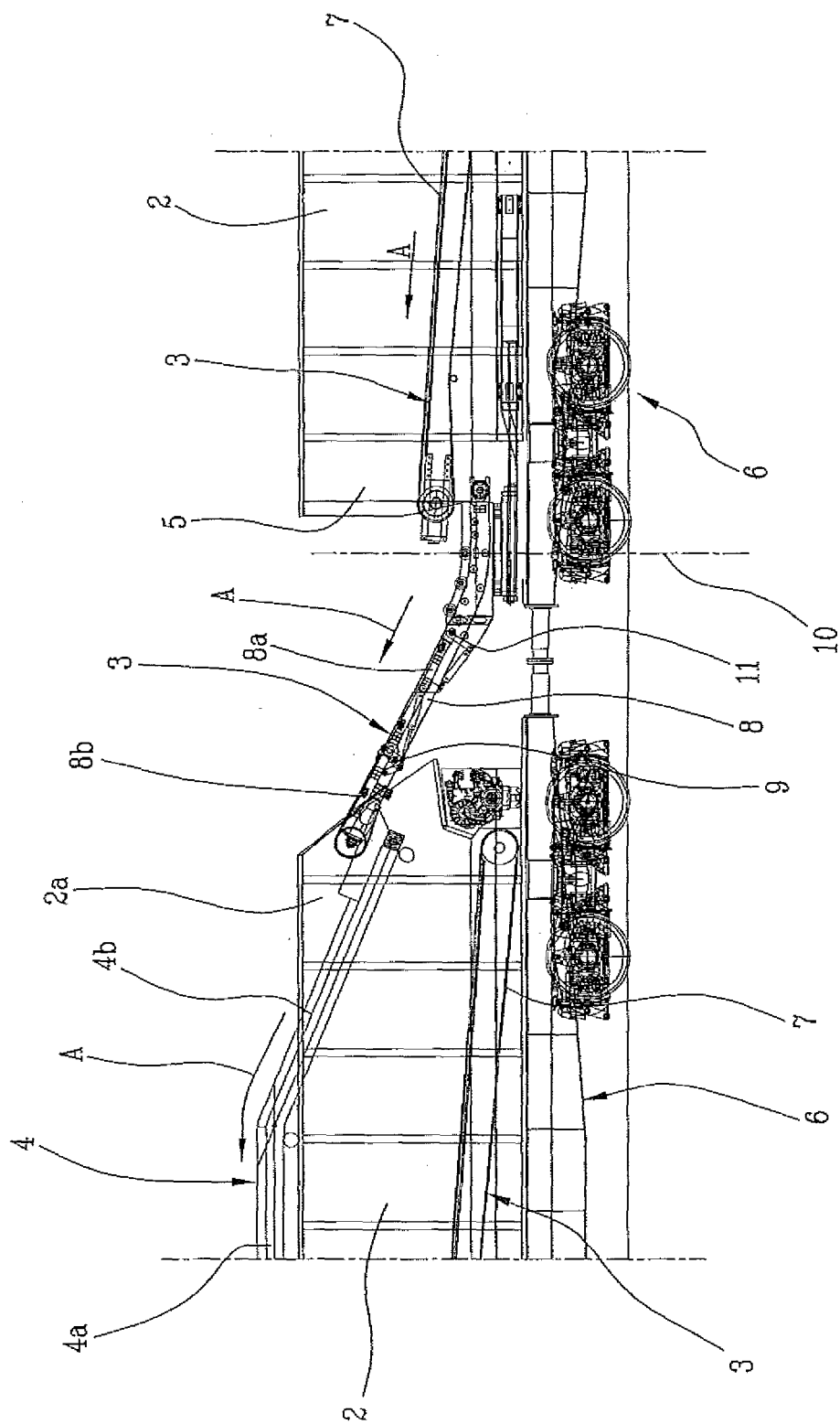
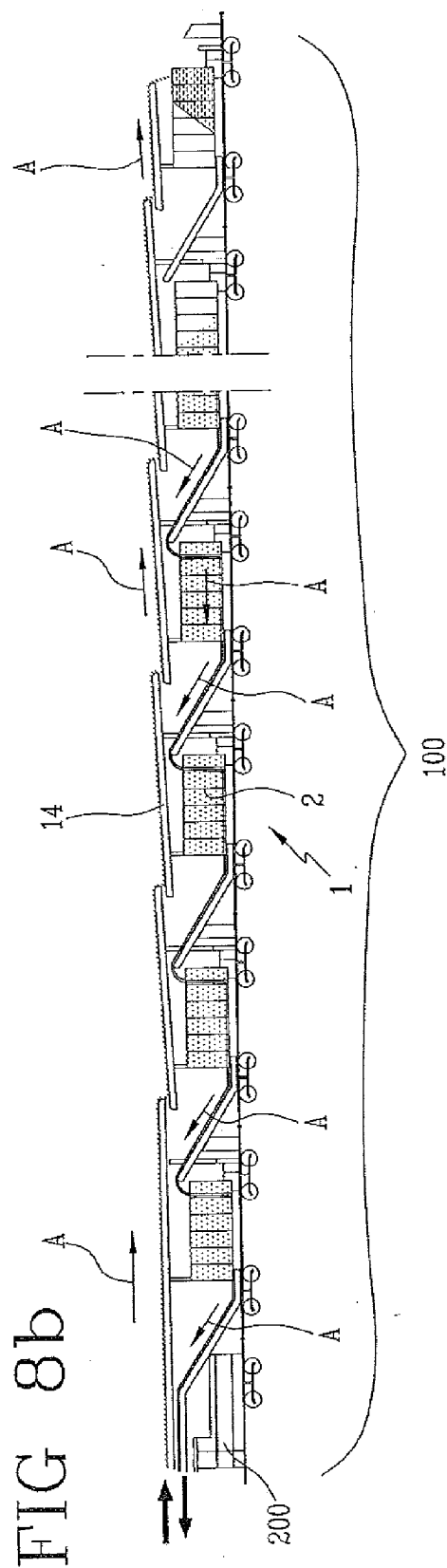
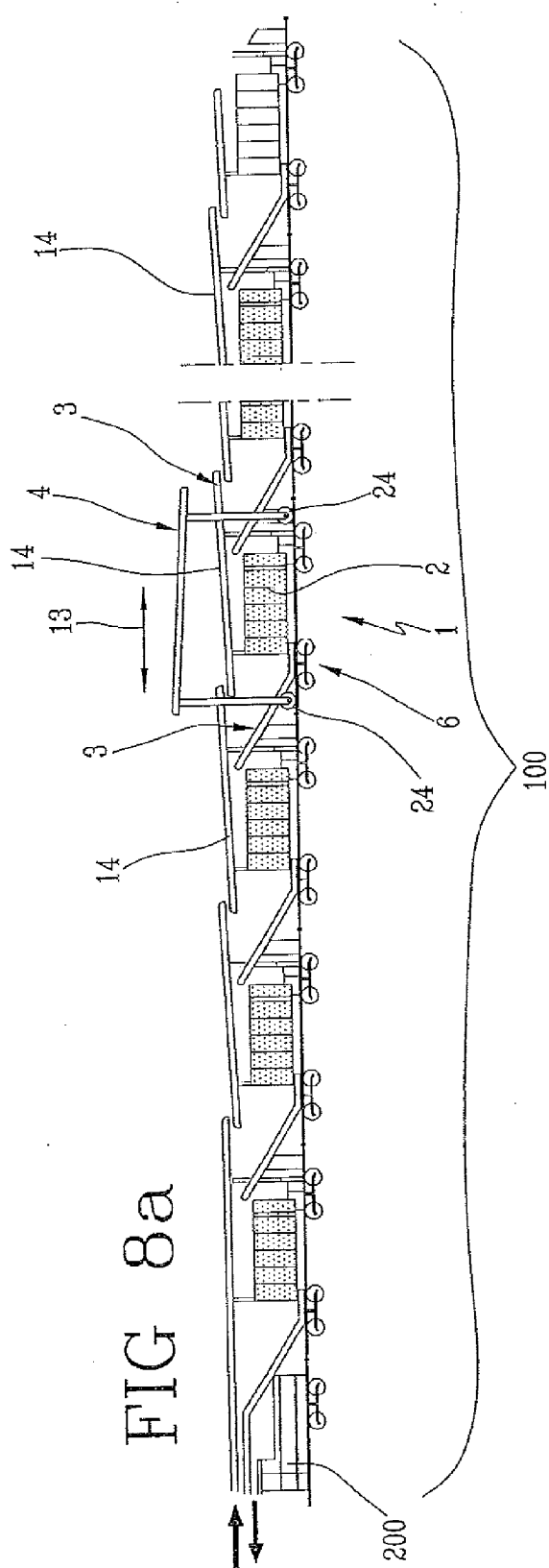


FIG 7





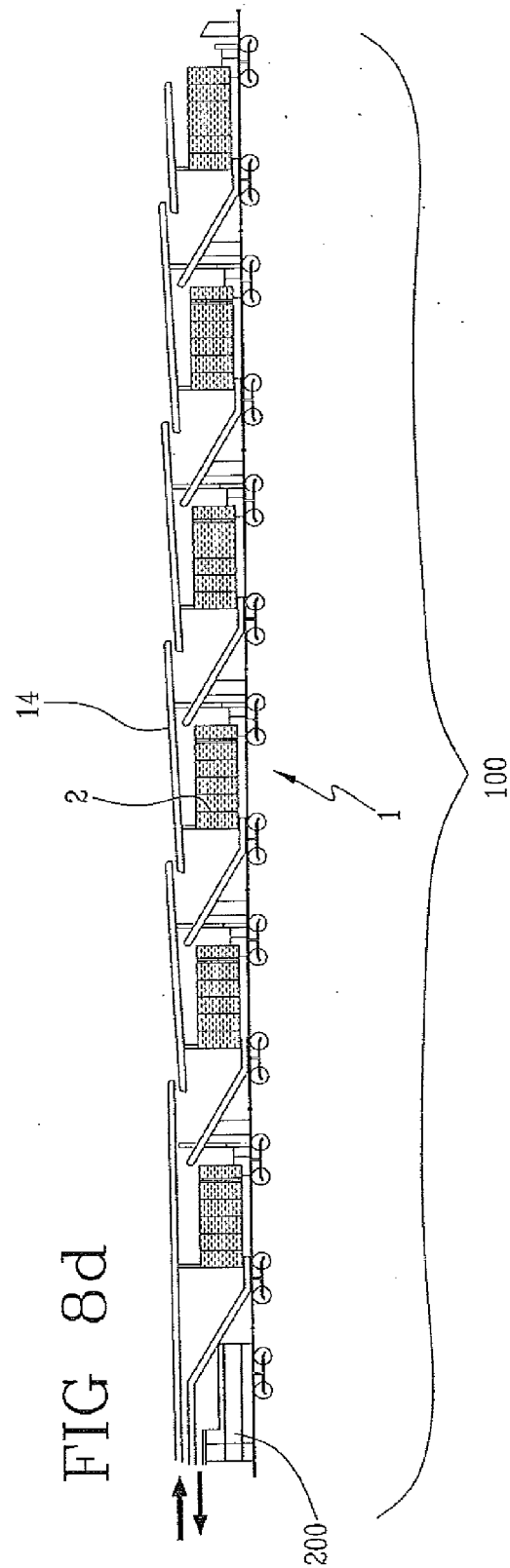
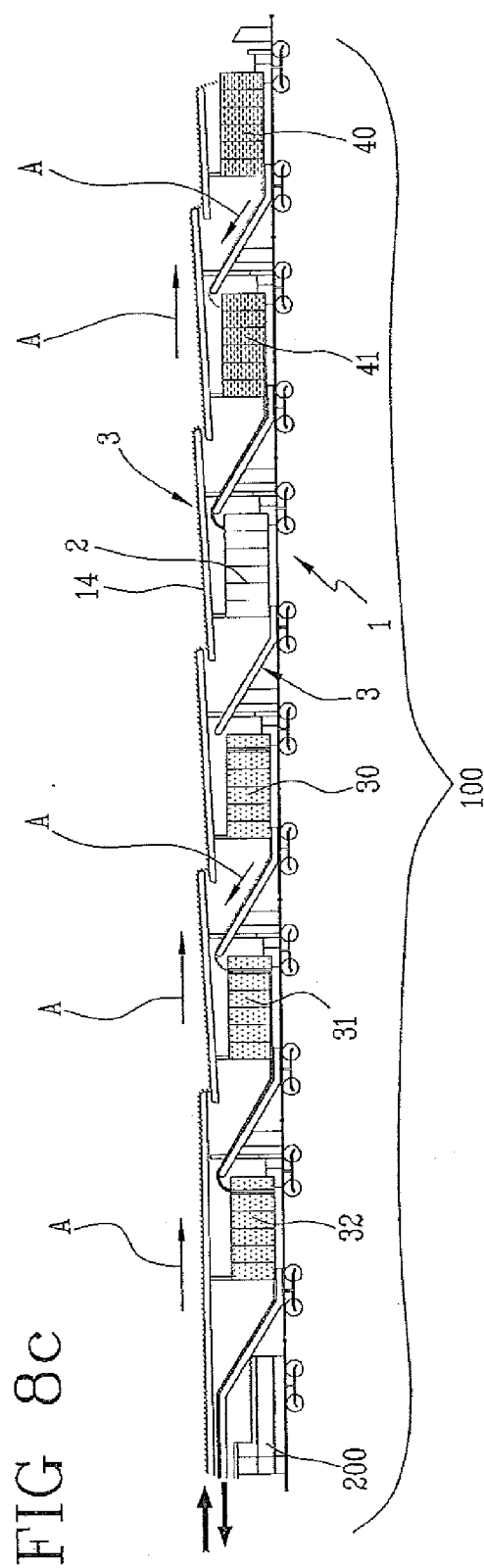


FIG 9

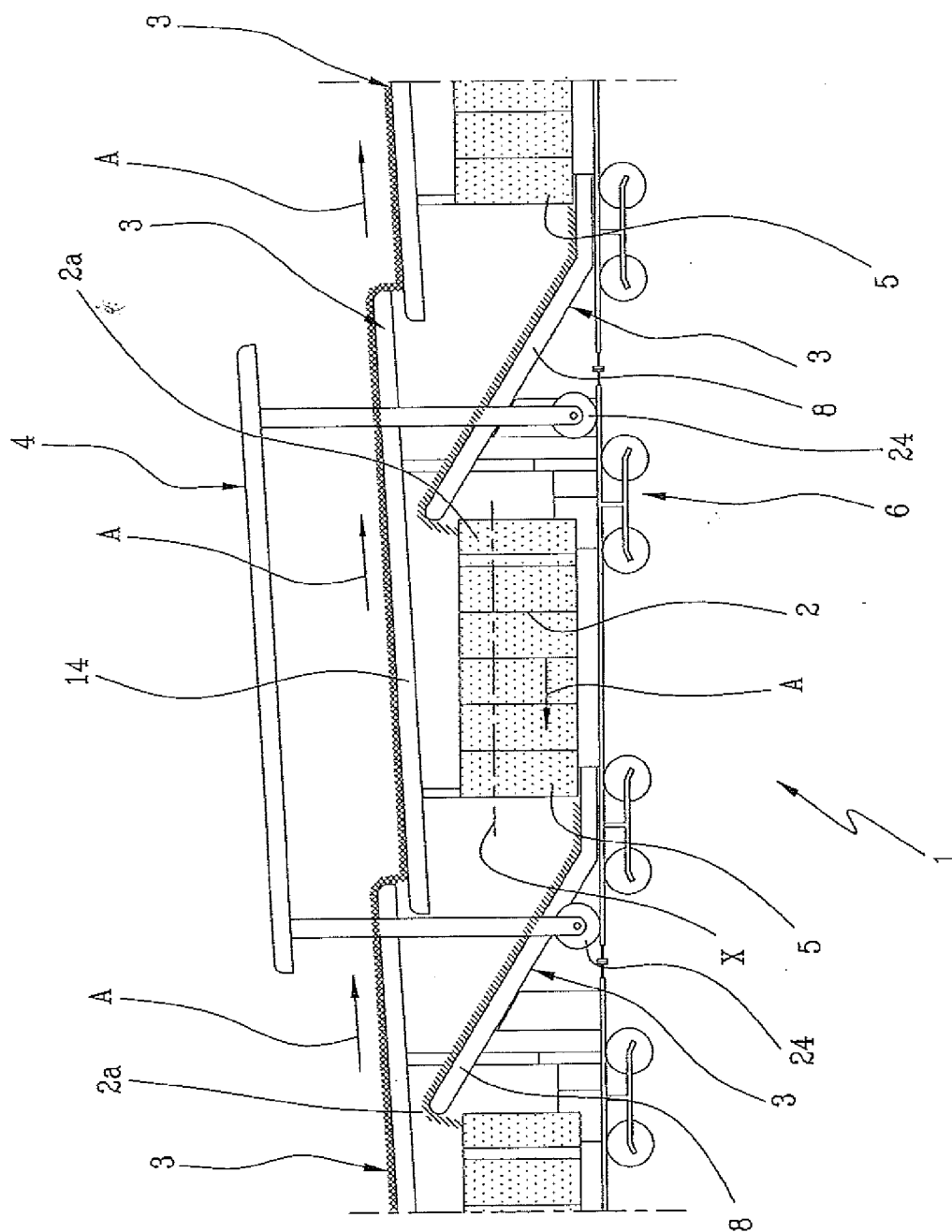


FIG 10

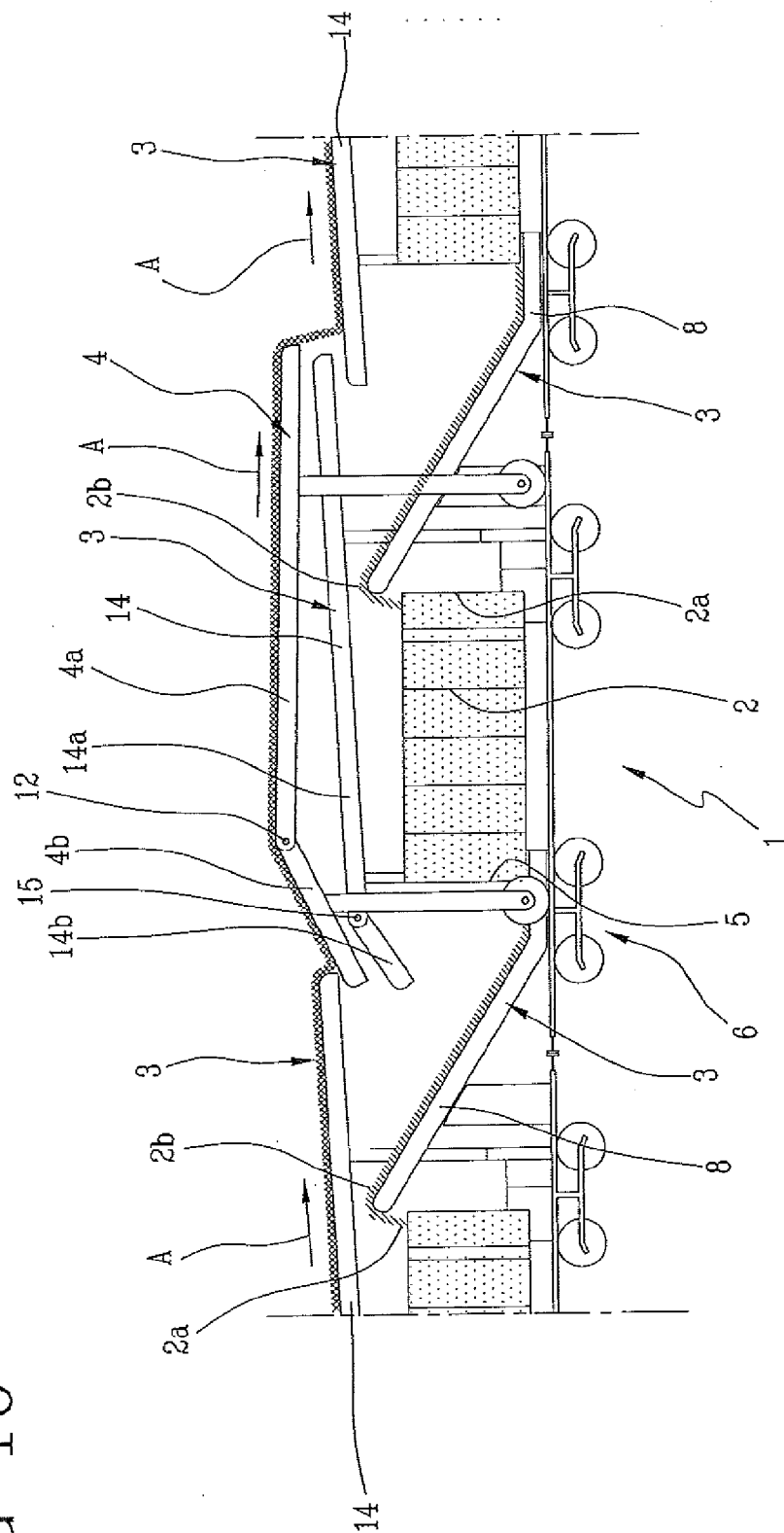
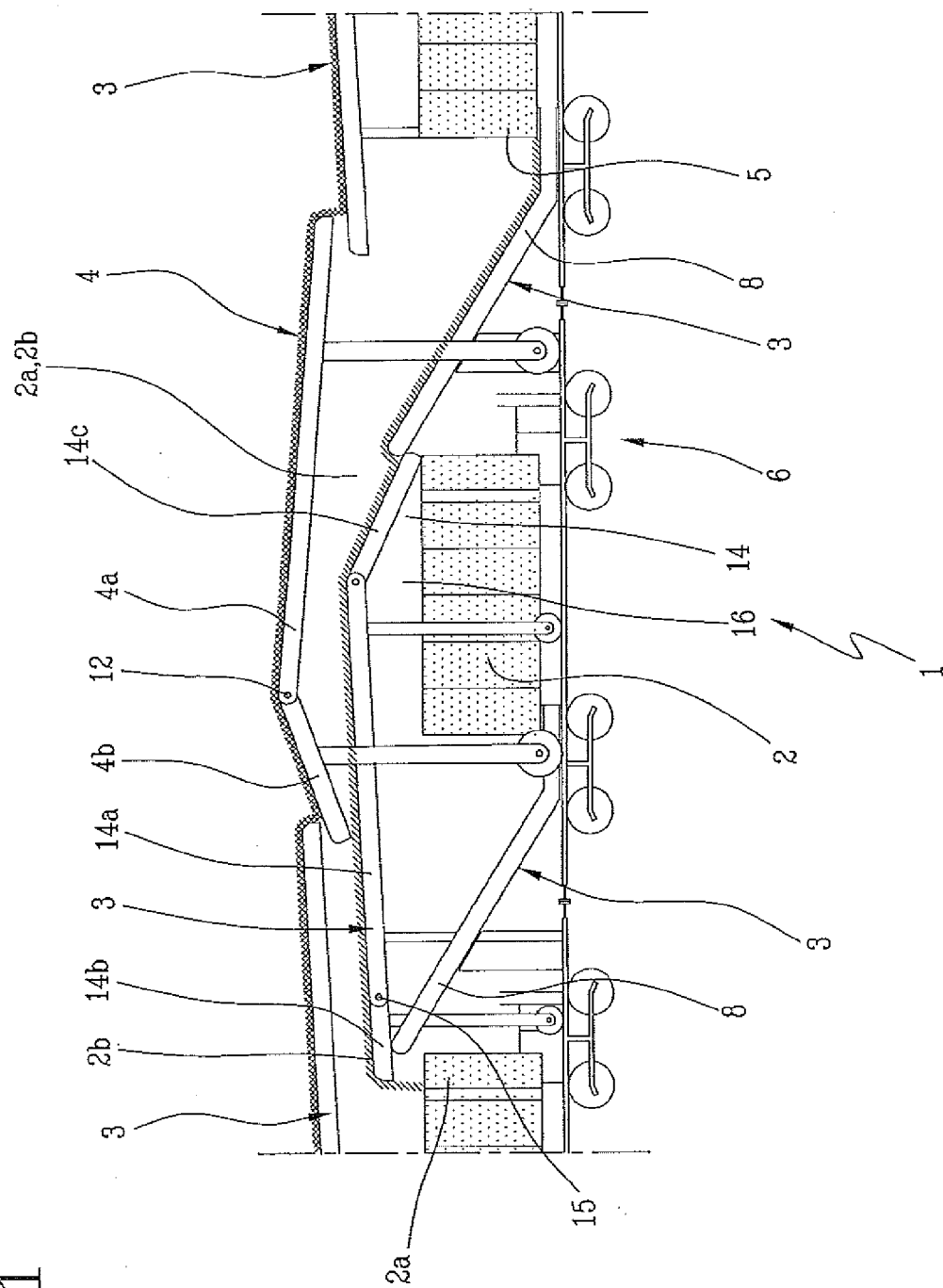


FIG 11



REFERENCES CITED IN THE DESCRIPTION

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