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

(11) Publication number: **0 052 089**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **81850207.2**

(22) Date of filing: **05.11.81**

(51) Int. Cl.³: **E 01 B 27/02**

(30) Priority: **06.11.80 SE 8007800**
23.04.81

(43) Date of publication of application: **19.05.82**
Bulletin 82/20

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

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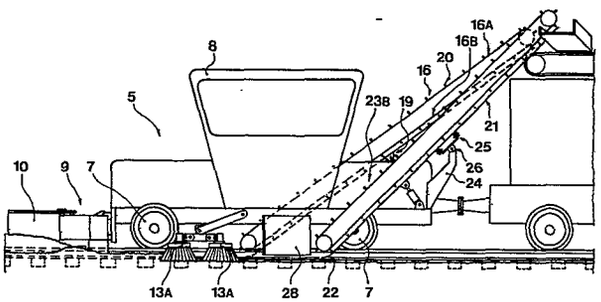
(54) Device for the mechanical handling of material on railway track embankments, particularly for handling ballast material.

(57) A device for the mechanical handling of ballast material or the like on railway track embankments, comprising a railborne, motor-driven vehicle (5) which carries one or more plough-like adjustable shields (9) for levelling and redistributing ballast material on the track embankment. The device further comprises a brush unit carried by the vehicle (5) at each railway rail, said brush unit being adjustable vertically and having rotatable brushes (13A) for cleanbrushing of ballast material close to the rail and on the sleepers supporting the rails. According to the invention, the brush units comprise brushes (13A) which are driven for rotation about substantially vertical axes. The brushes preferably have a conical shape and are designed with a brush surface which is substantially at right angles to the axis of rotation. The brushes (13A) are adjustable vertically and sideways and can be adjusted into inclined positions. The device also comprises two lateral conveyors (23B) and a conveyor (16) disposed in the middle for conveying excess ballast material into a material bin accompanying said motor-driven vehicle (5).



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DEVICE FOR THE MECHANICAL HANDLING OF MATERIAL ON RAILWAY TRACK EMBANKMENTS, PARTICULARLY FOR HANDLING BALLAST MATERIAL

The present invention relates to a device for the mechanical handling of material on railway track embankments, particularly for the handling of ballast material.

During the new construction of railways, ballast material in the form of stone and gravel is laid out in strands on the previously prepared track embankment. The ballast material is laid out partly in the middle of the track embankment and partly outside the two lines of rails. The ballast then has to be distributed to form an even layer close to the railway track for securely anchoring and supporting the track by the ballast material. Excess material is then removed. Also existing track embankments must be replenished with ballast material at regular intervals, since the vibration to which the ballast is exposed due to the traffic on the track embankment leads to settling so that the ballast sinks down and therefore is no longer able to transmit loading via the sleepers in an acceptable manner. Thus, the ballast has to cover the lateral portions of the sleepers not only along the sleepers but also at the ends of the sleepers, which is particularly important on curve sections.

Both during new building and during replenishment ballasting, the ballast is laid, as stated, in the middle and at the sides of the track embankment. The ballast consisting of gravel and stone is levelled with a ballast plough. During the subsequent clean-sweeping operation to remove excess material, it is very important that the ballast material which bears against the rails should be removed as completely as possible as well as the ballast material which is in contact with the rails

from below, since otherwise there is a risk of leakage currents developing in damp weather which might endanger the safety of the signal system. The signal system is actually based on the existence of a voltage potential of about 14V between the two lines of rails. If ballast material bears against the web of the rail or against the under-side of the rail there is a risk that this voltage potential may drop, which may result in that the remaining voltage potential only is sufficient to influence certain parts of the signal system. This may result in that a train receives a go-ahead signal because the voltage potential is sufficient to switch over to the go-ahead signal for the train while the circuit for lowering booms or for activating other warning systems is not activated.

Ballasting machines on the market comprise a railborne, self-propelled vehicle which is provided with ballasting ploughs for the distribution and levelling of the ballast material and with powerful brushes which rotate about horizontal shafts to sweep the railway sleepers clean. It is further known to provide such devices with a conveyor adapted to convey excess material to a ballast bin on the vehicle. The known devices suffer from certain disadvantages of which the following will be mentioned. The use of brushes which are rotatable about horizontal shafts renders it impossible or increases the difficulty to a very great extent of effective clean-sweeping close to the web of the rail and renders it practically completely impossible to remove ballast material which is bearing against the foot of the rail from below. Another disadvantage is that the use of brushes which rotate about horizontal shafts leads to a partly uncontrolled throwing movement, during the brushing of ballast material, which involves the risk of damage to personnel and equipment. Another

disadvantage of the known devices is the waste of large amounts of ballast material due to the fact that excess material accumulated at both sides of the track embankment is not collected. The conveyors so far used for collecting and carrying away excess material have not proved well suited for this purpose. When using belt conveyors, it has proved difficult to convey the ballast material effectively at the inclination at which it for practical reasons has been necessary to arrange the conveyor. Thus, gravel material could be conveyed while the stone material tends to roll back. If some kind of bucket conveyor is used, problems arise with respect to the loading of such conveyors.

The object of the present invention is to provide a device for the mechanical handling of material on railway track embankments which rapidly and simply renders possible an effective distribution of the ballast material along the track embankment while at the same time a particularly effective clean-sweeping is obtained adjacent the foot and the web of each rail.

A further object of the invention is to provide a device of the said kind wherein the excess material resulting from the clean-sweeping operation is collected in well-defined strands which are well suited for rational handling. Another object is to provide a device of said kind enabling in a particularly efficient way the collection of the excess material by using very efficient conveyors which are self-loading and which positively convey excess material to a collecting bin. Yet another object of the invention is to provide a device for the handling of ballast material wherein the risk of damage, caused by ballast material which is swept away, is reduced to a great extent.

The above objects are achieved according to the invention by a construction in accordance with the

characteristic features referred to in more detail in the following claims.

The invention is described below with reference to an example of embodiment shown on the accompanying drawings in which

FIG 1 shows diagrammatically a cross-section through a track embankment with ballast material laid out thereon,

FIG 2 shows diagrammatically the device according to the invention in position on the rails for levelling and distributing the ballast material,

FIG 3 shows a diagrammatic view seen from above illustrating the cooperation between the plough-like shields of the device, the brush unit and collecting conveyors,

FIG 4 shows a diagrammatic side view of the device according to the invention,

FIG 5 is a diagrammatic plan view of the device shown in FIG 4, obscuring parts being omitted for clearly illustrating the relation between the brush unit, protective and guide shields and conveyors,

FIG 6 shows diagrammatically, on a larger scale, two brushes working at each side of the rail,

FIG 7 is a side view marked by A-A in FIG 5,

FIG 8 is a diagrammatic side view which shows the transfer of collected ballast material to a plurality of ballast waggons connected after the traction vehicle, and

FIG 9 is a plan view of the arrangement shown in FIG 8.

FIG 1 shows a cross-section through a railway track embankment 1 with sleepers 2 and rails 3 disposed thereon. On the track embankment and the sleepers between the rails and outside the two rails, strands of ballast

material 4 are shown which have been laid out for example with a gravel waggon for ballast material or a ballast waggon specially intended for the purpose. It is important that the ballast material should cover the end portions 2a and 2b of the sleepers 2, in a satisfactory layer and in an adequate width, particularly on curve sections, since the lateral forces which have to be transmitted via the ballast are greater in curve sections than along the rectilinear extent of the track.

FIGS 2 and 3 illustrate diagrammatically and broadly how the device according to the invention is adapted to distribute, sweep clean and collect ballast material laid out on a track embankment. Thus, FIG 2 shows a diagrammatic view of the front portion of the device according to the invention, with front plough-like shields in position for distributing ballast material in an even layer for covering the sleepers of the track not only between the rails but also outside these. FIG 3 which is a diagrammatic horizontal view through the device according to the invention, illustrates the working procedure for carrying out ballasting using the device according to the invention. The rail-track travelling device 5 thus moves in the direction towards the left in the figure. The plough-like shields 9, 9A mounted at the front of the device thus cause a distribution and levelling of the ballast material as mentioned previously and as shown behind the plough-like shields 9. During the continued movement forwards of the device, the levelled layer of ballast material is exposed to the action of rotating brushes incorporated in the brush unit 11 which is carried underneath the device. The brushes 13A and 13B sweep clean close to the lines of rails 3, at both sides thereof, the ballast material swept away gathering on the one hand in a strand in the middle between the railway lines 3 and on the other hand in two

strands, one outside each of the lines. The middle strand of ballast material formed as a result of the brushing operation must necessarily be removed and this is brought about by means of a conveyor 16 which is supported by the device 5, the front end of said conveyor being situated a small distance above the level of the upper surface of the sleepers. The lateral strands of ballast material are collected in a similar manner by means of conveyors 23A, 23B supported by the device 5, guide shields 27 being adapted to guide the lateral strands of ballast material to the feed ends of the lateral conveyors. The purpose of the vertical shields 14 disposed close to the brush unit 11 is to prevent ballast material from being thrown out sideways during the brushing operation and to cooperate in forming said strands of excess material. Thus, by allowing the device 5 to pass over a certain section of track, a distribution and levelling of ballast material, a clean-sweeping close to the lines of rails and an exposure of the upper surfaces of the sleepers is brought about as well as a collecting of excess ballast material.

The device according to the invention, adapted for carrying out the work procedure described broadly above is described in more detail below with reference to FIGS 4 - 9.

The device illustrated diagrammatically in the figures consists of a motor-driven rail vehicle 5 with a chassis frame 6 and set of wheels 7. The vehicle 5 further comprises a control cabin 8 from which not only the propulsion of the vehicle but also the control and governing of the working unit of the vehicle is effected. The vehicle 5 is therefore provided with the necessary electrical and hydraulic power units, as well as with the necessary control and governing equipment.

At the very front of the vehicle 5, seen in the direction of travel, a plough device 9 is mounted on the vehicle chassis 6, said plough device being adapted for raising and lowering by means of a diagrammatically shown parallel mechanism and hydraulic means. In the figures, the plough device 9 is shown in the lowered position for levelling and distributing ballast material on the track embankment. Recesses 9C for the rails 3 are provided in the lower edge of the plough blade so that the ballast material can be distributed close to the rails 3 by ploughing. The outer portions 9A and 9B of the plough blade are adjustable, by means of hydraulic means, into various angular positions in relation to the centre portion of the plough and can be readjusted for example into the adjustment position shown for the outer portion 9B for distribution towards the outside of the line of rails 3 of ballast material situated at the side of the track embankment. Disposed at the tip of the plough device 9 is a distributing shield 10 which is pivotable sideways and which, in the normal position, is directed parallel to the rails but which can be adjusted into an angle as indicated in chain lines in FIG 5 so as to redistribute ballast material to the plough. This can be necessary if the strand of ballast material has come closer to one line of rails than to the other during the laying out, which can happen particularly in curves where the slope of the curve may result in that ballast material which falls freely from a ballast opening in a waggon loaded with ballast unintentionally comes closer to the line of rails forming the inner curve of the track-section. The described design of the plough device 9 thus renders it possible to distribute the ballast material uniformly and evenly as shown in FIG 2, regardless of how the strands of ballast are centred on the track

embankment during the laying out. The plough device 9 is fixed to the chassis frame 6 by means of a detachable coupling enabling, when necessary, an exchange of the plough unit for another working unit, for example a snow slinger for use during snow clearing.

Two brush units 11 are mounted after the plough unit 9, seen in the direction of travel, and under the chassis 6, one over each line of rails 3. Each brush unit 11 comprises a frame 12 which is supported by the chassis frame 6 and adjustable into different height positions by means of hydraulic power means. Seen from above, the frame 12 has a shape reminiscent of the letter H, and a rotatably driven brush 13A, 13B is supported at each of the ends of the parallel arms 12A of the H-shaped frame, one of said arms being disposed at one side and the other one at the opposite side of the line of rails 3. Thus, each brush unit 11 comprises two pairs of brushes 13A and 13B, one pair of brushes disposed at the outside of the line of rails 3 and the other pair of brushes disposed at the inside of the line of rails 3. The transverse arm 12B of the frame 12 of the brush unit 11 is telescopic and can be lengthened or shortened by means of power equipment not shown, enabling the pairs of brushes 13A, 13B to be adjusted into the required distance sideways in relation to the rail 3. According to the invention, the brushes 13A, 13B supported on the frame 12 of the brush unit 11, are rotatable about substantially vertical spindles and consist of strong conical steel brushes having a substantially plane brush surface. The brushes 13A, 13B are further adjustable into a certain inclination sideways and in the longitudinal direction of the track. A certain inclination is actually necessary in order for enabling the brushes to shift ballast material, since as a result of inclination of the brushes a necessary

clearance angle is obtained so that ballast material which is acted upon by the brushes receives a throwing motion imparted thereto in the tangential direction of the brushes when the brushes lose contact with the layer of ballast. Due to the fact that the brushes 13A, 13B are conical and rotatable about substantially vertical spindles, a very good accessibility is obtained right in to the foot of the rail 3, as illustrated in FIG 6. The inclination of the brushes and the possibility of adjusting them sideways in relation to the rail 3 makes it possible to get access even under the foot of the rail, as can be seen from FIG 6.

The two brushes which are situated on the right-hand side of the respective line of rails 3, seen in the direction of travel, are driven in rotation in the same direction, namely in clockwise direction as shown by arrows in the figures. The inclination of the brushes is adjusted so that ballast material swept away is thrown sideways or obliquely backwards towards the right. The two pairs of brushes on the left-hand side of the respective line of rails 3, seen in the direction of travel, are driven in rotation counter-clockwise and adjusted at such an angle of inclination that ballast material acted upon by the brushes is thrown sideways or obliquely backwards towards the left.

In order to prevent ballast material from being thrown out outside the track embankment during the brushing operation or from being thrown into an adjacent railway track in case of parallel sections of track, each brush unit 11 carries a shield 14, preferably a strong rubber shield which is supported by the frame 12 of the brush unit at a suitable distance outside the outermost pair of brushes 13A. The shield extends substantially vertically and is extended lengthwise over the whole range of action of the pair of brushes. Ballast

material which is thrown out sideways or obliquely backwards is caught by the rubber shield and drops down onto the track embankment close to the shield so that a longitudinal strand 4 of ballast material is formed (see FIG 3).

The two pairs of brushes 13B situated inside the rails 3, throw ballast material towards one another during the brushing operation. In order to prevent ballast material from being thrown out sideways and in order to produce a centre strand of excess ballast material between the rails, a third shield, preferably a rubber shield, is disposed centrally between the two inner pairs of brushes 13B. This centre shield 15 is supported by two guide plates 17 which are connected to the lower end of a ballast conveyor 16 as shown diagrammatically in FIG 7. The rubber shield 15 is firmly bolted to a rod 18 which, at its inner end, is rigidly connected to the guide plates 17 via stays 19 connecting the guide plates at the upper edges thereof. The guide plates 17 are constructed as sledges at the bottom and are adapted to slide against the surface of the support, for example against the upper surfaces of the sleepers 2, and may appropriately be rounded at the front edges so as to be able to climb over irregularities. The guide plates 17 are articulately connected to the lower end of the conveyor 16 so that a certain limited movement between them is rendered possible. The rubber shield 15 is likewise adapted to slide with its lower edge against the support and is rounded at the front edge like the guide plates 17. During the brushing operation, ballast material is thrown, under the action of the pair of brushes 13B from opposite sides towards the rubber shield 15, material being accumulated and collected close to the shield 15 in the form of a strand of ballast material situated immediately in front of the

take-up region of the conveyor 16.

During brushing operations in dry weather, a considerable amount of dust is formed which is highly embarassing for personnel working on the section of track in question. In order to avoid such dust formation, water nozzles are provided on the brush units 11 and at the lower ends of the conveyors 16, 23A, 23B, said water nozzles being provided with water through pipelines not shown in the drawings, from a water tank carried by the vehicle. Water is supplied through the nozzles to the brushes 13A and 13B and to the ends of the conveyors 16, 23A, 23B. The brushes distribute the water very effectively and the sprinkling with water as described has proved to prevent troublesome dust formation very effectively.

The ballast conveyor 16 for collecting the centre strand extends from its lower end behind the pair of brushes 13B, seen in the direction of travel, with an inclination upwards and backwards and ends with its opposite end above a ballast waggon 18 coupled to the rail vehicle. The conveyor 16 is supported on the rail vehicle 5 by means of a horizontal joint 19 and is pivotable about this joint, by means of power equipment not shown in the figures, to render possible swinging of the conveyor between a conveying position in which the lower end of the conveyor 16 and hence also the guide plates 17 and the shield 15 are elevated to obtain necessary clearance to the support, and a working position in close contact with the support. The conveyor 16 consists of two endless chains which are parallel to one another, the links of which being rigidly interconnected by means of flat rods 20 to which rubber plates projecting beyond the flat rods are secured. The conveyor 16 is motor-driven in such a direction that the upper part 16A of the chain moves downwards and

the lower part 16B of the chain upwards. The lower part 16B of the chain runs in a U-shaped channel 21, the internal dimensions of which correspond, with a certain clearance, to the external dimensions of the rubber plates. Formed in the lower end of the channel 21 is a bent climbing plate 22, and the conveyor 16 is adjustable into a working position with the front edge of the climbing plate 22 situated a short distance, for example 10 mm, above the upper edge of the sleepers 2. During the movement of the vehicle 5 forwards, the conveyor 16 penetrates into the strand 4 of ballast material, thereby feeding ballast material into the conveying channel 22 where it is forcibly forwarded to the upper end of the conveyor. For this operation it is important that the conveyor 16 is driven at a speed which is adapted to the propulsion speed of the vehicle 5 so that the conveyor 16 will be able to take charge of and convey up all the ballast material in the centre strand.

The strands of excess ballast material formed at the outsides of the rails 3 during the brushing operation are collected and forwarded in a similar manner by means of two lateral conveyors 23A and 23B of the same construction as the conveyor 16. The conveyors 23A and 23B are articulately carried on the vehicle 5 by means of supporting frames 24 rigidly connected to the vehicle. The conveyors 23A and 23B are carried in a cradle 25 which in turn is articulately suspended in said supporting frame 24 for pivoting of the conveyor about a horizontal pivot 26. At the side situated closest to the vehicle 5, each conveyor 23A and 23B is articulately connected to the cradle 25 to render possible swinging of the conveyors sideways in towards the vehicle 5 so as to reduce the total width of the vehicle when necessary for enabling the vehicle to pass a section of track

having a limited loading-gauge, for example a tunnel.

Disposed on a transverse supporting structure 26, situated in front of the lower ends of the conveyors 23A and 23B seen in the direction of travel are guide plates 27, 28 which are pivotable about vertical spindles and which can be readjusted, by means of power means, to guide the strands of ballast material to the lower ends of the conveyors for reliable infeed and further conveying of the ballast material to the ballast waggon. The supporting structure 26 can be lengthened or shortened by means of power equipment so that the desired adjustment position can be obtained.

The ballast material conveyed by the conveyors 16, 23A and 23B is emptied into a ballast bin situated below the conveyors. Said ballast bin may be disposed in the vehicle 5 but consists preferably of separate ballast waggons 29 and 30 coupled to the vehicle 5 and pulled by the vehicle, as shown in the figures. The ballast waggons used are often so long that the ballast material, instead of being emptied from the conveyors directly into the waggon, is emptied onto a belt conveyor 31 disposed above the ballast waggon and provided with a plough-like raisable stripper 32 situated substantially centrally above the waggon. Chutes 33 which end over the belt conveyor 31 are provided for emptying of the ballast material conveyed by means of the lateral conveyors 23A and 23B. A plurality of ballast waggons 29, 30 coupled after the vehicle are thus served by one belt conveyor which extends over all the waggons, a raisable stripper 32 being disposed centrally over each waggon. When the first ballast waggon 29 is full of ballast, the stripper is raised whereupon the ballast material is conveyed further, by means of the belt conveyor 31, to the following waggon and is deflected into the waggon by means of its stripper 32.

The ballast waggons 29, 30 may appropriately be provided with discharge openings in the bottom and at the sides making possible their use also for laying out ballast material during ballasting. During ballasting a track section the vehicle 5 having ballast waggons coupled behind is driven along the intended section laying out strands 4 of ballast material both in the middle of the track embankment and at its sides. The vehicle is then reversed back to the starting position, after which the plough device 9, the brush unit 11, the conveyors 16, 23A and 23B and the shields 27 are brought into working position. During forward travel of the vehicle 5, the ballast material is levelled by means of the plough device 9, excess ballast material is swept away and then conveyed by means of the conveyors 16, 23A and 23B and emptied into the ballast waggon or waggons 29, 30 coupled behind. The device according to the invention thus renders possible a particularly effective handling of ballast material and the like on track embankments in connection with ballasting work thereon. The device according to the invention is, however, equally well suited for handling other material which is situated on or beside the track embankments, for example ploughing away, sweeping clean and handling snow in connection with snow clearing operations. There is also the possibility of exchanging the plough device for a snow slinger.

CLAIMS

1. A device for the mechanical handling of material on railway track embankments, particularly for the handling of ballast material, comprising a railborne, motor-driven vehicle (5) which carries one or more plough-like, adjustable shields (9) for levelling and redistributing ballast material or the like on the track embankment at both sides of each railway line (3); a brush unit (11) which is carried by the vehicle next to each railway line and is adjustable in height and having brushes (13A, 13B) rotatably driven for sweeping clean of ballast material or the like close to the rails (3) and on the sleepers (2) supporting the rails; and at least one driven conveyor (16) for conveying excess ballast material or the like to a material bin accompanying said motor-driven vehicle (5), c h a r a c t e r i s e d in that said brush unit (11) comprises preferably conical brushes (13A, 13B) which are disposed at each side of each rail (3) and are driven for rotation about substantially vertical axes, said brushes having a brush surface substantially at right angles to the axis of rotation, the brushes being adjustable, by means of power equipment, on the one hand vertically and on the other hand sideways in relation to one another, and that the substantially vertical spindles of the brushes (13A, 13B) are adjustable into inclined positions deviating from the vertical direction.

2. A device as claimed in claim 1, c h a r a c t e r i s e d in that the brush unit (11) comprises two pairs of brushes (13A, 13B) disposed one behind the other in the direction of the rail, at each side of the rails (3).

3. A device as claimed in claim 1 or 2, c h a r a c t e r i s e d in that the brushes (13A, 13B) are supported by a frame (12) which can be raised and lowered, said

frame having one frame portion situated outside the rail (3) and supporting a first pair of brushes (13A) and one frame portion situated inside the rail (3) and supporting a second pair of brushes (13B), the frame portions being connected to one another for transverse displacement enabling displacement of the pairs of brushes towards and away from one another or towards and away from the rails (3).

4. A device as claimed in any of claims 1 - 3, characterised in shields (15, 14) disposed between the brush units (11) for the two lines of rail (3) and outside each of the outer brushes (13A) of the brush units (11) said shields extending substantially vertically and parallel to the lines of rails (3) to prevent ballast material from being thrown out outside the shields and to form close to the shields a strand of swept away excess material.

5. A device as claimed in claim 4, characterised in that said motor-driven vehicle (5) carries a conveyor (16), the lower end of which ending between the two brush units (11) and behind them seen in the direction of travel, the conveyor (16) carrying, at its lower end, said shield (15) disposed between the brush units, and that the conveyor (16) extends upwards and backwards, ending with its upper end over a ballast bin (29) accompanying the motor-driven vehicle.

6. A device as claimed in claim 5, characterised in that the motor-driven vehicle (5) also carries a conveyor (23A, 23B) at each side of the vehicle, said conveyors being adapted to collect and convey excess ballast material collected at the sides of the track embankment to the collecting bin (29) accompanying the vehicle.

7. A device as claimed in claim 5 or 6, characterised in that said conveyor/con-

veyors (16, 23A, 23B) each comprise two conveyor chains which are parallel to one another and of which the links, situated sideways opposite one another, are rigidly connected to one another transversely by means of members carrying rectangular plates (20) projecting substantially at right angles from the conveyor chains, and that the conveyor chains run, at the under-side, in a channel--shaped casing (21), the internal dimensions of which correspond, with a certain clearance, to the external dimensions of said rectangular plates (20) with the object, during the upward movement of the conveyor chains, in said channel-shaped casing, of feeding in ballast material at the lower end of the conveyor and conveying it further in the channel-shaped casing to the upper end of the conveyor.

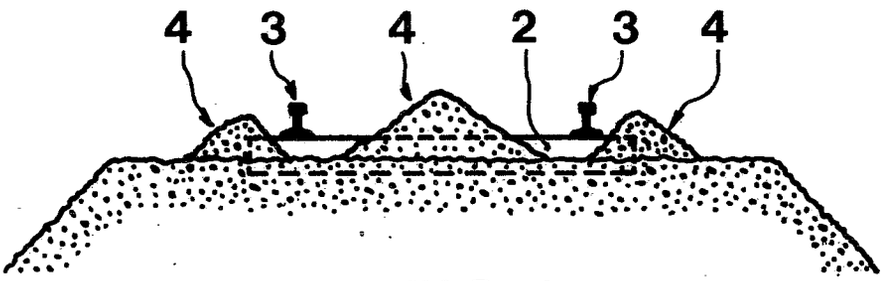

FIG. 1

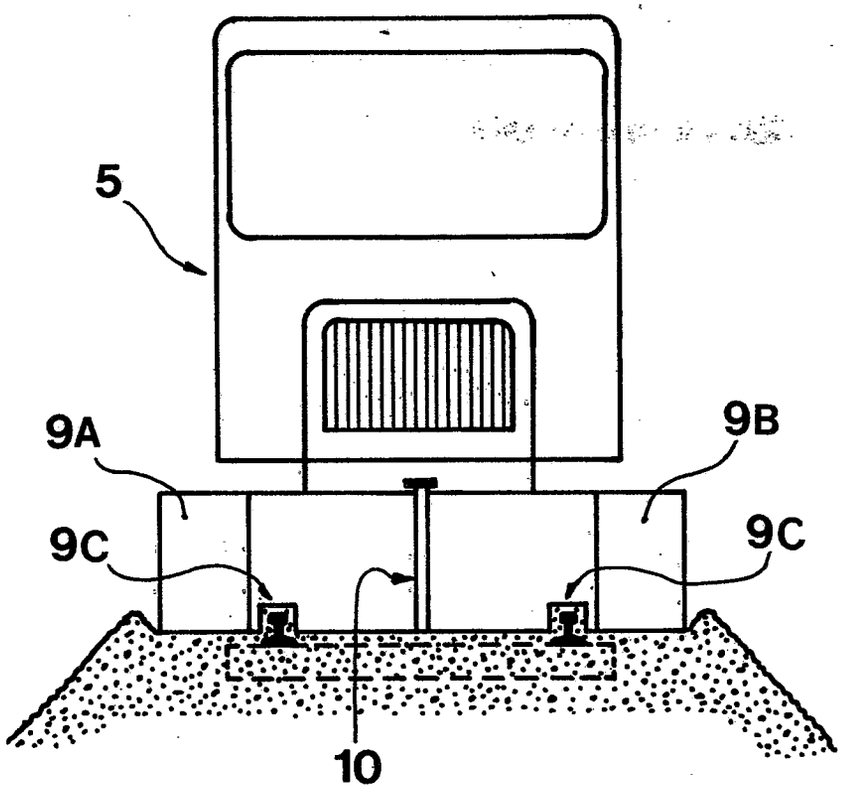

FIG. 2

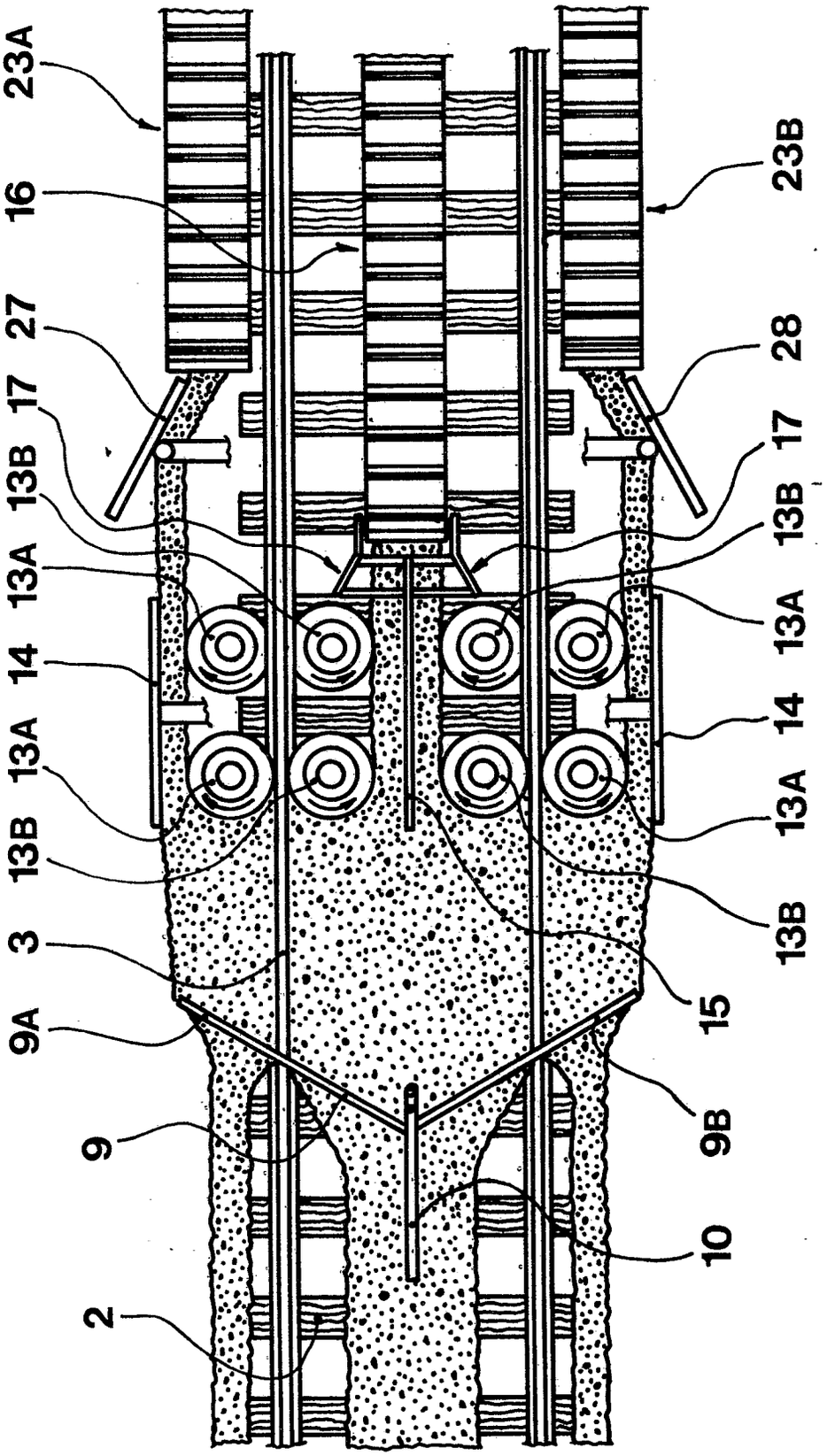
23A
16
27
17
13B
13A
14
13A
13B
3
9A
9
2
23B
28
17
13B
13A
14
13A
13B
15
9B
10

FIG. 3

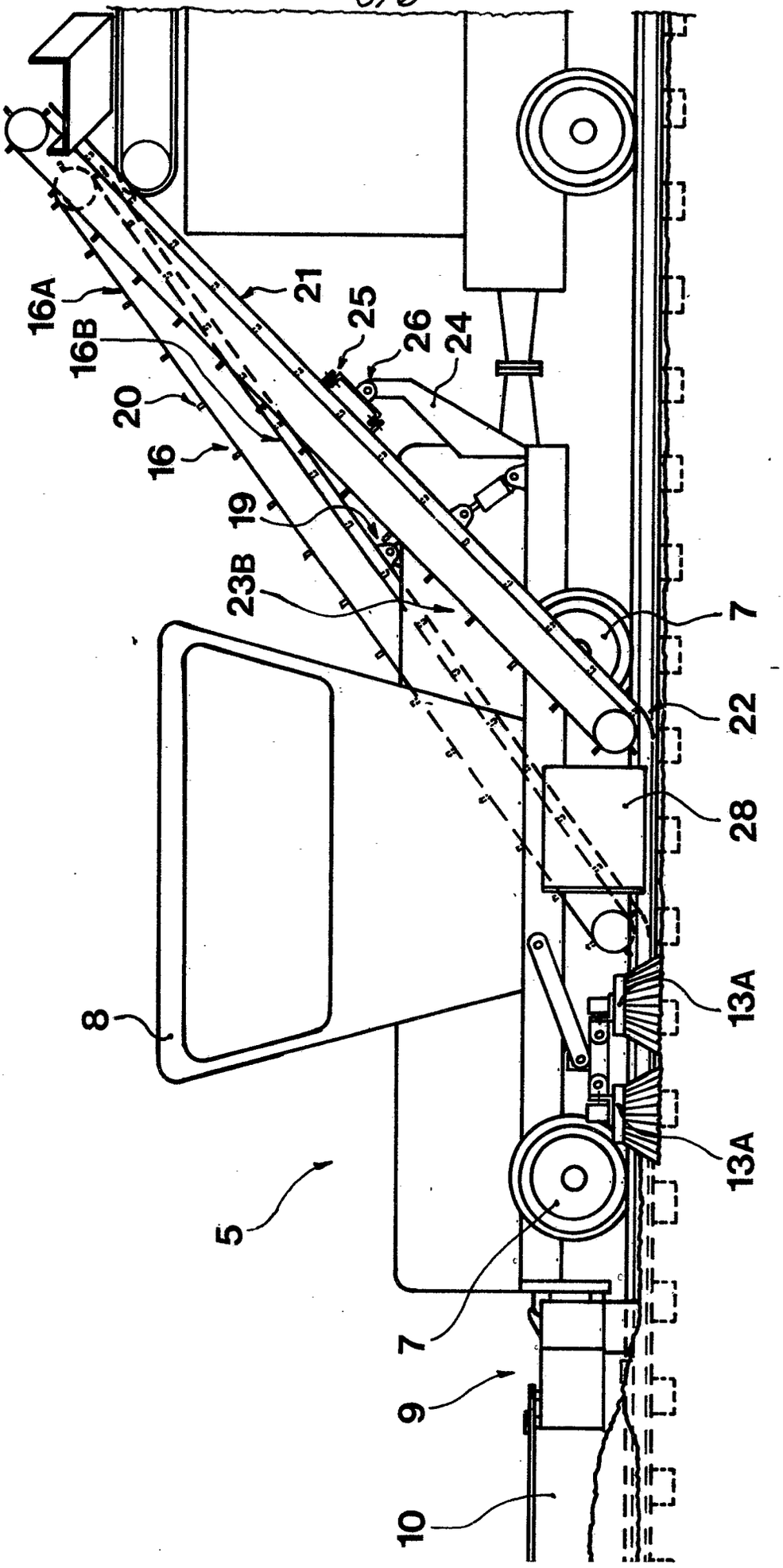

FIG. 4

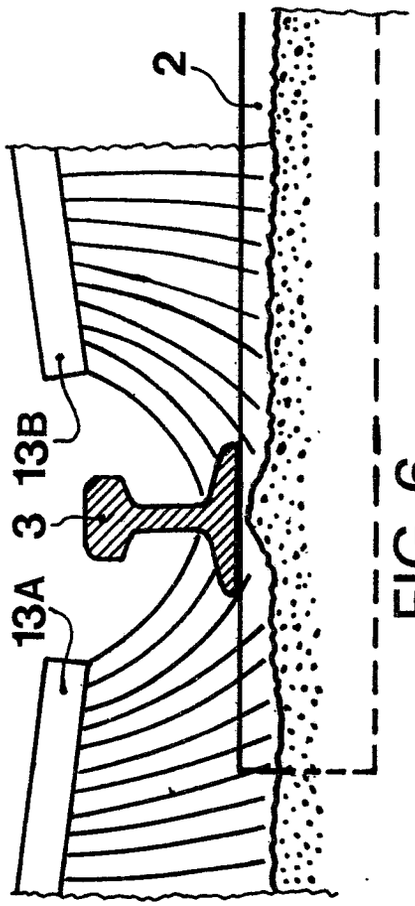

FIG. 6

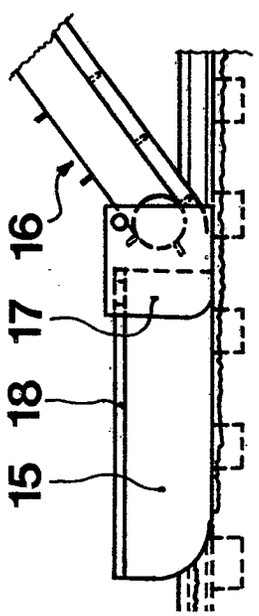

FIG. 7

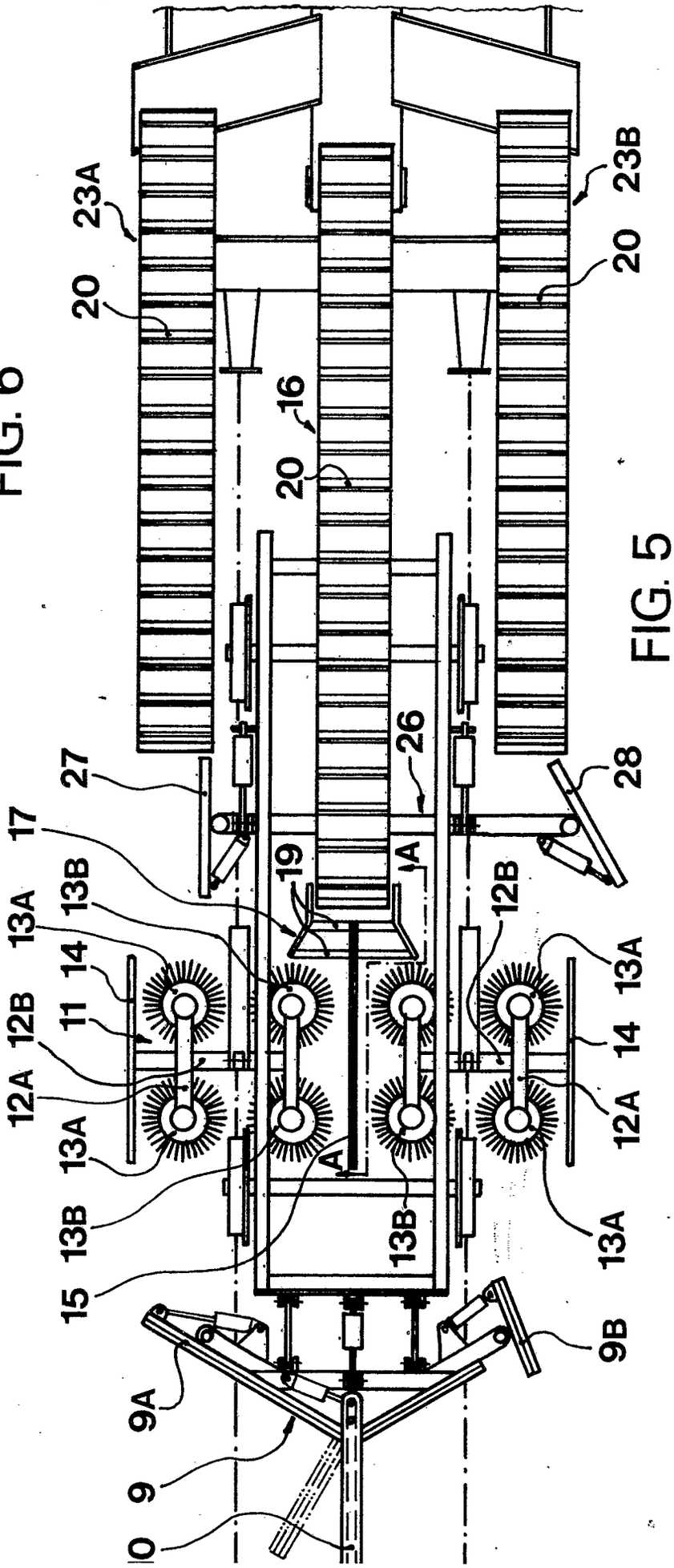

FIG. 5

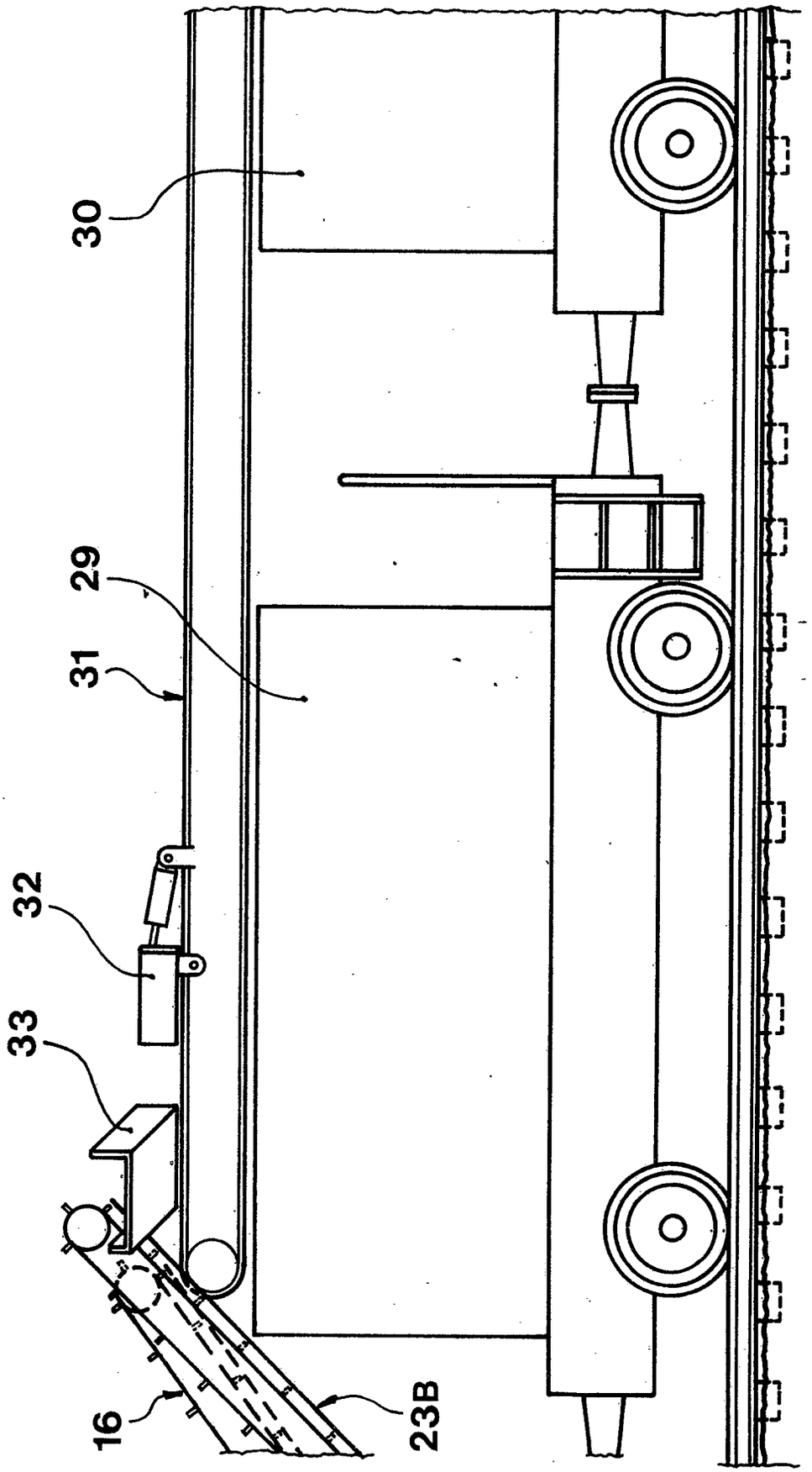

FIG. 8

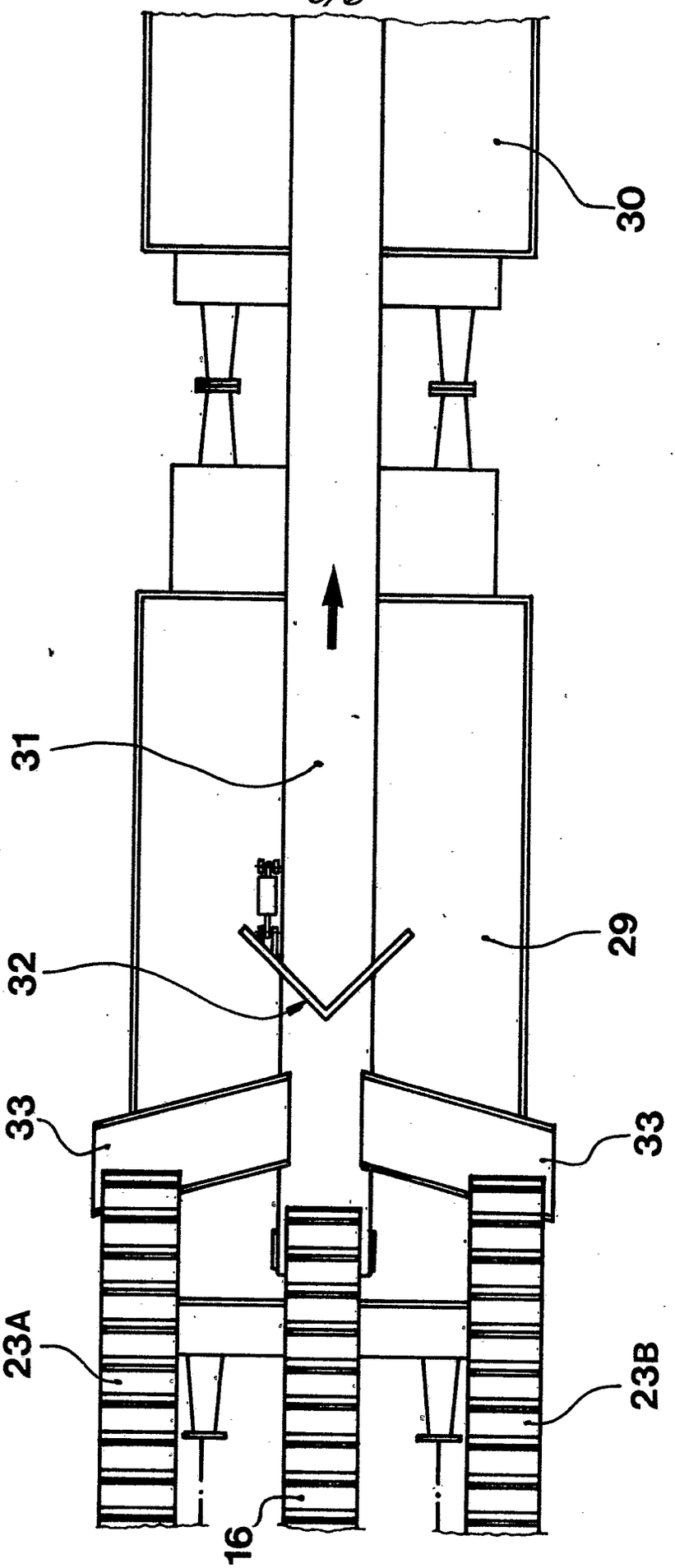

FIG. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 81 85 0207.2

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	US - A - 2 416 241 (L.O. STRATTON) * fig. 1,2 *	1,3
A	US - A - 1 397 436 (M. MARKOVICH) * fig. 1 to 6 *	5,7
A	DE - C - 275 251 (P. ROSKO)	
A	AT - B - 306 773 (F. PLASSER et al.)	
A	US - A - 3 007 264 (G.W. STANTON)	
A	US - A - 3 468 042 (C.L. COY)	

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

E 01 B 27/02

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

E 01 B 27/00
E 01 H 8/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	25-01-1982	PAETZEL