



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.11.2012 Bulletin 2012/47

(51) Int Cl.:
B66C 1/64 (2006.01)

(21) Application number: **12165854.6**

(22) Date of filing: **27.04.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **19.05.2011 IT FI20110103**

(54) **A universal apparatus for multiple handling of train rails and the like**

(57) The present invention refers to an apparatus for the multiple grabbing and moving of train and tram-line rails or similar elongated bodies, such as extrusions and metallic profiles in general, by way of example for their

transfer from the hold of a ship to a means of transport or *vice versa*. The apparatus allows to operate on trails of any size placed in a side-by-side relationship in ranks, with no limitations in the pitch of the rank.

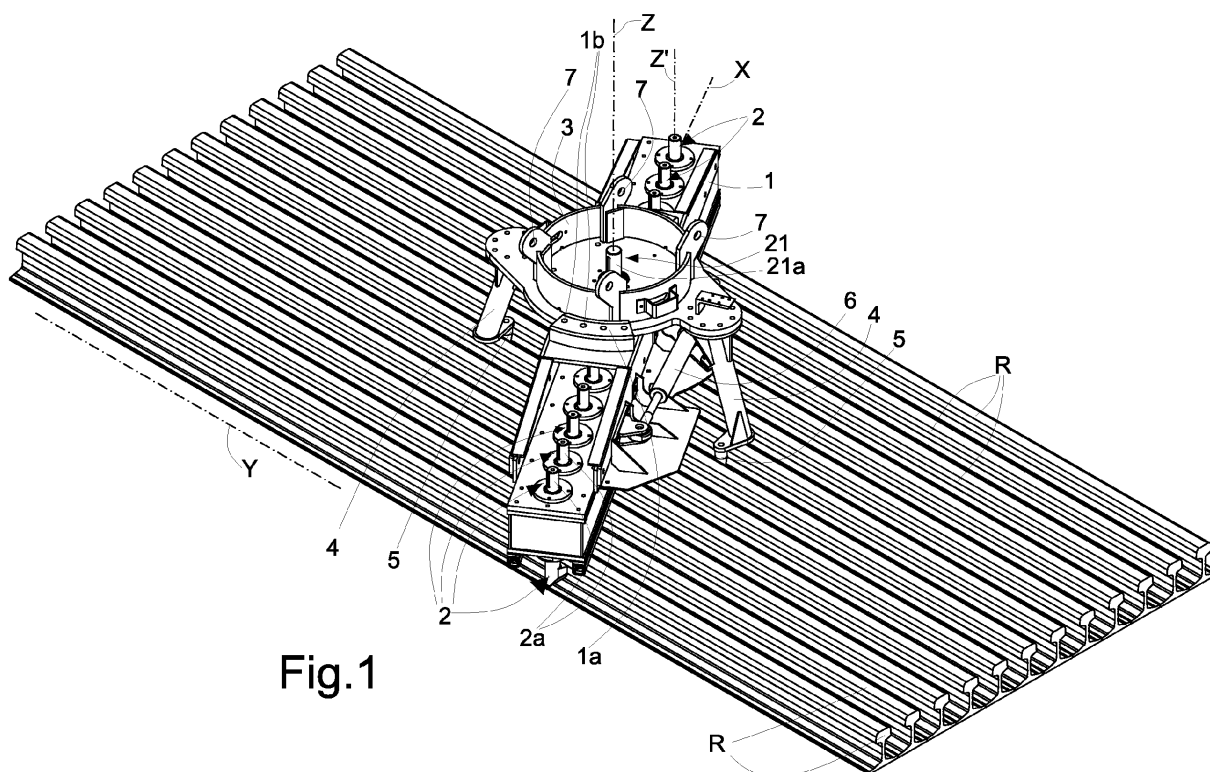


Fig.1

Description

[0001] The present invention refers to the field of industrial apparatus for handling materials and, more precisely, it concerns an apparatus for the multiple grabbing and transporting of train and tram-line rails or similar elongated bodies, like extrusions and metallic profiles in general, by way of example for their transfer from the hold of a ship to a land transport vehicle or *vice versa*.

[0002] A universal apparatus destined to this kind of use is disclosed in Italian patent application No. M191A000360. Like similar and prior apparatus, the apparatus at issue provides for a lined-up rank of grabbing hammers adapted to be inserted between respective couples of rails, lain down and placed side-by-side in a group, to engage with the rails and lift them up when the apparatus itself, possibly in association with one or more identical apparatus arranged in a spaced disposition on the same lifting equipment (by way of example a crane), is activated by such equipment. The grabbing hammers, supported by a box-like frame, are suitably shaped and pivotable around their respective axis with coordinated drive. In such a way, they are adapted to take an inserting (and releasing) position allowing their penetration in the space between the rails (or their coming out from this space) and an engagement position rotated with respect to the inserting position, in which the mechanical abutment on the head of the mushroom-like section of the rails allows the mentioned lifting.

[0003] The above mentioned universal apparatus is then provided with an adjustment system which allows its adaptation and use as the pitch between the rails placed side-by-side in the group changes. Such variation is an obvious consequence of the fact that rails can be of different kinds and dimensions and, therefore, the distance between two rails placed side-by-side can have a higher or a lower value. The pitch is in particular equal or proportional to the width of the base, the so-called rail "foot", given that the rails in the rank are placed in a side-by-side relationship on the very edges of the base.

[0004] The adjustment system provides for the angling of the box-like support of the hammers around a vertical axis. The pitch of the hammers along the alignment direction is set in such a way as to correspond to the maximum pitch of the liftable rail system, in a working configuration wherein such alignment direction and the direction of the length of the rails are mutually orthogonal. Starting from such configuration, by rotating the frame and therefore changing the angle between the above mentioned directions in a controlled way, the operative pitch among the hammers (i.e. the one projected along the direction of the length of the rails) can be decreased to adapt to the pitch of the rank of rails.

[0005] As the working angle of the frame changes, the functionality of the hammers must however remain unchanged given that, as said, they must rotate between an inserting position and a grabbing position. In particular, to guarantee the correct effectiveness of the grabbing

operations, the absolute angle of such positions, i.e. the one with respect to a fixed point of reference external to the frame (such as, in particular, the very direction of the length of the rails) must remain unchanged as the working configuration of the frame changes. Therefore, the above referenced apparatus provides for a leverage device capable of intervening on the operative arrangement of the hammers with respect to the frame, by automatically adjusting the same in reply to the entity of the angle given to the frame itself to adapt to the pitch of the rank of rails.

[0006] However, these very leverages, and the functional need they satisfy, cause a significant limitation in the use of the apparatus since the frame cannot be angled beyond a given limit, corresponding to an angle covering approximately 30° and to a reduction of the pitch of approximately 13%. The applicability of the apparatus is to a certain extent jeopardized and, in particular, considering that the apparatus itself is set up in such a way to be compatible with rails of the highest existing pitch, rails with reduced pitch cannot be handled.

[0007] The main object of the present invention is to solve the above mentioned problem, by providing an improved apparatus of the kind described above, which allows to significantly widen its applicability and, in particular, to carry out the grabbing and handling of rails by way of example with a pitch ranging between a maximum of 150 mm to a minimum of 12 mm, considering such extremes as non-limiting.

[0008] This and other objects are achieved with the improved apparatus according to the present invention, the essential features of which are defined by the first of the appended claims.

[0009] The main advantage obtained by the apparatus according to the present invention substantially lies in the fact that the kinematic motion of the hammers is no longer limited to fixed angular rotations but adapted to allow the rotation of the hammers themselves, on their respective axis, at 360° in a continuous way.

[0010] The characteristics and advantages of the apparatus according to the present invention will be apparent from the following description of embodiments thereof, given as a non-limiting example with reference to the attached drawings, wherein:

-- figure 1 is an axonometric view in a working configuration of an apparatus according to the present invention, a motorized drive system of the grabbing hammers being omitted;

-- figure 2 is an exploded side view, partially in cross-section, of the apparatus in a first embodiment of the invention, with omitted parts but associated with a motorized drive system;

-- figures 3 and 4 are schematic top views of an apparatus according to the first embodiment of the invention, respectively in a configuration of maximum pitch (with the alignment direction of the hammers orthogonal to the direction of the length of the rails) and with a reduced pitch, i.e. angled with respect to

the one with maximum pitch;

-- figure 5 is a cross-section axonometric view of an apparatus according to the present invention in a second embodiment thereof.

[0011] With reference to said figures, an apparatus for grabbing and handling rails includes, substantially as known, an elongated box-like frame 1 which supports in a pivoting way a rank of grabbing hammers 2 lined-up along an alignment axis X. The working configuration of the apparatus is such to arrange the alignment axis X on a plane parallel to the lying plane of a rank of rails R to be lifted (virtually the ground plane or a plane parallel to it). The direction of the length of the rails is indicated under reference Y in the figures, while it is apparent that each hammer 2, conveniently shaped, rotates around its own axis z' which is arranged vertically, to carry out the already mentioned rotating movement by covering a 90° angle, for engaging and releasing the rails (this will be discussed thoroughly afterwards).

[0012] Still substantially in accordance with prior art, on top of the box 1 an upper yoke 3 is connected with respect to which the box itself can carry out an adjustment movement; the box and the yoke can in fact be subjected to a mutual angular displacement around a central axis Z orthogonal to the plane XY and therefore parallel to the axis of rotation z' of the hammers 2 with respect to the box 1.

[0013] The yoke 3, which is substantially tubular in the example, presents respective arms 4 at two diametrically opposed points, which project tangentially and which have respective positioning pins 5 downwards protruded at their free ends, adapted to insert in the rails R to guarantee an exact position reference between the rails themselves and the yoke 3 of the apparatus.

[0014] The mutual position between the yoke 3 and the box 1, in positions of different angular displacement, is by way of example fixed through a system of perforations 1 b on shelves 1a projecting integrally from the top of the box 1 and superimposed upon the yoke 3 (the pivotable connection of the box is in fact obtained thanks to an engagement between such shelves and the yoke). The perforations 1 b are organized in two diametrically opposed distributions (of which only one visible in figure 1) and are adapted to be selectively engaged by threaded elements which tighten in two seats (one for each distribution 1 b) formed in the yoke 3. Neither such threaded elements nor the relating seats are visible in the figures. An oil-pressure cylinder 6 can also be operatively arranged between the box 1 and the yoke 3, as in the example. Such cylinder, which is not necessary for and does not limit the present invention, can be optionally provided to assist, through the connection to a suitable hydraulic control unit, the adjustment rotation of the apparatus, thus decreasing the necessary driving power.

[0015] The hammers 2 are odd in number and a central hammer 21 is placed with its own axis z' in correspondence with the axis Z. A shaft 21 a integral with such central

hammer projects axially outside the box 1, on the upper side and in the center of the yoke 3 with respect to which (and to the very box 1) it is clearly free to rotate. As described hereafter, the shaft 21 a is used for the transmission of the drive to the set of hammers 21.

[0016] A number of grommets 7 integrally project from the upper side of the yoke 3 to directly connect the apparatus to a lifting equipment, which is not represented in the figures, or otherwise and preferably, as shown in figure 2, to a rotating drive system (around the axis z' coincident with axis Z) of the central hammer 21. The system, as a whole indicated with 8, comprises brackets 81 for the connection to the grommets 7, and a box-like body 83 carrying a motor reducer 84, over a plate 82 from which the brackets 81 project. The motor reducer is arranged horizontally and is adapted to drive into rotation, though a gear transmission of suitable characteristics, a driving shaft 85 which runs centrally inside the body 83 and along it, then outside through the plate 82 and between the brackets 81 and the grommets 7 to finally engage coaxially with the shaft 21 a of the central hammer 21. As visible in figure 2, the driving shaft 85 has a segmented structure with cardan joints adapted to compensate possible assembly misalignments.

[0017] In a different version with manual drive, the adjustment movement can be controlled through a maneuvering steering-wheel integral with the shaft 21a of the central hammer 21.

[0018] Going back to the set of hammers 2 and their related drive, according to the present invention such drive is controlled independently with respect to the adjustment or angular displacement movement of the box 1 and is in fact operated and controlled by the propulsion of the central hammer 21 and by a transmission which makes a corresponding rotation of all the other hammers 2 (the number of which can obviously change according to the various needs) respond to the rotation of the central hammer.

[0019] According to a first embodiment of the invention, and in particular to that shown in figures 3 and 4, such transmission provides for a train of toothed pinions 9 which cooperate tangentially with the hammers 2, by engaging with corresponding toothed profiles 2b, 21 b, made integrally with the respective shafts 2a, 21 a of the hammers 2, 21. In particular, the toothed profile 21 b of the central propelling hammer will act as conductor for a couple of idle pinions engaged with it, from which the motion is transmitted, through the respective profiles 2b, to the two adjacent hammers 2, and so on for the remaining hammers through the further pinions 9 of the train. Therefore, the profile 21 b of the central hammer, and the hammer itself, serves as driver of the transmission, while the remaining profiles 2b are driven.

[0020] When the angular position of the whole box is adjusted to decrease the pitch among the grabbing hammers (figure 4), thanks to the transmission with toothed pinions, the control of the rotational position of the single hammers and the related drive between the insertion and

engagement positions can be carried out without being limited by the angle change, since the propulsion (in this case through the automatic system 8) can independently make the hammers take a freely rotated position at 360°. Therefore, the reduction of the pitch can theoretically reach the lowest value, without damaging at all any functionality of the apparatus.

[0021] In case of movement with motorized drive, the stop positions of the rotation of the hammers which, separated by a 90° angle, respectively determine the releasing and grabbing configurations of the hammers themselves, will be made through electrical end runs on the motor reducer 84. Other systems of motorized drive can provide for different methods; by way of example, by using an hydraulic rotating actuator, the 90° rotation can be imposed as design parameter of the actuator itself, which will exactly perform the necessary 90° rotation. On the contrary, in case of manual drive, mechanical abutments will be implemented as obvious to the skilled person.

[0022] According to an alternative embodiment of the invention, the solution of a chain transmission (shown in figure 5) can also be used, in which each shaft of one hammer 2 engages with the shafts of the two adjacent hammers through couples of chains (not depicted in the figure) engaged between ring gears 12b, 121b arranged integrally with the shafts, in axially spaced couples. The kinematic mechanism will on the whole result as fully similar to the previous one.

[0023] It will be apparent from the above that a significant increase in the versatility of use of the apparatus at issue is obtained according to the present invention, thus making it usable for any rail size. The constructive solutions here proposed do not significantly complicate the structure and functionality of the apparatus, the control of which can be entrusted, in the solution with motorized drive, to systems - also remote-controlled by an operator in charge of the lifting equipment - which can be easily implemented by the skilled person.

[0024] The present invention has been here described with reference to its preferred embodiments. It should be understood that that there may be other embodiments within the same inventive concept, as defined by the scope of protection of the following claims.

Claims

1. An apparatus for engaging and releasing a plurality of rails arranged side-by-side over a horizontal plane, comprising:
 - a box-like body (1);
 - connection means for connecting said box-like body (1) to a lifting equipment;
 - adjustment means (3, 4) adapted to vary the angle between said box-like body (1) and said connection means, around a vertical axis (Z);
 - a rank of side-by-side grabbing hammers (21,

2) projecting from said body (1) and supported by the same body so as to be pivotable around respective vertical axis;

- drive means (8) for driving a central hammer (21) of said rank, said central hammer (21) being coaxial with said axis (Z), so that the central hammer (21) is driven into rotation in an independent manner with respect to said adjustment means (3);

- stop means for stopping the rotation of said driven hammer (21), in end run positions determined in an independent manner with respect to said adjustment means (3); and

- transmission means (9) adapted to transmit the rotation from said central hammer (21) to the other hammers.

2. The apparatus according to claim 1, wherein said transmission means comprise a set of toothed pinions (9) engaged with corresponding toothed profiles (2b) associated with said hammers (2).

3. The apparatus according to claim 2, wherein each pinion (9) of said set is engaged with a couple of consecutive and adjacent hammers (2).

4. The apparatus according to claim 1, wherein said transmission means comprise chain drive means engaged with corresponding toothed profiles (21 b) associated with said hammers (21).

5. The apparatus according to claim 4, wherein said chain means comprise a plurality of closed loop chains each engaging with a couple of consecutive and adjacent hammers (21).

6. The apparatus according to any of the claims from 2 to 5, wherein said hammers are each provided with a shaft (2a, 21a) projecting inside said box-like body (1) in a parallel fashion with said axis (Z), said transmission means being arranged inside the body and engaging with said toothed profiles that are formed in said shafts.

7. The apparatus according to any of the previous claims, wherein said drive means comprise motor reducer means (84), said stop means comprising electric end runs to be set on said motor reducer (84).

8. The apparatus according to any of the claims from 1 to 6, wherein said drive means comprise manual manoeuvre means, said stop means comprising mechanical abutments associated with said manoeuvre means.

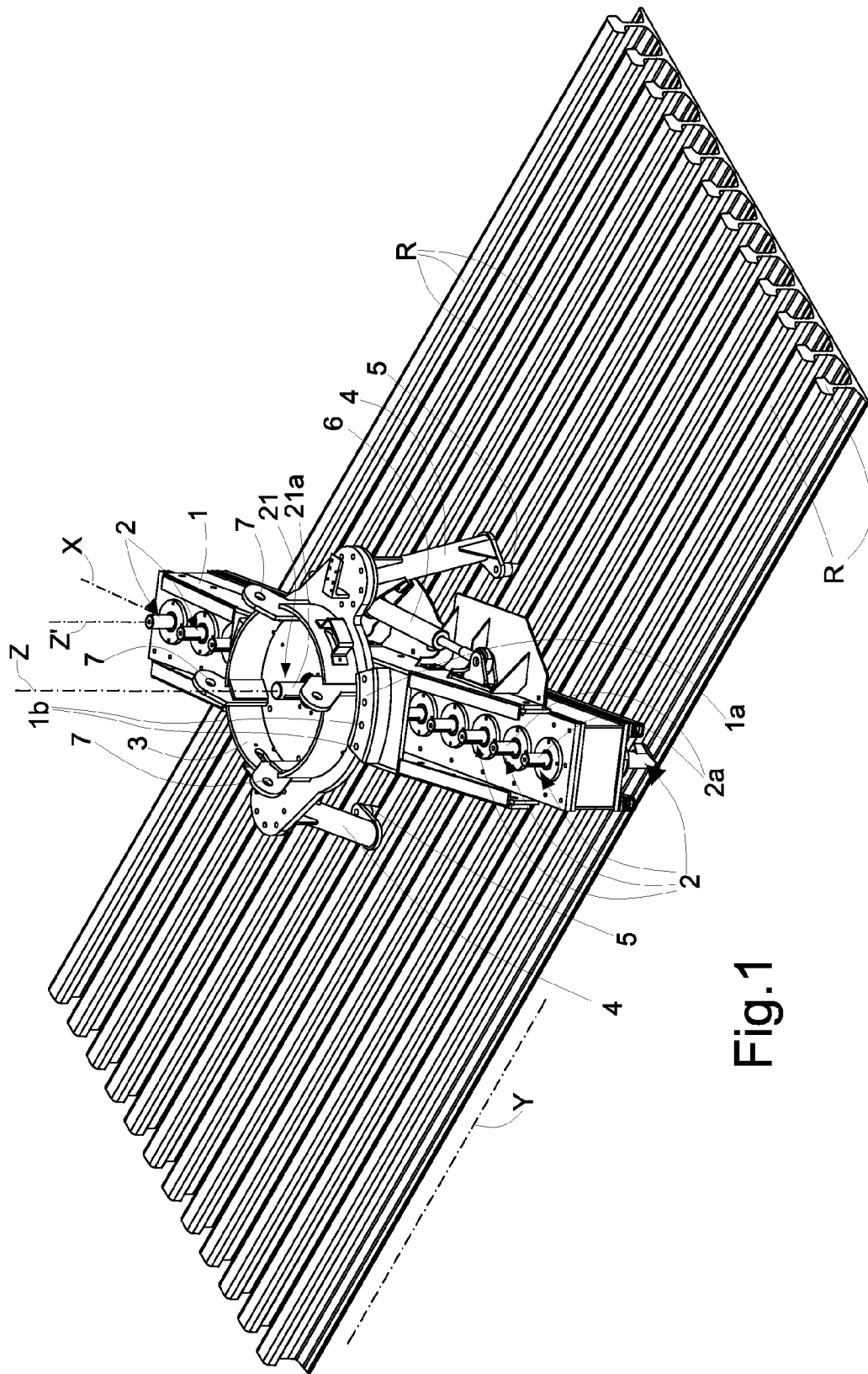


Fig.1

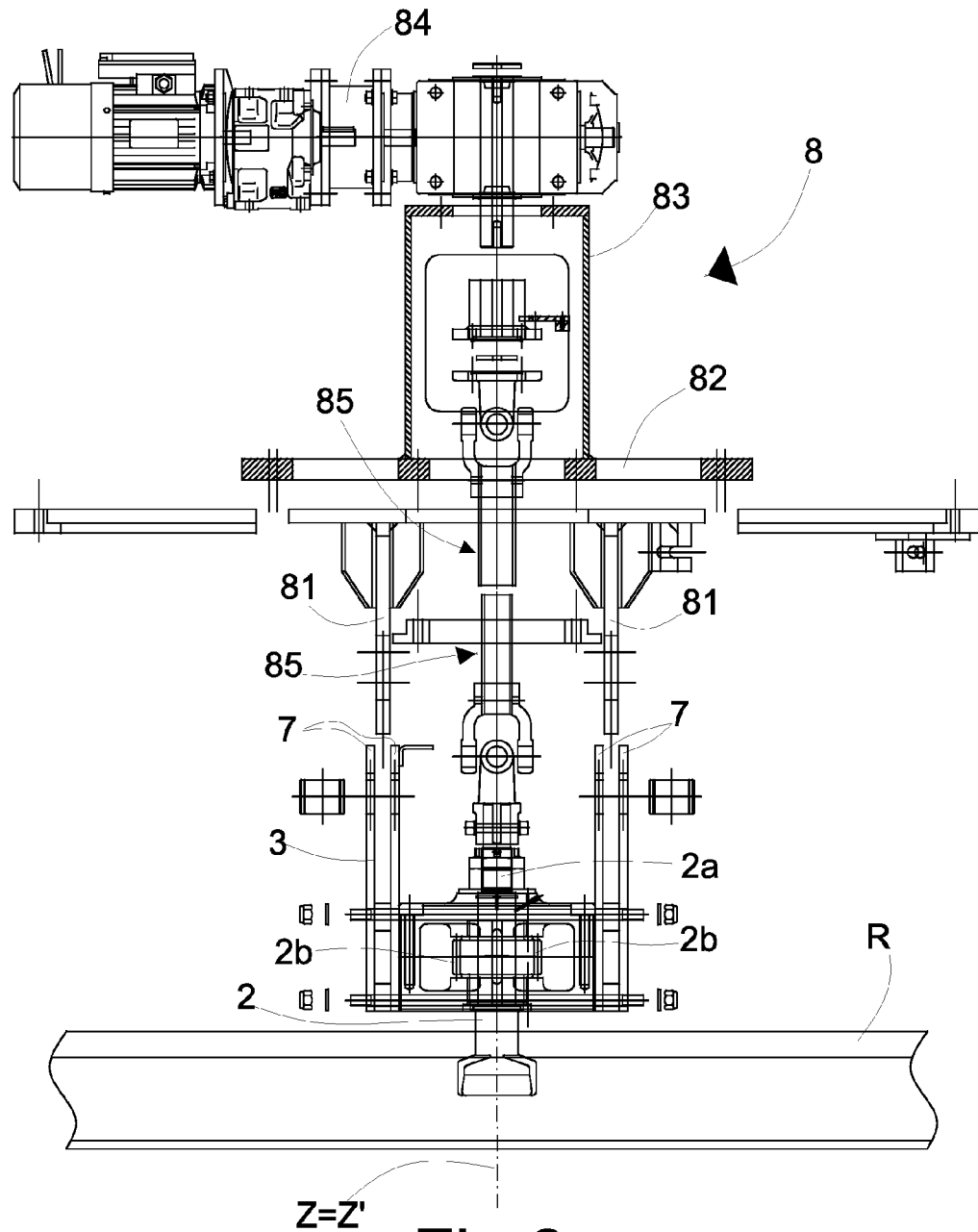


Fig.2

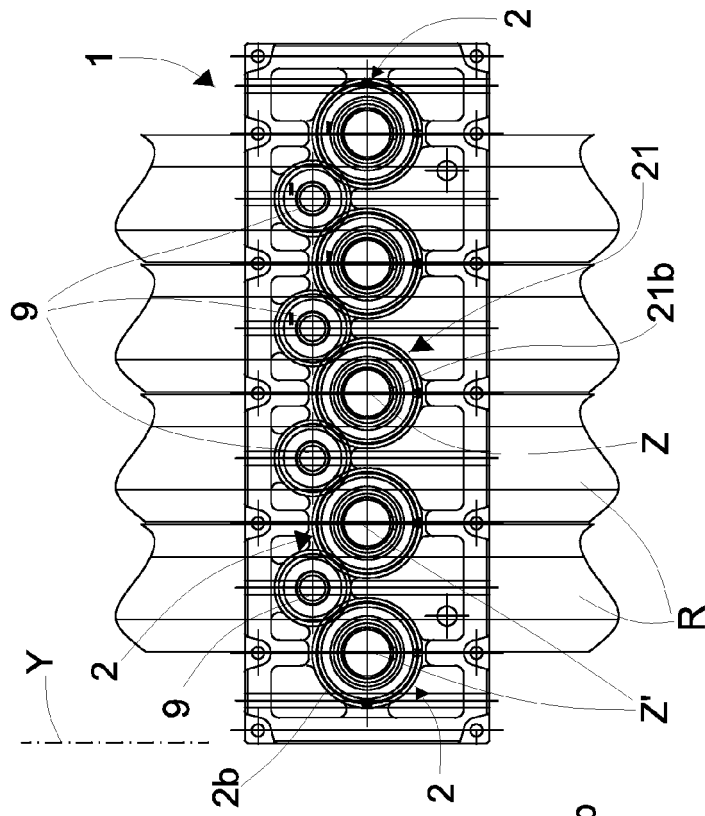


Fig. 3

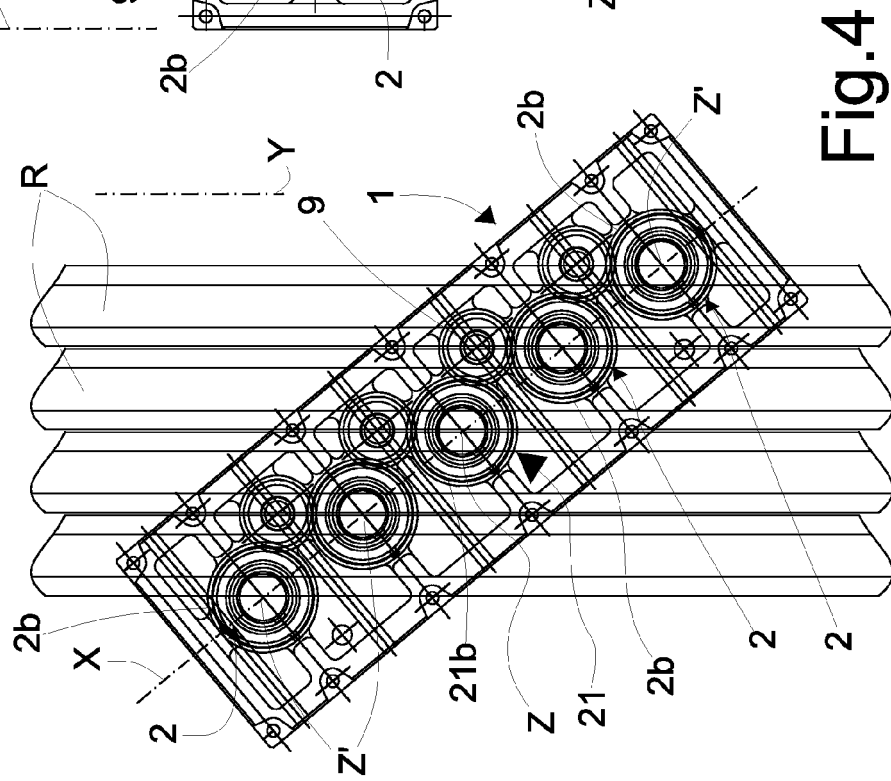


Fig. 4

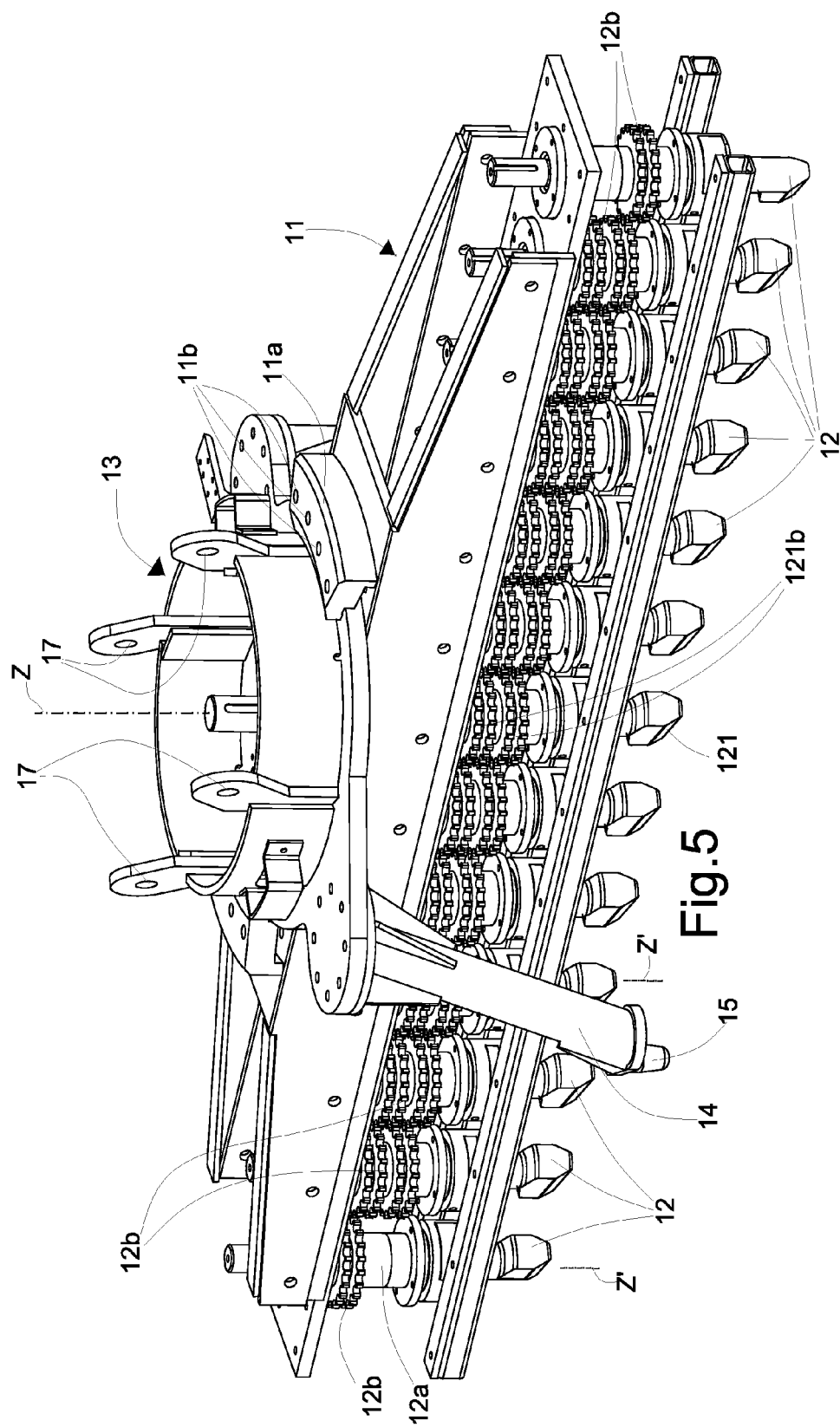


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 12 16 5854

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 4 496 182 A (KRIEGER FRIEDRICH [DE]) 29 January 1985 (1985-01-29) * the whole document *	1-8	INV. B66C1/64
A	GB 2 056 405 A (PIOMBINO ACCIAIERIE) 18 March 1981 (1981-03-18) * the whole document *	1-8	
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			TECHNICAL FIELDS SEARCHED (IPC)
			B66C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 May 2012	Examiner Faymann, L
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 16 5854

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18-05-2012

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US 4496182	A	29-01-1985	NONE	

GB 2056405	A	18-03-1981	NONE	

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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