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

(11) **EP 1 881 109 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
30.12.2009 Bulletin 2009/53

(51) Int Cl.:
E01B 27/10 *(2006.01)* ***E01H 1/14*** *(2006.01)*
E01H 8/00 *(2006.01)*

(21) Application number: **07075594.7**

(22) Date of filing: **13.07.2007**

(54) **Device for removing iron-containing waste from railway**

Vorrichtung zur Beseitigung von eisenhaltigem Abfall von Schienen

Dispositif pour éliminer les déchets contenant du fer de rails

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR

(30) Priority: **18.07.2006 NL 1032200**

(43) Date of publication of application:
23.01.2008 Bulletin 2008/04

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Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a device for removing iron-containing waste from a railway, comprising a vehicle which can be driven over rails of the railway, which vehicle has a number of endless parallel magnetic belt units, each unit composed of an endless conveyor belt guided and driven over guide rollers, magnets being placed at some points along each belt, which conveyor belts lie with a bottom end near the ballast of the railway and lie with the other end higher up above a collection container.

[0002] More particularly, the invention relates to a device for removing grinding material residues lying in the form of pieces or lumps in the ballast of the railway. Such grinding material residues are produced after grinding of the rail, and are still often removed by hand. This removal by hand is a labour-intensive operation, which is carried out by persons walking along the rail track and picking up the lumps and throwing them into a container travelling over the tracks.

[0003] US Patent Specification US-A-2006/0045684 discloses a device for removing metal objects from a railway. This device comprises a vehicle which can be driven over the tracks, which vehicle has a number of parallel adjacent endless magnetic belt units. These magnetic belts lie with their bottom end near the ballast of the railway and end with the top end above a collection container for the metal-containing objects. The device has a lift mechanism, by means of which magnetic belt units can be raised slightly, so that the bottom end of the magnetic conveyor belts can be lifted up slightly from the working position. This lift serves to make the magnetic belts more accessible when said belts have to be replaced. Since this known device is confined to railways, it cannot quickly and easily be used in different places.

[0004] The object of the present invention then is to provide a device which can automatically and reliably pick up and remove metal objects and grinding material residues, which device can easily be employed on any desired stretch of railway.

[0005] This object is achieved according to the invention by the features indicated in Claim 1.

[0006] Owing to the fact that the vehicle is a rail/road vehicle, said vehicle can be placed on the rail at any railway crossing in order to reach a stretch of the railway to be cleaned. By pulling the frame to which the magnetic belt units are connected onto the loading platform, said magnetic belt units are taken into the transport position on the loading platform. In this transport position the total length of the device is considerably reduced, so that the device is suitable for road transport. Furthermore, the metal-containing materials removed from the railway can be taken to a waste processing plant by the same vehicle.

[0007] According to the invention, each of the magnetic belt units is connected to the frame so as to be rotatable over some distance in a vertical plane, so that each unit can move from the working position, in which a belt part of the magnetic belt runs directly above the railway sleepers, to a non-working position, in which the abovementioned belt part is raised slightly. This construction has the advantage that the device is easily able to pass over railway crossings and points and other infrastructural objects, while the frame remains in the working position, and the clearing process can proceed.

[0008] According to the invention, four magnetic belt units disposed parallel to each other are present, which magnetic belt units are fixed on the frame so as to be movable in a direction crosswise to the direction of movement of the rail/road vehicle. In this way it is possible to cover a large area of the railway with the magnetic belts, while for road transport of the device the magnetic belts can be moved towards each other, so that the total width of the device can be reduced for the purpose of meeting the requirements applicable for road transport.

[0009] In another expedient embodiment of the invention the rail/road vehicle has an additional air compressor, which supplies two pairs of jet nozzles which, viewed in the direction of travel of the vehicle, are situated in front of the bottom parts of the magnetic belts, each pair of jet nozzles blowing air against the opposite sides of a rail. The object of said jet nozzles is to blow adhering iron-containing material off the rails, so that this material is taken within the reach of the magnetic conveyor belt units. This jet cleaning of the rails is particularly important for keeping the electric separation joints of the rails (ES joints) clean.

[0010] Other details and further developments of the invention will become clear from the following drawing, in which:

Figure 1 shows a diagrammatic side view of the device according to the invention, in the working position of the magnetic belt unit;

Figure 2 shows a view corresponding to that of Figure 1, in which the magnetic belt unit is raised slightly;

Figure 3 shows a view corresponding to that of Figures 1 and 2, showing the device in the transport position;

Figure 4 shows diagrammatically a top view of the device in the working position.

[0011] As is clearly visible in Figures 1 - 3, the device according to the invention is composed of a rail/road vehicle 1 which is know per se, of which only a rail wheel 2 and a road wheel 3 and the loading platform 4 are shown. In the drawing the vehicle is placed on a railway comprising tracks 5 with two rails 5a and 5b.

[0012] A frame 6 is connected to the loading platform of the rail/road vehicle, which frame bears four magnetic belt units 7a, 7b, 7c and 7d (see Figure 4), which magnetic belt units lie two by two on either side of each rail, and can therefore substantially cover the entire area between

and beside the rails.

[0013] As can best be seen in Figure 2, each magnetic belt unit is composed of an endless belt 8 made of a suitable synthetic material, which belt is guided over a number of guide rollers 9, 10, 11 and 12. The guide wheels are disposed in such a way that a straight belt part 8' is formed near the bottom end of the belt between the guide wheels 10 and 11. This belt part 8' is intended to move in its working position some distance above the ballast bed of the railway. In practice, this belt part runs directly above the upper side of the railway sleepers (not shown). The belt 8 is driven in the direction of the arrow V, which means that the belt 8 moves over the belt part 8' in a direction opposite to the direction of travel of the vehicle 1. Along the belt part 8' is a collection magnet 13, which draws the grinding material residues up out of the ballast. The guide wheel 11 is also a magnetic wheel, while magnets 13' are placed along the top belt part of the belt 8 connected to said wheel, so that the iron-containing material is retained on the belt until said material has reached the upper side of the magnetic belt and falls into a collection container 14 provided here.

[0014] The frame 6 is composed of a flat box-shaped framework 15, having on the upper side a gantry 16 positioned at right angles to it and on the lower side two bearing legs 17, each bearing on the end a supporting wheel 18. The supporting wheels 18 are in the form of a railway wheel and in the working position of the frame shown in Figures 1 and 3 each run over a rail 5a and 5b.

[0015] The device is also provided with an additional air compressor (not shown), which is connected by means of lines to two pairs of jet nozzles. Each pair of jet nozzles is composed of two jet nozzles 22, 23, and 22', 23' respectively which, viewed in the direction of travel of the device, are situated in front of the belt parts 8' of the magnetic belts, on either side of the rail. The jet nozzles in this way blow compressed air against the opposite sides of the rail concerned, with the result that adhering dirt and iron-containing material is cleaned off the rail. This material is blown off the rail, so that it comes within the reach of the magnetic belts. This removal of iron-containing material by blasts of air also has the advantage that the electric separation joints of the rails are cleaned, with the result that faults are prevented from occurring in the electric safety and control systems. The figures show that each pair of jet nozzles is fixed to an extending arm 20, which on the end is provided with a railway wheel 21, which in the extended working position runs over the rail. Other structural solutions for fitting the jet nozzles are also possible. Said jet nozzles can, for example, also be connected to the magnetic belt units or to the frame 6.

[0016] Fig. 1 shows the device in its working position, which means that the rail/road vehicle is travelling with the railway wheels over the rails 5a and 5b, the frame 6 with the supporting wheels 18 is also running over the rails, and the magnetic belt units with their belt part 8' are running close to the ballast bed to be cleaned. In this working position the magnetic belt units and the flat framework 15 of the frame 6 lie substantially in the same plane. When the device has to pass over a railway crossing, the magnetic belt units 7a - 7d must be raised slightly so that they do not come into contact with the level crossing plates. For this purpose, each magnetic belt unit 7a - 7d is rotatably connected in a vertical plane to the frame 6 by means of a pivot pin 25. For the purpose of rotating each magnetic belt unit, each unit is provided with an upwardly projecting arm 26, which is connected by means of a hydraulic cylinder 27 to the gantry 16. Retracting the hydraulic cylinder makes it possible to rotate the magnetic belt unit about the pivot pin (25) relative to the frame 6, from the working position shown in Fig. 1 to the raised position of Fig. 2. The frame 6 stays in the working position here, the railway wheels 18 running on the rails. Only one magnetic belt unit is visible in each case in Figures 1 and 2, but it will be clear that there are in fact four adjacent magnetic belt units, each having its own cylinder 27, by means of which each individual magnetic belt unit can be raised slightly in order to be able to pass over infrastructural objects such as points, safety elements, cables and the like, while the clearing process can proceed.

[0017] By means of the cable 30 fixed on the upper side of the gantry 16, which cable is connected to a winch 31, the frame 6 with the magnetic belt units fitted on it can be pulled onto the loading platform of the rail/road vehicle. During this process the frame first performs a tilting movement, until the flat framework 15 is lying substantially horizontally, after which said frame is pulled by means of suitable guides onto the platform until it assumes the position shown in Figure 3. As this figure shows, the collection container 14 is, of course, pushed forward first.

[0018] In order to meet the road transport requirements, the magnetic belt units are fixed on the frame so as to be movable in the direction crosswise to the direction of travel of the vehicle. This means that these magnetic belt units can be moved closer up against each other in the conveyor belt, so that the total width of the device is reduced and meets the road transport requirements.

[0019] It will be clear that the invention is not limited to the device described and illustrated here, but that within the scope of the claims a large number of possible modifications and variants which are obvious for the person skilled in the art can be made.

Claims

1. Device for removing iron-containing waste from a railway, comprising a vehicle which can be driven over rails of the railway, which vehicle has a number of endless parallel magnetic belt units (7a, 7b, 7c, 7d), each unit composed of an endless conveyor belt guided and driven over guide rollers (9, 10, 11, 12),

magnets being placed at some points along each belt, which conveyor belts lie, in a working position, with a bottom end near the ballast of the railway and lie with the other end higher up above a collection container (14), **characterized in that** the vehicle is a rail/road vehicle (1) having a loading platform (4) and the magnetic belt units (7a, 7b, 7c, 7d) are connected to a frame (6), which is in turn movably fixed on the rail/road vehicle and has at least one set of supporting wheels (18), in such a way that the frame (6) with the magnetic belts can be moved from a transport position lying on the loading platform (4) of the vehicle, whereby the total length of the device is considerably reduced, so that the device is suitable for road transport, to a working position, in which the at least one set of supporting wheels (18) rolls over the tracks (5), and vice versa.

2. Device according to Claim 1, **characterized in that** the magnetic belt units are connected to the frame (6) so as to be rotatable over some distance in a vertical plane, so that each unit can move from the working position, in which a belt part (8') of the magnetic belt runs directly above the railway sleepers, to a non-working position, in which the abovementioned belt part is raised slightly.

3. Device according to the preceding Claims 1 - 2, **characterized in that** four magnetic belt units (7a - d) disposed parallel to each other are present, which magnetic belt units (7a - d) are fixed on the frame (6) so as to be movable in a direction crosswise to the direction of movement of the rail/road vehicle.

4. Device according to one or more of the preceding Claims 1 - 3, **characterized in that** the rail/road vehicle has an additional air compressor, which supplies two pairs of jet nozzles which, viewed in the direction of travel of the vehicle, are situated in front of the bottom parts of the magnetic belt units, each pair of jet nozzles blowing air against the opposite sides of a rail (5a, 5b).

5. Device according to one of the preceding claims, **characterized in that** the collection container (14) is fitted so as to be slidable on the loading platform (4) in the longitudinal direction of the vehicle (1).

Patentansprüche

1. Vorrichtung für das Entfernen von eisenhaltigem Abfall von einem Gleis mit einem Fahrzeug, das über Schienen des Gleises gefahren werden kann, wobei das Fahrzeug eine Anzahl endloser paralleler magnetischer Bandeinheiten (7a, 7b, 7c, 7d) aufweist, wobei jede Einheit aus einem endlosen Förderband, das über Führungsrollen (9, 10, 11, 12) geführt und angetrieben wird, und Magneten, die an einigen Punkten entlang jedes Bandes platziert sind, zusammengesetzt ist, wobei die Förderbänder in einer Arbeitsposition mit einem unteren Ende nahe der Bettung des Gleises und mit dem anderen Ende höher oberhalb eines Sammelbehälters (14) liegen, **dadurch gekennzeichnet, dass** das Fahrzeug ein Schienen-/Straßenfahrzeug (1) ist, welches eine Ladeplattform (4) aufweist, und die magnetischen Bandeinheiten (7a, 7b, 7c, 7d) mit einem Rahmen (6) verbunden sind, der wiederum wenigstens einen Satz Stützräder (18) aufweist und derart beweglich an dem Schienen-/Straßenfahrzeug befestigt ist, dass der Rahmen (6) mit den Magnetbändern aus einer Transportposition, in der er auf der Ladeplattform (4) des Fahrzeuges liegt, wodurch die Gesamtlänge der Vorrichtung erheblich reduziert ist, so dass die Vorrichtung für einen Straßentransport geeignet ist, in eine Arbeitsposition, in welcher der wenigstens eine Satz Stützräder (18) über die Gleise (5) rollt, bewegt werden kann und umgekehrt.

2. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die magnetischen Bandeinheiten so mit dem Rahmen (6) verbunden sind, dass sie über eine gewisse Entfernung in einer vertikalen Ebene rotieren können, so dass jede Einheit aus der Arbeitsposition, in der ein Bandteil (8') des Magnetbandes direkt oberhalb der Bahnschwellen läuft, in eine Nichtarbeitsposition, in der der vorgenannte Bandteil leicht angehoben ist, bewegt werden kann.

3. Vorrichtung gemäß den vorhergehenden Ansprüchen 1 bis 2, **dadurch gekennzeichnet, dass** vier magnetische Bandeinheiten (7a bis d), die parallel zueinander angeordnet sind, vorhanden sind, wobei die magnetischen Bandeinheiten (7a bis d) so an dem Rahmen (6) befestigt sind, dass sie in einer Richtung quer zu der Bewegungsrichtung des Schienen-/Straßenfahrzeuges bewegbar sind.

4. Vorrichtung gemäß einem oder mehreren der vorhergehenden Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** das Schienen-/Straßenfahrzeug einen zusätzlichen Luftkompressor aufweist, der zwei Paare Strahldüsen versorgt, die, in der Bewegungsrichtung des Fahrzeuges gesehen vor den Bodenteilen der magnetischen Bandeinheiten positioniert sind, wobei jedes Paar Strahldüsen Luft gegen die gegenüberliegenden Seiten einer Schiene (5a, 5b) bläst.

5. Vorrichtung gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Sammelbehälter (14) derart montiert ist, dass er auf der Ladeplattform (4) in der Längsrichtung des Fahrzeuges (1) verschiebbar ist.

Revendications

1. Dispositif destiné à enlever des déchets contenant du fer sur une voie ferrée, comprenant un véhicule qui peut être entraîné sur des rails de la voie ferrée, lequel véhicule comporte un certain nombre d'unités formant bande magnétique parallèles sans fin (7a, 7b, 7c, 7d), chaque unité étant composée d'une bande de convoyeur sans fin guidée et entraînée sur des rouleaux de guidage (9, 10, 11, 12), des aimants étant placés à certains points le long de chaque bande, lesquelles bandes de convoyeur sont agencées dans une position active, avec une extrémité inférieure à proximité du ballast de la voie ferrée et sont agencées avec l'autre extrémité plus haut, au-dessus d'un conteneur de collecte (14), **caractérisé en ce que** le véhicule est un véhicule ferroviaire/routier (1) comportant une plate-forme de chargement (4) et les unités formant bandes magnétiques (7a, 7b, 7c, 7d) sont couplées à un châssis (6), qui est lui-même fixé de manière à pouvoir se déplacer sur le véhicule ferroviaire/routier et comporte au moins un ensemble de roues de support (18), de telle manière que le châssis (6) avec les bandes magnétiques peut être déplacé à partir d'une position de transport reposant sur la plate-forme de chargement (4) du véhicule, ce par quoi la longueur totale du dispositif est considérablement réduite, de sorte que le dispositif est adapté au transport routier, jusqu'à une position active, dans laquelle le ou les ensembles de roues de support (18) roulent sur les voies (5), et réciproquement.

2. Dispositif selon la revendication 1, **caractérisé en ce que** les unités formant bandes magnétiques sont couplées au châssis (6) afin de pouvoir tourner sur une certaine distance dans un plan vertical, de telle sorte que chaque unité peut se déplacer à partir de la position active, dans laquelle une partie de bande (8') de la bande magnétique s'étend directement au-dessus des traverses de voie ferrée, vers une position non active, dans laquelle la partie de bande mentionnée ci-dessus est légèrement soulevée.

3. Dispositif selon les précédentes revendications 1 et 2, **caractérisé en ce que** quatre unités formant bandes magnétiques (7a à 7d) disposées parallèlement les unes par rapport aux autres sont présentes, lesquelles unités formant bandes magnétiques (7a à 7d) sont fixées sur le châssis (6) de manière à pouvoir être déplacées dans une direction transversale par rapport à la direction du déplacement du véhicule ferroviaire/routier.

4. Dispositif selon une ou plusieurs des précédentes revendications 1 à 3, **caractérisé en ce que** le véhicule ferroviaire/routier comporte un compresseur d'air additionnel, qui alimente deux paires d'orifices d'éjection qui, vus dans la direction du déplacement du véhicule, sont situés face aux parties inférieures des unités formant bandes magnétiques, chaque paire d'orifices d'éjection soufflant de l'air sur les côtés opposés d'un rail (5a, 5b).

5. Dispositif selon l'une des précédentes revendications, **caractérisé en ce que** le conteneur de collecte (14) est adapté de manière à pouvoir glisser sur la plate-forme de chargement (4) dans la direction longitudinale du véhicule (1).

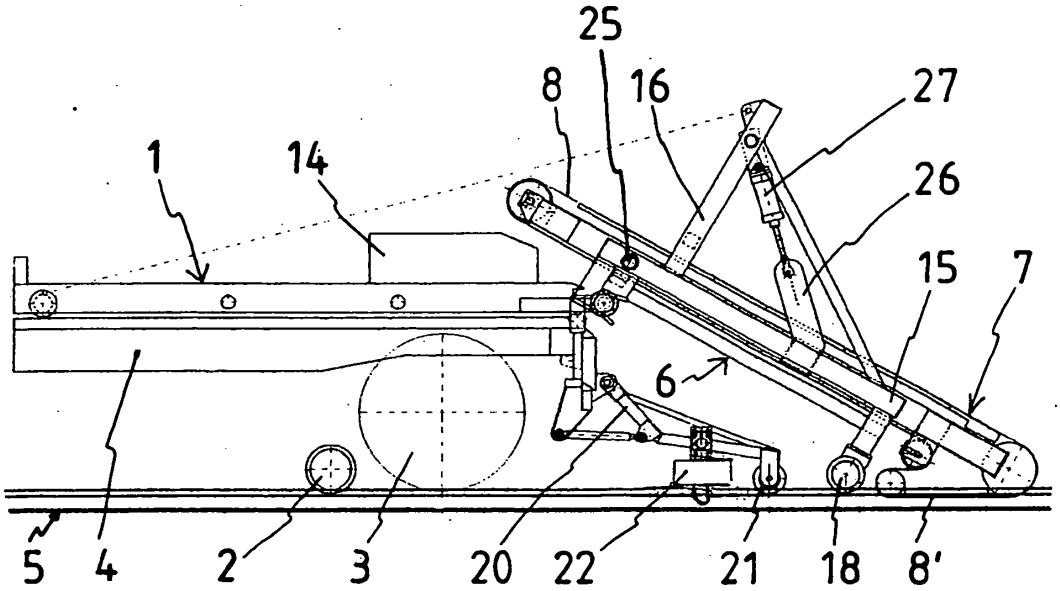

25
8
16
27
1
14
26
15
7
6
5
4
2
3
20
22
21
18
8'

FIG. 1

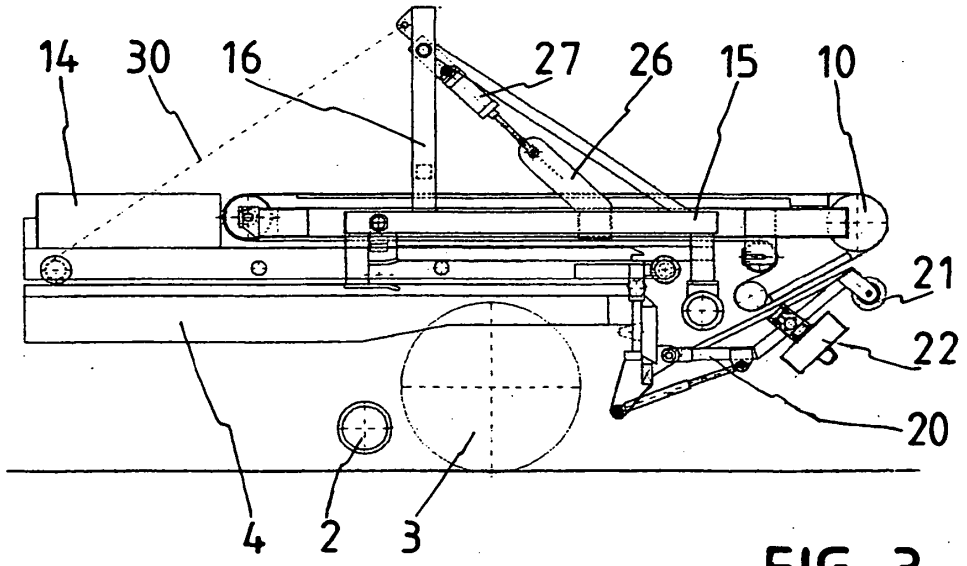

14
30
16
27
26
15
10
21
22
20
4
2
3

FIG. 3

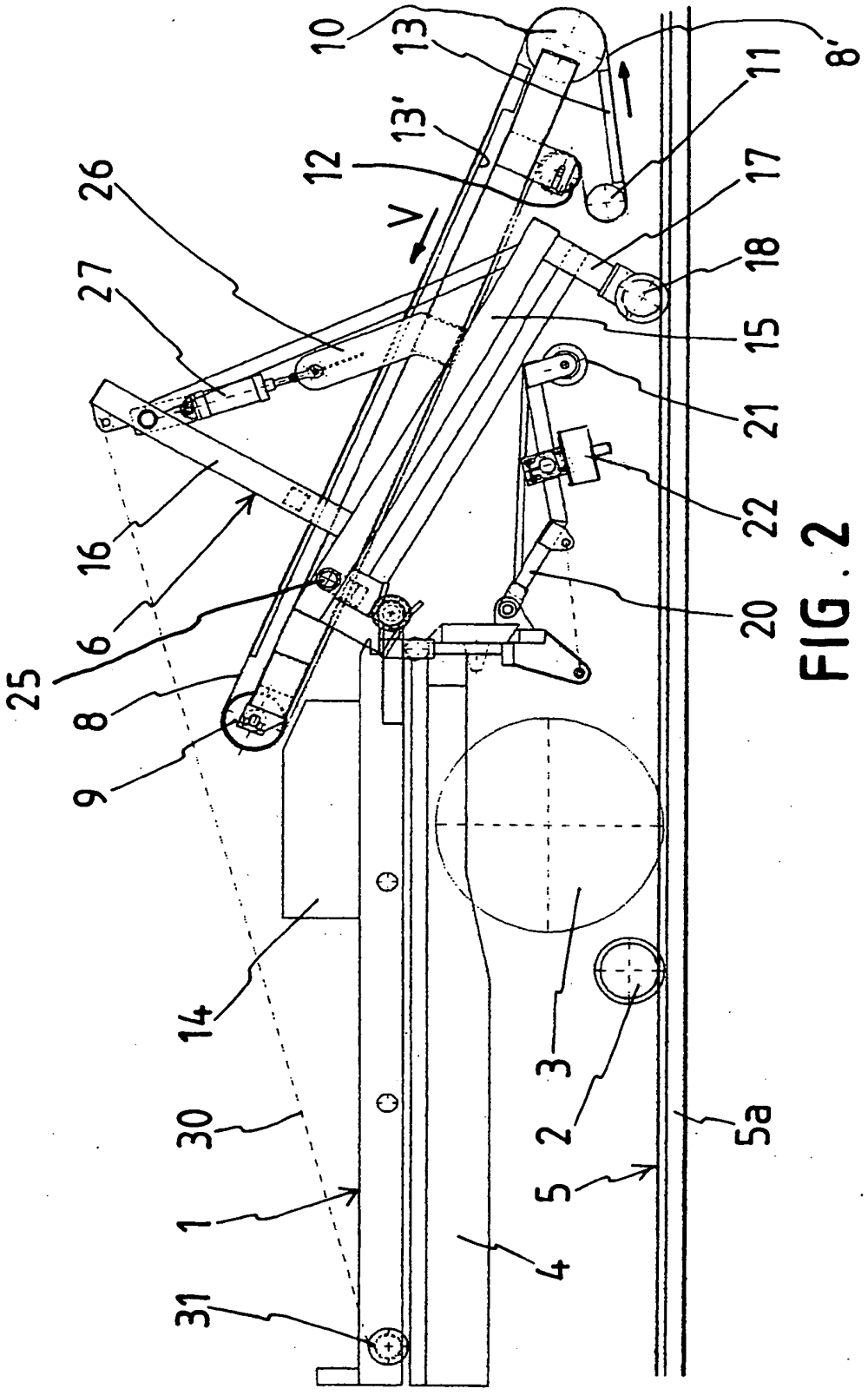


FIG. 2

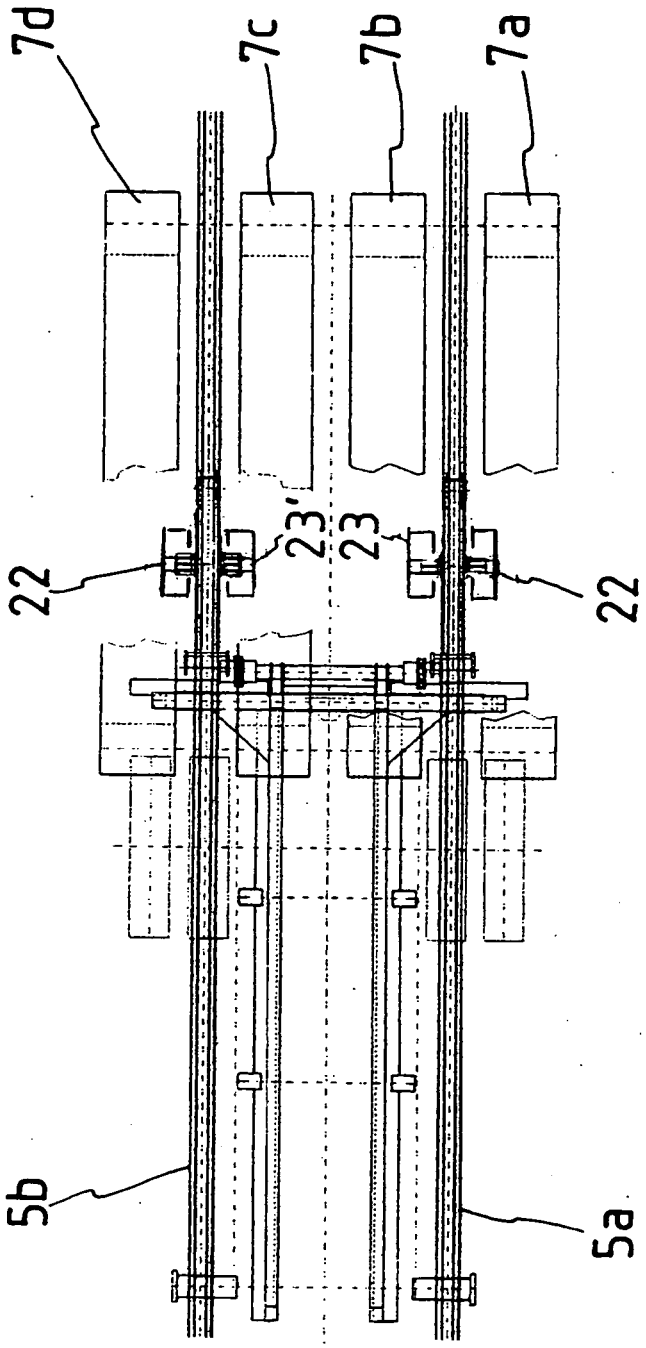


FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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