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(54) **APPARATUS FOR REMOVING THE BALLAST OF A RAILWAY WITHOUT DEMOUNTING THE TRACK**

VORRICHTUNG ZUM ENTFERNEN DES SCHOTTERS EINES GLEISES OHNE SELBIGES ZU DEMONTIEREN

APPAREIL PERMETTANT D'ENLEVER LE BALLAST D'UNE VOIE FERREE SANS LA DEMONTER

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Description

[0001] The invention relates to an apparatus for removing the ballast of a railway without demounting the track according to the first part of claim 1.

[0002] The structural parts of a railway are the track comprising rails and sleepers, the ballast layer, the intermediate layer, the insulating layer and the embankment fill. The purpose of the ballast layer is to hold the track in a specified, geometrically right position and the purpose of ballasting is to obtain a track which is accurately positioned in vertical and lateral directions.

[0003] The ballast layer is commonly made of railway ballast. The mineral aggregate used for the ballast must be hard, weather resistant, wear and impact resistant. Railway ballast should not contain any humus, plant remains or any other impurities which might enhance frost lifting.

[0004] Although there are strict quality specifications for the ballast, it is obvious that in the course of years there will be deformations due to weathering and soiling which change the geometry of the railway. Freezing contaminations in the ballast cause frostheaves in the railway. For instance, railway level crossings are particularly apt to be damaged by frost and it is the humus and other frost-susceptible material that spoils the ballast. In this case, the ballast must be removed and the ballasting must be done anew to get the track in the right position.

[0005] To enable reballasting the old ballast layer must be removed and cleaned by sieving for reutilization. If the ballast is of poor quality it is preferably utilized as filling material for the embankment or it is carried away. If used ballast is to be used as filling material for the embankment it would be beneficial that the removed ballast could be conveyed to both sides of the track to facilitate reutilization.

[0006] Ballast replacement is conventionally performed so that first the track is demounted and put aside after which the old ballast and possibly other structural layers of the railway can be replaced. An apparatus is known which removes the ballast without demounting the track. In this apparatus there is a scraper chain which goes under the track and which scrapes the mineral aggregate of the ballast and transfers it onto a sieve. By means of the sieve, the waste material of the mineral aggregate is separated from the ballast. The ballast is returned under the track and the waste material is carried by a belt-conveyor to one side of the track. The buckets of the scraper chain typically consist of finger-like members which are made of hard metal and which loosen stones from the ballast. The sieve of the apparatus is typically a vibrating sieve.

[0007] It is essential of the apparatus of the prior art that the scraper chain and the guide members belonging thereto form a closed unit which goes round the track. The apparatus is mounted to a chassis which moves on the track and it is generally provided with a mechanism for supporting the track. Said apparatus is originally designed as a ballast washing-machine.

[0008] There are several drawbacks in the operation of the conventional apparatus. In order to mount the scraper chain, a trench must be excavated across the track whereto the first end of the chain is placed to be attached to the other end of the chain to form an endless member which goes round the track. Normally, the trench must be digged manually. If it is desired to use the removed material as filling material for the embankment, the apparatus of prior art moves all material to one side of the track. Therefrom, the material must then be separately distributed evenly to both sides of the track. When there is a passing train, the apparatus must be moved to a side track which may require that the apparatus must be moved a long way and which naturally causes a delay in the work. The purchase price of the apparatus is very high which means that capital costs have a dominant role compared to the relatively modest work of ballast removing. It should be possible to change the ballast using a much less heavy and a considerably less costly equipment.

[0009] From US-A-3,436,848 there is known an apparatus for removing ballast from beneath railway tracks. It includes a driving machinery supported on wheels running on the rails and a digging unit supported by an arm from the machinery. The digging unit includes a chain with scrapers running around an elongated structure. As there is no resiliency in the chain, the risks for broken chain and other damages to the digging unit are great, in case the chain hits a stone or other big object. Further, as the apparatus is supported directly on the track it cannot be easely removed but has to be driven to a railway siding or similar in order to let trains pass the place of work.

[0010] From US-A-2,886,904 there is known an apparatus of the same type as the one above and it shows the same drawbacks. However, it is even more complicated in that it is provided with four "diggers".

[0011] From FR-A-2 551 781 there is known an apparatus for removing ballast which is extremely complicated as it also includes a device for raising the track during the removal operation. However, the chains of the two digging units are not resiliently supported, which means that the risks for chain breaks and other problems are great as in connection with the two apparatuses above. Further, it cannot easely be brought aside in order to let trains pass.

[0012] The object of the invention is to eliminate above drawbacks and present an apparatus for removing the ballast of a railway without demounting the track which apparatus has a simple structure and versatile operation. This object is obtained by means of an apparatus which is presented in the claim 1.

[0013] The problem to keep the digging chain unbroken although it often hits big stones and other obstacles, is solved by the structure that one of the pulleys guiding and supporting the digging chain is resiliently arranged

so that the chain is biased.

[0014] The apparatus comprises an aggregate remover which is operated by such an excavator which is provided with track wheels in addition to conventional wheels or caterpillar tracks. This is advantageous in that the apparatus can be moved both on roads and on railway tracks and, when there is a passing train, the apparatus need not be moved a long way since one can use e.g. the nearest level crossing to move the excavator aside for the time of the passing train. The aggregate remover, which is mounted to the boom of the excavator, is pushed by means of said boom into the ballast below the track from one side of the track. The aggregate remover can be pushed under the track without any trenches and it enables removal of the ballast evenly to both sides of the track. One aggregate remover is provided with blade-like transporting members which are wider within their lower portion and which carefully move the ballast aside through sliding so that the sleepers are not damaged.

[0015] The apparatus according to the invention brings along a considerable saving of time. For instance, it takes only 2-3 hours to change the ballast under a one-track level crossing. The working speed on track is approximately 100 track-m/h and the work requires only a few persons. If necessary, a sieve dipper can be provided in connection with the excavator which then enables one to perform all those stages of operation which are needed in reballasting.

[0016] The invention will now be described in the following referring to the enclosed drawings in which

figure 1 shows an aggregate remover installed to an excavator seen obliquely from above when the remover is being pushed under the track,

figure 2 shows the aggregate remover installed to an excavator seen from above,

figure 3 shows an aggregate remover seen from above and partly cross-sectioned,

figure 4 shows a part of the aggregate remover according to figure 3 seen from the side,

figure 5 shows a cross-sectioned view of the aggregate remover according to figure 3 with the endless circumferential member removed and seen from the side and

figure 6 an apparatus according to the invention with the aggregate remover pushed under the track.

[0017] In the exemplary case, the apparatus according to the invention comprises an excavator 12, having a boom 13 and own wheels, and a mechanism 15 for removing mineral aggregate which hereon will be called the aggregate remover 15. Thus an excavator or the like apparatus, which has conventional operational capabilities and which is provided with normal wheels or track chains, serves as the drive mechanism for the aggregate remover 15. To make use of the aggregate remover 15 possible in a reballasting work that proceeds along the longitudinal direction of the track, the excavator 12 is also provided with track wheels 14, which are made of steel, to move the excavator 12 specifically on the same track whose ballast is being removed. Therefore, the excavator 12 that is used is a normal excavator except that it is provided with track wheels 14 for travel along the track.

[0018] The aggregate remover 15 is attached to a fast coupling member on the boom 13 of the excavator. To this fast coupling member, e.g. a sieve dipper can be connected after the ballast removal work by which dipper the ballast removed from beneath the track is cleaned and sieved for reuse.

[0019] As to the trajectories of the aggregate remover 15, there are available the same trajectories of motion as there are in a normal operation of the excavator 12. Therefore, it can be moved up, down, forward, backward, left and right, and it can be inclined and rotated at the end of the boom.

[0020] The aggregate remover 15 gets its power from the hydraulic system of the excavator. The hoses of the hydraulic motor, which serves as the drive unit 7, are connected to the corresponding hydraulic connectors of the excavator 12 i.e. to the hydraulic inlet and outlet connectors whereby operation of the hydraulic motor can be controlled by a valve in the cab of the excavator 12. If it is desired to change the direction of rotation of the hydraulic motor, the flow direction of the hydraulic liquid is changed so that the inlet hose becomes the outlet hose and the outlet hose becomes the inlet hose, respectively.

[0021] The aggregate remover 15 comprises primarily a body 1 and, in connection with the body 1, an endless circumferential member 2 having transporting members 3 attached thereto. The body 1 is essentially a planar blade or the like, which is designed to be positioned essentially horizontally under the track. The endless circumferential member 2 is disposed on the outer circumference of the body 1.

[0022] The aggregate remover 15 is pushed into the ballast layer under the track from the side of the track essentially in a horizontal plane and the endless circumferential member 2 is rotated in a plane below the track. Transporting members 3 attached to the endless circumferential member 2 dig into the mineral aggregate of the ballast and transport it from beneath the track to the side thereof. The aggregate remover 15 transports mineral aggregate of the ballast layer from the middle of the track to the side of the track. The aggregate remover 15 can be turned to operate in a similar way on the other side of the track.

[0023] The endless circumferential member 2 is in the exemplary case a track chain or the like and the transporting member 3 is a blade which projects perpedicularly from the circumferential member 2 and extends vertically. Attached to the circumferential member 2 be-

tween the transporting members 3, there are also provided finger-like members 4 made of hard metal which are designed to disintegrate possible ice or very tightly compacted mineral aggregate in the ballast.

[0024] The lower part 3' of the transporting member 3 is essentially wider than the upper part 3''. This enables the transporting member 3 to dig into the mineral aggregate so that, during rotation of the endless circumferential member 2, the mineral aggregate of the ballast above the lower portion of the transporting member 3' first falls down and then it is transported, pushed by the transporting member 3, to the side of the track. Transporting members 3 transport mineral aggregate from the ballast layer so that the ballast layer slides down in slices along a slide plane specific to used mineral aggregate to be then transported by the transporting members 3. Therefore, the rotating track chain cannot damage the track structure.

[0025] The circumferential member 2 is arranged to rotate under guidance of a pulley 5 which is mounted in bearings to the body 1 so that the pulley 5 is connected to the drive unit 7 preferably by means of a power transmission assembly 8. As already mentioned earlier, a hydraulic motor serves as the drive unit 7 in the exemplary case. The power transmission assembly 8 comprises a planetary gear which is arranged to control the rotational speed of the endless circumferential member 2. The transmission ratio of the planetary gear is so chosen that the speed of the circumferential member 2 i.e. the track chain can be changed within suitable limits.

[0026] The trajectory of the circumferential member 2 is elongated. This has been achieved so that the circumferential member 2 is arranged to rotate under guidance of a second pulley 6 which is mounted in bearings to the body 1. The second pulley 6 is mounted in bearings to a spring-loaded traveller 10 which traveller 10, in case of overload, is constrained to move along guides 11, which are mounted to the body 1 and which are parallel with the longitudinal direction of the aggregate remover, towards the pulley 5 which is connected to the drive unit 7. This is beneficial in that if it happens that a stone gets between the track chain and the pulley 6 or the pulley 5 the aggregate remover will not be damaged.

[0027] The body 1 of the aggregate remover 15 is also provided with suspension means 9 which are advantageously placed closer to the pulley 5, which is connected to the drive unit 7, apart from said drive unit 7.

[0028] The aggregate remover functions in the following way. The hydraulic motor drives the planetary gear which transmits power to the driven pulley and further to the track chain which performs removal of ballast from beneath the track by means of transporting members. The track chain turns around the sheave pulley and back to the driven pulley. The sheave pulley is spring-loaded and it can move in the traveller 10 towards the driven pulley 5. The pulley assembly of the aggregate remover is protected by protective plates which are part of the body and which are placed on both sides of the track chain. When the operation is transferred to the other side of the track, the rotational direction of the chain is changed so that mineral aggregate moves outwards from beneath the track. That portion of the track whose ballast layer is removed is supported e.g. on jacks or the like. Supporting the track on a right height level can also be performed only when cleaned ballast is being layed under the track.

[0029] The invention is not limited to the embodiment described above but can be varied within the limits of the enclosed claims.

Claims

1. Apparatus for removing the ballast of a railway without demounting the track, the apparatus comprising an excavator (12) or the like supported on wheels and provided with a boom (13) and an aggregate remover (15) mounted to the free end of the boom (13), the aggregate remover (15) being arranged to be operated by means of said excavator (12) or the like and which comprises a body (1) essentially in the shape of a planar blade or the like and, in connection with the body (1), an endless member (2) having at least one transporting member (3) attached thereto and extended around the periphery of the body (1) and arranged to be moved thereabout, guided by at least two pulleys (5,6), a driving pulley (5) and an idle pulley (6), mounted to the body (1), the driving pulley (5) being connected to a drive unit (7) via a power transmission assembly (8) for moving the endless member (2) around the periphery of the body (1), characterized in that the idle pulley (6) is mounted to the body (1) by means of a spring assembly (10,11;fig. 5) for biasing the endless member (2).

2. Apparatus according to claim 1, characterized in that the spring assembly includes a traveller (10) to which the idle pulley is mounted by bearings, and guides (11) mounted to the body (1) and movably supporting the traveller (10), and that the idle pulley (6) in case of overload, is constrained to move towards the driving pulley (5).

3. Apparatus according to claim 1 or 2, characterized in that the spring assembly includes a coil spring.

4. Apparatus according to any of claims 1 - 3, characterized in that the power transmission assembly (8) is a planetary gear.

5. Apparatus according to any of preceding claims, in which the endless member (2) of the aggregate remover (15) is a track chain disposed on the outer peripery of the body and in which said at least one transporting member (3) is essentially a vertical

blade projecting from the endless member (2), characterized in that the lower part (3') of the transporting member(s) (3) is essentially wider than the upper part (3").

6. Apparatus according to any of preceding claims, characterized in that finger-like members (4) made of hard metal for braking ice or the like in the ballast are attached to and projecting from the endless member (2).

Patentansprüche

1. Vorrichtung zur Entfernung des Schotters von einer Bahnstrecke ohne Abbau des Gleises, welche Vorrichtung einen Bagger (12) oder dergleichen umfaßt, der auf Rädern läuft und mit einem Ausleger (13) und einem Aggregatentferner (15) versehen ist, der am freien Ende des Auslegers (13) angebracht ist, wobei der Aggregatentferner (15) dazu eingerichtet ist, mittels des Baggers (12) oder dergleichen betrieben zu werden und einen Körper (1) im wesentlichen in Gestalt eines ebenen Schildes oder dergleichen und in Verbindung mit dem Körper (1) ein Endloselement (2) umfaßt, das mindestens ein an diesem befestigtes Transportelement (3) aufweist, das sich um den Rand des Körpers (1) erstreckt und dazu eingerichtet ist, um diesen durch mindestens zwei Riemenscheiben (5, 6) bewegt zu werden, die eine Antriebsscheibe (5) und eine Leerlaufscheibe (6) umfassen, die am Körper (1) angebracht sind, wobei die Antriebsscheibe über eine Kraftübertragungsanordnung (8) zur Bewegung des Endloselements (2) um den Rand des Körpers (1) mit einer Antriebseinheit (7) verbunden ist,
dadurch gekennzeichnet,
daß die Leerlaufscheibe (6) am Körper (1) mit Hilfe eines Federaufbaus (10, 11; Fig, 5) zur Vorspannung des Endloselements (2) angebracht ist.

2. Vorrichtung gemäß Anspruch 1, dadurch gekennzeichnet, daß der Federaufbau einen Läufer (10), an dem die Leerlaufscheibe mit Lagern angebracht ist, und Führungen (11) umfaßt, die am Körper (1) angebracht sind und den Läufer (10) beweglich tragen, und daß die Leerlaufscheibe (6) im Überlastfall gezwungen ist, sich hin zur Antriebsscheibe (5) zu bewegen.

3. Vorrichtung gemäß Anspruch 1 oder 2,
dadurch gekennzeichnet,
daß der Federaufbau eine Spiralfelder umfaßt.

4. Vorrichtung gemäß einem der Ansprüche 1 bis 3,
dadurch gekennzeichnet,
daß die Kraftübertragungsanordnung (8) ein Planetengetriebe ist.

5. Vorrichtung gemäß einem der vorhergehenden Ansprüche, bei der das Endloselement (2) des Aggregatentferners (15) eine Spurkette ist, die am äußeren Rand des Körpers angeordnet und in der mindestens ein Transportelement (3) im wesentlichen ein vertikales Schild ist, das vom Endloselement (2) hervorragt, dadurch gekennzeichnet,
daß der untere Teil (3') des oder der Transportelement(e) (3) wesentlich breiter als der obere Teil (3") ist.

6. Vorrichtung gemäß einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
daß fingerartige Elemente (4), die aus Hartmetall hergestellt sind, zum Brechen von Eis oder dergleichen im Schotter am Endloselement (2) angebracht sind und von diesem hervorragen.

Revendications

1. Appareil pour enlever le ballast d'une voie ferrée sans démonter les rails, l'appareil comprenant une excavatrice (12) ou un engin analogue, supporté sur des roues et pourvu d'une flèche (13), et un dispositif d'enlèvement d'agrégats (15) monté à l'extrémité libre de la flèche (13), le dispositif d'enlèvement d'agrégats (15) étant agencé de manière à être commandé au moyen de ladite excavatrice (12) ou analogue et comprenant un corps (1) sensiblement en forme de lame plane ou analogue et, en association avec le corps (1), un élément sans fin (2) auquel est attaché au moins un élément de transport (3), ledit élément sans fin s'étendant autour de la périphérie du corps (1) et pouvant se déplacer autour de celui-ci, guidé par au moins deux poulies (5,6), à savoir une poulie d'entraînement (5) et une poulie folle (6) montées sur le corps (1), la poulie d'entraînement (5) étant connectée à un groupe d'entraînement (7) par l'intermédiaire d'un ensemble de transmission de puissance (8) pour déplacer l'élément sans fin (2) autour de la périphérie du corps (1), caractérisé en ce que la poulie folle (6) est montée sur le corps (1) par l'intermédiaire d'un dispositif élastique (10,11;figure 5) pour solliciter l'élément sans fin (2).

2. Appareil selon la revendication 1, caractérisé en ce que le dispositif élastique comprend un coulisseau (10), sur lequel la poulie folle est fixée par des paliers, et des guidages (11) montés sur le corps (1) et supportant de façon mobile le coulisseau (10), et en ce que la poulie folle (6), en cas de surcharge, est obligée de se déplacer vers la poulie d'entraînement (5).

3. Appareil selon la revendication 1 ou 2, caractérisé

en ce que le dispositif élastique comprend un ressort hélicoïdal.

4. Appareil selon une quelconque des revendications 1 à 3, caractérisé en ce que l'ensemble de transmission de puissance (8) est un mécanisme à engrenages planétaires.

5. Appareil selon une quelconque des revendications précédentes, dans lequel l'élément sans fin (2) du dispositif d'enlèvement d'agrégats (15) est une chaîne guidée disposée sur la périphérie extérieure du corps, et dans lequel ledit au moins un élément de transport (3) est essentiellement une lame verticale en saillie à partir de l'élément sans fin (2), caractérisé en ce que la partie inférieure (3') du ou des éléments de transport (3) est sensiblement plus large que la partie supérieure (3").

6. Appareil selon une quelconque des revendications précédentes, caractérisé en ce que des éléments en forme de doigt (4) en métal dur, pour briser la glace ou analogue dans le ballast, sont attachés à l'élément sans fin (2) et font saillie à partir de celui-ci.

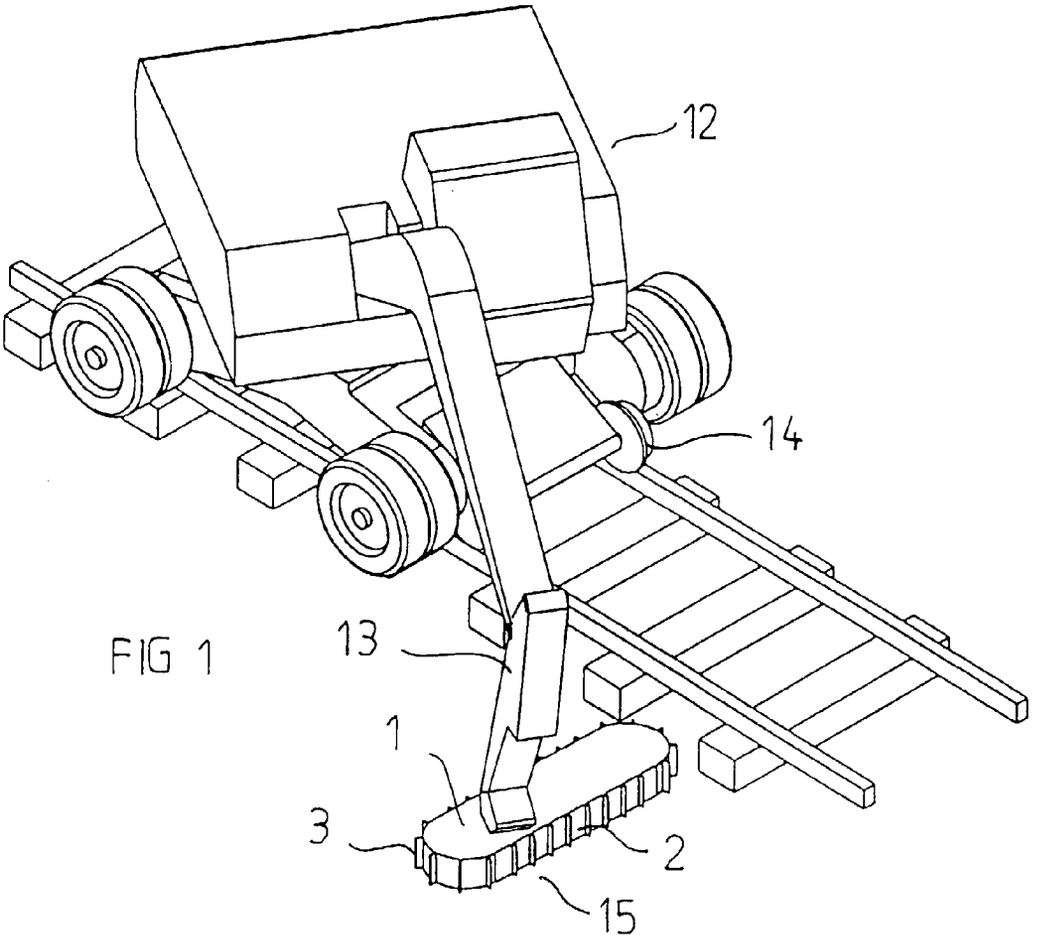


FIG 1

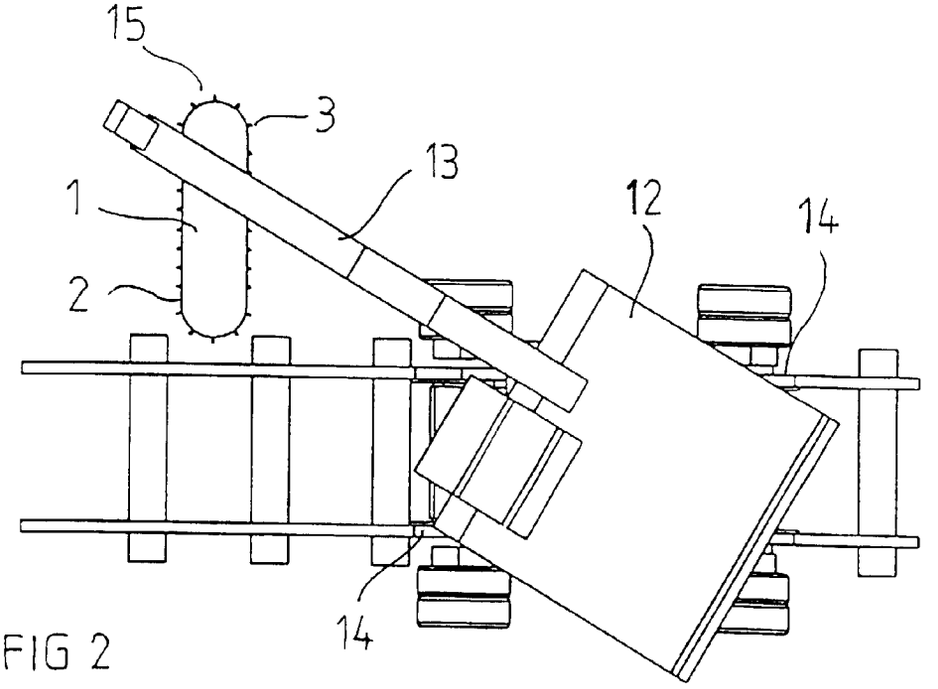
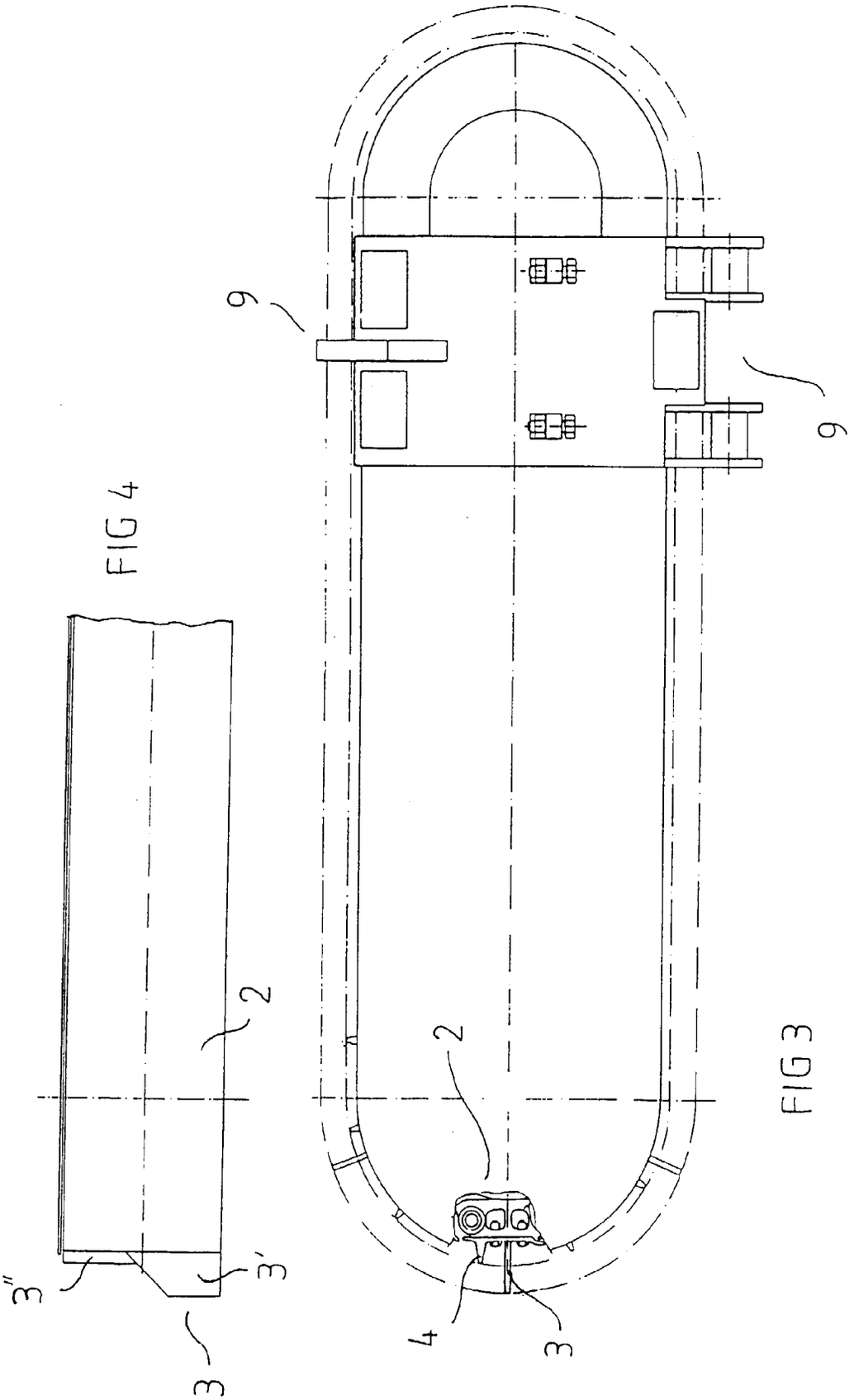


FIG 2


9
9
2
4
3
FIG 3
FIG 4
2
3''
3'
3

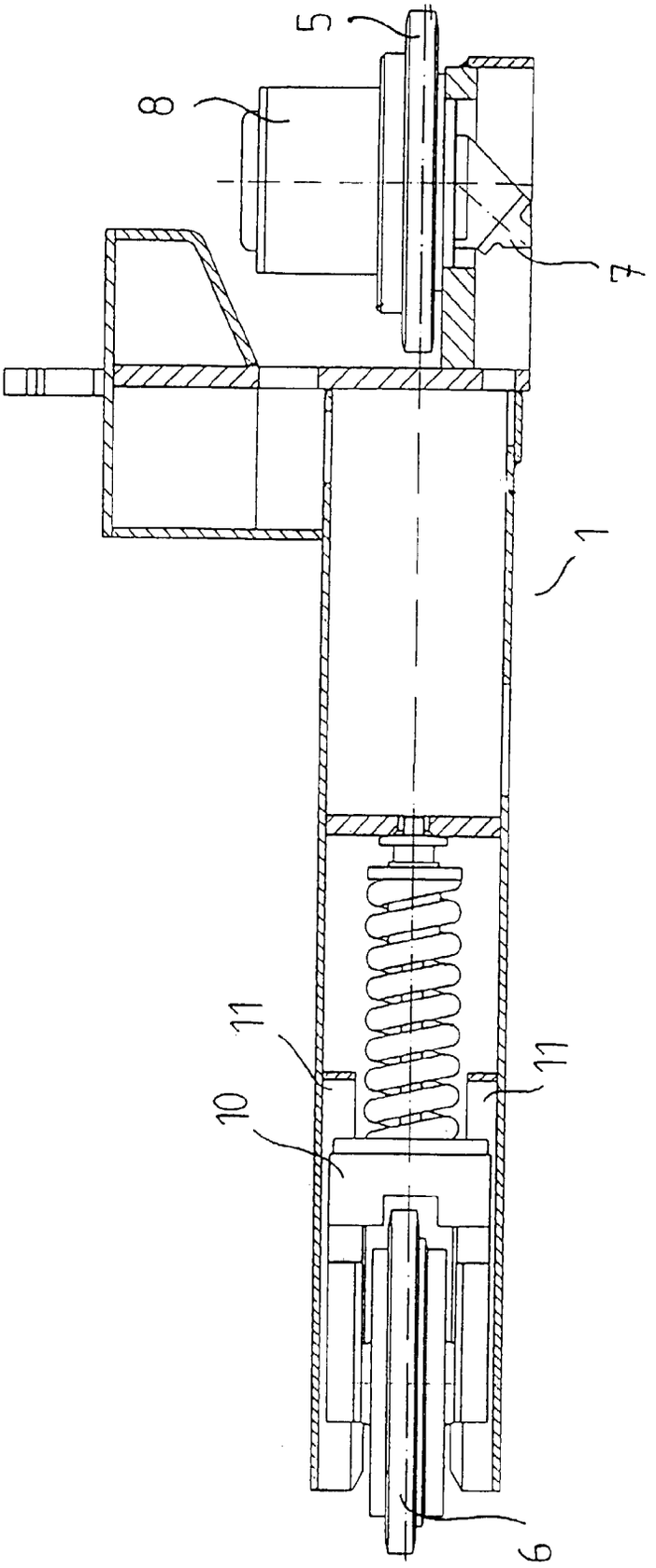


FIG 5

FIG 6