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- **Pello Garcia, Alberto**
33450 Piedrasblancas, Asturias (ES)
- **Ojeda Arenas, José**
33205 Gijón, Asturias (ES)
- **Gil Coto, Sandra**
33930 Langreo (ES)
- **Mangas Suárez, Mario**
33203 Cimadevilla, Asturias (ES)

(71) Applicant: **TK Escalator Norte, S.A.**
33682 Mieres (ES)

(74) Representative: **Paustian & Partner Patentanwälte
mbB
Oberanger 32
80331 München (DE)**

(72) Inventors:

- **Castaño Lantero, Aurelio**
33203 Cimadevilla, Asturias (ES)

(54) **TRUSS REINFORCEMENT DEVICE, PASSENGER CONVEYING DEVICE AND METHOD FOR RETROFITTING A PASSENGER CONVEYING DEVICE**

(57) The invention concerns a truss reinforcement device (50) for a passenger conveying device (10), comprising at least one truss support (51) to absorb braking forces applied by a braking system (20) arrangeable be-

tween the cross beam (12) and the main shaft (31). The invention relates further to a method (100) for retrofitting a passenger conveying device (10).

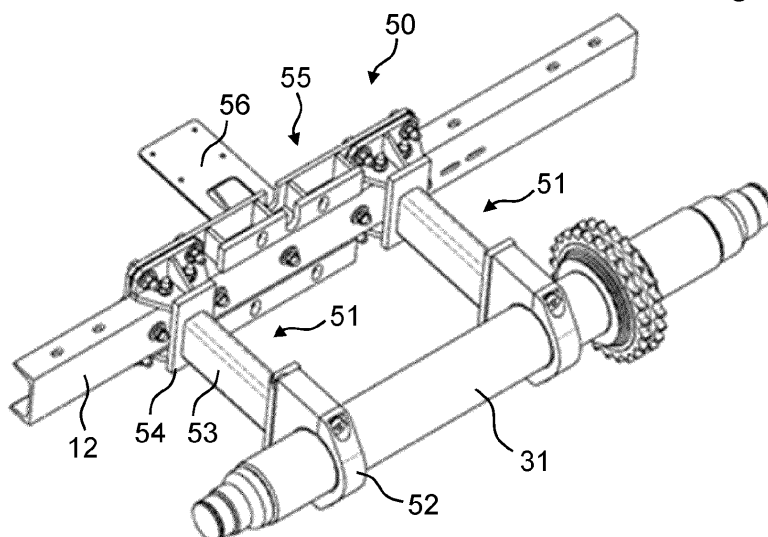


Fig. 3

Description

[0001] The present invention concerns a truss reinforcement device for a passenger conveying device with a braking system arrangeable between a cross beam of a truss of the passenger conveying device and a main shaft of a drive system of the passenger conveying device. The invention further concerns a passenger conveying device and a method for retrofitting a passenger conveying device.

[0002] Passenger conveying devices such as escalators and moving walkways or travelators are widely applied in various public and private places such as shopping malls, airports, and the like. Safety and functional reliability are crucial factors with respect to passenger conveying devices of all kinds.

[0003] All passenger conveying devices, such as escalators and moving walks are equipped with an operational brake system, but may additionally comprise an auxiliary brake system in order to fulfill safety requirements. Furthermore, updated safety regulations may call for an installation of an auxiliary braking system in an existing passenger conveying device, for example due to one or more of the following conditions: A connection between the operational brake and the driving sprockets of the steps/pallets may not be accomplished by shafts, gearwheels, multiplex chains or may be accomplished by a single chain only or the operational brake does not comprise an electro-mechanical brake. Such auxiliary brakes or braking systems may be furnished to impose braking forces on a main driving shaft of the escalator or moving walk.

[0004] Against this background, it is an object of the present invention to provide an improved truss reinforcement device for a passenger conveying device or an improved passenger conveying device in order to increase durability and/ or reliability of a passenger conveying device in particular with an auxiliary braking system.

[0005] In order to solve the above problem, a truss reinforcement device for a passenger conveying device, a passenger conveying device and a method for retrofitting a passenger conveying device according to the independent claims are proposed. Further embodiments and/ or features of the invention are subject of the dependent claims and the description below.

[0006] According to one aspect of the present invention, a truss reinforcement device for a passenger conveying device is proposed, comprising at least one truss support configured to rotatably seat a main shaft of a drive system of the passenger conveying device and to connect the main shaft to a cross beam of a truss of the passenger conveying device, such that the main shaft is mechanically supported against the cross beam to absorb braking forces applied by a braking system arrangeable between the cross beam and the main shaft.

[0007] With this solution, braking forces and reacting forces thereof acting on the truss, the cross beam and/ or the main shaft, may be lowered by means of the truss

reinforcement device. Therefore, a necessity for upscaling a resiliency or hardness of the truss, the cross beam and/ or the main shaft themselves may be avoided. Hence an, in particular subsequent or supplementary, installation of an auxiliary brake to the main shaft, e.g. on existing escalators or moving walkways, may be enabled, without the need to modify the truss of the escalator or moving walkway. In other cases the auxiliary brake may be installed during an initial assembling.

[0008] According to another aspect of the present invention, a passenger conveying device is proposed, comprising a truss, having two support walls, which are connected by at least one cross beam, a drive system comprising a main shaft being arranged between the support walls for driving a step band or pallet band, wherein a braking system arranged between cross beam and main shaft is configured to apply a braking force to the main shaft and a truss reinforcement device and/ or at least one truss support configured to mechanically support the main shaft against the cross beam.

[0009] A passenger conveying device may be an escalator, moving walk or travelator and is configured to transporting people between two points in a building. Typically, the passenger conveying device comprises a plurality of individual stepping elements connected to one another, which move on a rail system in an endless loop between two end points or reversing stations. In the case of an escalator, an endless band of steps is formed from a plurality of steps as stepping elements, and in the case of a moving walk, an endless band of pallets is formed from a plurality of pallets as stepping elements, each of these pluralities of stepping elements forming a step belt.

[0010] The escalator or moving walk typically comprises a drive system powering the main shaft, which drives the stepping elements along the rail system, and for example a handrail drive, which can drive handrails provided in the system. These drives and other components of the escalator or moving walk are installed in a building typically by means of a supporting structure respectively a truss, with the truss forming a framework for the components. In a typical construction, the rails, the drive system(s), skirt boarding etc. are individually installed in or on the truss and/ or welded or otherwise attached to the truss.

[0011] The truss or support structure for an escalator or a moving walk is in particular a frame formed from profiles or scaffolding made up of truss-like assembled carriers, which is designed to accommodate or fasten escalator components or moving walk components. For example, a truss may comprise welded combinations of profiles that form a substantially U-shaped channel for accommodating the step band or pallet band and other components, which may be striped by cross beams or cross braces. Two side walls of the truss may be arranged opposite one another, in particular parallel to one another, form the side walls of the channel and are designed, for example, as a framework made up of profiles, beams or belts connected to one another. Rails of a rail system

may be arranged on the support walls, by means of which the step belt or pallet belt may be guided along a predetermined travel path. These side walls may be supported by and/ or strutted against each other by means of one or more cross beam(s). Such cross beam may be arranged perpendicular to the two side walls in order to distance and maintain the side walls.

[0012] The main shaft is in particular part of the main mechanical movement system of the escalator or moving walk and may be connected to a drive motor. The motor may convert electrical energy into mechanical energy in order to create a motive force to rotate the main shaft, which consequently causes turning of the step or pallet belt. Some passenger conveying devices are or must be equipped or retrofitted with an additional brake based on their specification. Such an additional or auxiliary brake may be configured to stopping the passenger conveying device e.g. in case a speed of the passenger conveying device exceeds a nominal speed or an unintentional reversal happens. The brake system, typically installed in a central position of the main shaft, may be configured to apply a predetermined braking torque to the main shaft in order to for example initiate an emergency stop. The brake system may comprise a pawl assembly, e.g. affixed to the cross beam, configured to engage with a ratchet, e.g. mounted on the main shaft, in order to brake the main shaft, thereby decelerating and/ or arresting the step or pallet belt. In case of a braking action of said auxiliary braking system, the cross beam, the truss and/ or the main shaft may need to withstand forces which result from the braking torque applied by means of the auxiliary braking system.

[0013] The invention is, among other things, based on the thought, that in order to tolerate and/ or withstand braking forces resulting from such braking action, the components, such as the cross beam and the main shaft, may have to undergo upscaling i.e. strengthened. This may prove difficult to achieve in case of upgrading an existing passenger conveying device, where the truss may not be easily modified without disassembling a number of components of the passenger conveying device.

[0014] It is therefore proposed to provide additional physical structures, in order to mechanically stabilize the components affected by forces resulting from the braking action of the (auxiliary) braking system. The proposed truss reinforcement device is configured to support the main shaft against the cross beam, such that reacting forces resulting from the applied braking torque may be absorbed by the truss reinforcement device and/ or transmitted via the truss reinforcement device towards other or more truss components, in order to divert the impact of such braking action. Forces, which the truss and/ or the main shaft need to withstand may thus be lowered and these components may not need to be upscaled or fortified. The truss reinforcement device may, therefore, enable installing an auxiliary brake to the main shaft of existing passenger conveying devices, which may con-

tribute to heightened safety levels of the passenger conveying device. In other cases, the truss reinforcement device may enable providing an additional or alternative braking system for passenger conveying devices to be newly installed.

[0015] According to one embodiment, the truss support may comprise a bushing or bearing configured to rotatably seat the main shaft. Such bushing or bearing may be provided as a split or segmented bushing and/ or may comprise several parts, in order to be assembled around the main shaft, thereby enabling rotatability of the shaft, whilst providing for improved or easier installation of the truss support i.e. the truss reinforcement device to the main shaft.

[0016] In some embodiments, the seat of the main shaft, may be provided as a bush, a bearing, rollers or any other suitable rolling system, which is capable of rotatably seating and/ or securing the main shaft. This may result in a reduction of installation time for the truss reinforcement device, in particular if the auxiliary brake and/ or the truss reinforcement device is to be installed in an existing passenger conveying device.

[0017] According to one embodiment the truss support may comprise a mounting bracket configured to rigidly connect to the cross beam, thereby enabling the truss support i.e. the truss reinforcement device to be stably connected to the cross beam. The mounting bracket may comprise several parts and may be geometrically adapted to fit an outline of the cross beam in order to provide for simplified installation and a positive mechanical engagement. By means of such mounting bracket the transmission of forces may be enhanced, thereby reducing the residual forces to be endured by the main shaft and/ or other components.

[0018] According to one embodiment, the truss support may comprise a bar, comprising the bushing or bearing at a first end and the mounting bracket at a second end, thereby in particular connecting the bushing or bearing and the mounting bracket. By providing the bar in between the mountings of the truss support for connecting to the cross beam and the main shaft, a distance between the cross beam and the main shaft, may be bridged. The bar may be configured to absorb in particular a horizontal force, which may result from the braking action, as to not transmit such horizontal force between the main shaft and the cross beam solely by means of the braking system.

[0019] As the reaction force on the cross beam is the one which supports the braking torque, the reaction on the cross beam may be lowered by increasing the distance between the main shaft and cross beam bridged by the bar, hence, reducing the vertical force transmitted to the cross beam. Thus forces acting on the cross beam, the truss and/ or main shaft are at least partially absorbed, which may lower or eliminate the need for upscaling the individual components affected. Modernization of existing passenger conveying devices may thus be facilitated as the need to modify existing components of the pas-

senger conveying device may be rendered unnecessary.

[0020] According to one embodiment the truss support may comprise at least two truss supports, configured to be arranged at opposite sides of the braking system. Especially in cases, wherein the auxiliary braking system is arranged at a central position of the main shaft, arranging two truss supports, which may be arranged in a symmetrical manner, enables force transmission on both sides of the auxiliary brake, in particular in equal measures, in order to uniformly transmit and/or absorb braking forces resulting from an applied braking torque.

[0021] The two truss supports may be arranged at equal or similar distance to the auxiliary brake in order to provide for even distribution of transmitted forces to other components or, in other embodiments, the two truss supports may be configured different from each other and/or may be placed in diverging distances to the auxiliary brake in order to account for differing prerequisites of the passenger conveying device.

[0022] According to one embodiment the truss support may comprise a support plate, configured to brace the at least one truss support against the cross beam.

[0023] The support plate may be arranged on a side of the cross beam, in particular a side opposing to the side which the auxiliary brake and or the truss reinforcement device is arranged, such that the mounting bracket of the truss support and the support plate may encompass the cross beam to brace the truss support against the cross beam. Thus, the support plate may enlarge a force receiving structure and/or an enhanced distribution of the braking forces may be provided.

[0024] According to one embodiment the support plate may be configured to connect at least two truss supports. With that, the support plate may form a mechanical connection for the two truss supports, in particular at the opposite side of the cross beam to which the auxiliary brake or the truss reinforcement device is installed, in order to provide further stabilizing properties e.g. by means of leverage effects.

[0025] According to one embodiment the truss support may be configured to support at least one component of the braking system. For that, the truss support may comprise one or more holding members, which in particular are arranged such that one or more components of the braking system may be arranged and/or fixed thereto. These holding members may be attached to the cross beam via the truss support, e.g. by means of additional fixings or fastening elements. This may enable a simple means of installation for the auxiliary brake. In other embodiments the auxiliary brake may be installed to the cross beam and/or the main shaft independently of the truss reinforcement device.

[0026] According to one embodiment the cross beam may be arranged parallel to the main shaft. Such an arrangement allows for one or more truss supports to be installed perpendicular to, i.e. in between, the main shaft and the cross beam, thereby enabling absorption of braking or resulting forces in particular in directions in which

such forces occur respectively produce an effect.

[0027] According to one embodiment the truss reinforcement device and/or the truss support of the passenger conveying device may be configured according to an embodiment described herein. Hence, such passenger conveying device may benefit of the same advantages provided by the truss reinforcement device described herein.

[0028] According to another aspect of the present invention, a method for retrofitting a passenger conveying device is proposed, comprising steps of a) installing a braking system in the passenger conveying device, in particular in operative connection with and/or between a main shaft and a cross beam of the passenger conveying device and b) installing a truss reinforcement device according to an embodiment described herein to or in the passenger conveying device. A passenger conveying device, being equipped with a truss reinforcement device via the method proposed, may comprise and enable the effects and advantages described herein. In particular the truss reinforcement device is installed such, that at least one truss support of the truss reinforcement device rotatably seats a main shaft of a drive system of the passenger conveying device and the truss support connects the main shaft to a cross beam of a truss of the passenger conveying device. Thereby, the main shaft is mechanically supported against the cross beam such, that braking forces applied by the braking system installed between the cross beam and the main shaft may be absorbed via the truss support or the truss reinforcement device, respectively.

[0029] Further features, advantages and possible applications of the invention result from the following description in connection with the figures. In general, features of the various exemplary aspects and/or embodiments described herein may be combined with one another, unless this is clearly excluded in the context of the disclosure.

[0030] In the following part of the description, reference is made to the figures, which are presented to illustrate specific aspects and embodiments of the present invention. It is understood that other aspects may be employed and structural or logical changes may be made in the illustrated embodiments without departing from the scope of the present invention. The following description of the figures is therefore not to be understood as limiting.

[0031] Illustrating are

Fig. 1 a schematic representation of a passenger conveying device according to the present invention;

Fig. 2 a schematic representation of a truss reinforcement device for a passenger conveying device according to the present invention;

Fig. 3 a further schematic representation of a truss reinforcement device for a passenger convey-

ing device according to the present invention;
and

Fig. 4 a schematic representation of a flow diagram of an exemplary embodiment of a method 100 for retrofitting of a passenger conveying device.

[0032] In the following, identical reference symbols refer to identical or at least similar features.

[0033] Fig. 1 illustrates a schematic detail representation of an exemplary embodiment of a passenger conveying device 10 comprising an auxiliary brake 20 and a truss reinforcement device 50 described herein.

[0034] In the depicted embodiment, the passenger conveying device 10 comprises a truss, having two support walls, which are connected by at least one cross beam 12, a drive system 30 comprising a main shaft 31 being arranged between the support walls for driving a step band or pallet band. A braking system 20 is arranged between the cross beam 12 and the main shaft 31, which are parallelly aligned to each other, and is configured to apply a braking force and/ or braking torque to the main shaft 31. In the embodiment shown, the braking system 20 comprises a pawl assembly 21 affixed to the cross beam 12, which is configured to engage with a ratchet wheel 22 being mounted on the main shaft 31, in order to apply a braking force and/ or braking torque to the main shaft 31, thereby to braking and/ or arresting a step or pallet belt driven by the main shaft 31.

[0035] The truss reinforcement device 50 is arranged between the main shaft 31 and the cross beam 12 and is configured to mechanically support the main shaft 31 against the cross beam 12. Two truss supports 51 of the truss reinforcement devices 50 are arranged at opposite sides of the braking system 20 in order to disperse absorbed braking and/ or reaction forces.

[0036] Fig. 2 illustrates a schematic representation of a mounting solution of the truss reinforcement device 50 of the passenger conveying device 10 of Fig. 1 in a disassembled state.

[0037] The truss reinforcement device 50 comprises two truss supports 51, configured to rotatably seat the main shaft 31 of a drive system of the passenger conveying device 10. The rotatable mounting is accomplished by a two-part split bushing 52 in this embodiment located at a first end of a bar 53 of the truss support 51. The bar 53 connecting the bushing 52 to a mounting bracket 54 provided at a second end of the bar 53, the mounting bracket 54 being configured to rigidly connect to the cross beam 12. Thus, the truss support 51 connects the main shaft 31 to the cross beam 12 of the truss of the passenger conveying device 10. Hereby the main shaft 31 is mechanically supported against the cross beam 12 in order to absorb braking forces applied by the braking system 20 (not displayed in Fig. 2).

[0038] A support plate 55 of the truss reinforcement device 50 is configured to brace the truss support 51 against the cross beam 12. The mounting brackets 54 of

the two truss supports 51 are configured to be fixed to the support plate 55 at a predetermined distance to each other, enabling the support plate 55 to act as an additional stabilizing structural component.

[0039] In order to absorb braking forces of the auxiliary braking system 20, a holding member 56 may be provided with the truss reinforcement device 50, as to support at least one component of the braking system 20.

[0040] Fig. 3 illustrates a schematic representation of an exemplary embodiment of the truss reinforcement device 50 for the passenger conveying device 10 of Fig. 1 and Fig. 2 in an assembled state.

[0041] The bushing 52 rotatably seats the main shaft 31 at an opposite side of the bar 53 of the truss support 51. The mounting bracket 54 rigidly connects the truss support 51 to the cross beam 31, such that the main shaft 31 is mechanically supported against the cross beam 12 to absorb braking forces applied by the braking system 20 arrangeable at least partially between the cross beam 12 and the main shaft 31 and the two truss supports 51 respectively.

[0042] Fig. 4 illustrates a schematic representation of a flow diagram of an exemplary embodiment of a method 100 for retrofitting of a passenger conveying device 10 as described herein.

[0043] In a first step a) a braking system in form of an auxiliary brake 20 is installed, in particular in operative connection and between a cross beam 12 and a main shaft 31 of the passenger conveying device 10, in order to, for example impose braking forces on a main driving shaft 31 of the escalator or moving walk. In a following, concurrent or preceding step b) a truss reinforcement device 50 according to an embodiment described herein is installed in the passenger conveying device 10.

[0044] In particular, the truss reinforcement device 50 is installed such that at least one truss support 51 of the truss reinforcement device 50 rotatably seats the main shaft 31 of a drive system 30 of the passenger conveying device 10. Furthermore, the truss support 51 connects the main shaft 31 to a cross beam 12 of a truss of the passenger conveying device, in particular in a way, that the main shaft 31 is mechanically supported against the cross beam 12 in order to absorb braking forces applied or applicable by the braking system.

List of reference signs

[0045]

10	passenger conveying device
12	cross beam
20	(auxiliary) braking system
21	pawl assembly
22	ratchet wheel
30	drive system
31	main shaft
50	truss reinforcement device
51	truss support

52 bushing
 53 bar
 54 mounting bracket
 55 support plate
 56 holding member
 100 method
 a, b steps

Claims

1. Truss reinforcement device (50) for a passenger conveying device (10), comprising at least one truss support (51), configured to rotatably seat a main shaft (31) of a drive system (30) of the passenger conveying device (10) and to connect the main shaft (31) to a cross beam (12) of a truss of the passenger conveying device (10), such that the main shaft (31) is mechanically supported against the cross beam (12) to absorb braking forces applied by a braking system (20) arrangeable between the cross beam (12) and the main shaft (31). 15
2. Truss reinforcement device (50) according to claim 1, the truss support (51) comprising a bushing (52) or bearing configured to rotatably seat the main shaft (31). 25
3. Truss reinforcement device (50) according to at least one of the preceding claims, the truss support comprising a mounting bracket (54) configured to rigidly connect to the cross beam (12). 30
4. Truss reinforcement device (50) according to claim 2 and 3, comprising a bar (53) comprising the bushing (52) or bearing at a first end and the mounting bracket (54) at a second end. 35
5. Truss reinforcement device (50) according to at least one of the preceding claims, comprising at least two truss supports (51), configured to be arranged at opposite sides of the braking system (20). 40
6. Truss reinforcement device (50) according to at least one of the preceding claims, comprising a support plate (55), configured to brace the at least one truss support (51) against the cross beam (12). 45
7. Truss reinforcement device (50) according to at least one of the preceding claims, wherein the support plate (55) is configured to connect at least two truss supports (51). 50
8. Truss reinforcement device (50) according to at least one of the preceding claims, configured to support at least one component of the braking system (20). 55
9. Passenger conveying device (10), comprising a

truss, having two support walls, which are connected by at least one cross beam (12), a drive system (20) comprising a main shaft (31) being arranged between the support walls for driving a step band or pallet band, wherein a braking system (20) arranged between the cross beam (12) and the main shaft (31) is configured to apply a braking force to the main shaft (31) and a truss reinforcement device (50) configured to mechanically support the main shaft (31) against the cross beam (12).

10. Passenger conveying device (10) according to claim 9, wherein the cross beam (12) is arranged parallel to the main shaft (31).
11. Passenger conveying device (10) according to at least one of the claims 9 or 10, wherein the truss reinforcement device (50) is configured according to at least one of the claims 1 to 7.
12. Method (100) for retrofitting a passenger conveying device (10), comprising the following steps:
 - a) installing a braking system (20) in the passenger conveying device (10), in particular in operative connection with a main shaft (31) and a cross beam (12) of the passenger conveying device (10), and
 - b) installing a truss reinforcement device (50) according to at least one of the claims 1 to 8 in the passenger conveying device (10).
13. Method (100) according to claim 12, wherein the truss reinforcement device (50) is installed such, that at least one truss support (51) of the truss reinforcement device (50) rotatably seats the main shaft (31) of a drive system (30) of the passenger conveying device (10) and connects the main shaft (31) to the cross beam (12) of a truss of the passenger conveying device (10) and the main shaft (31) is mechanically supported against the cross beam (12) to absorb braking forces applicable by the braking system (20).

Fig. 1

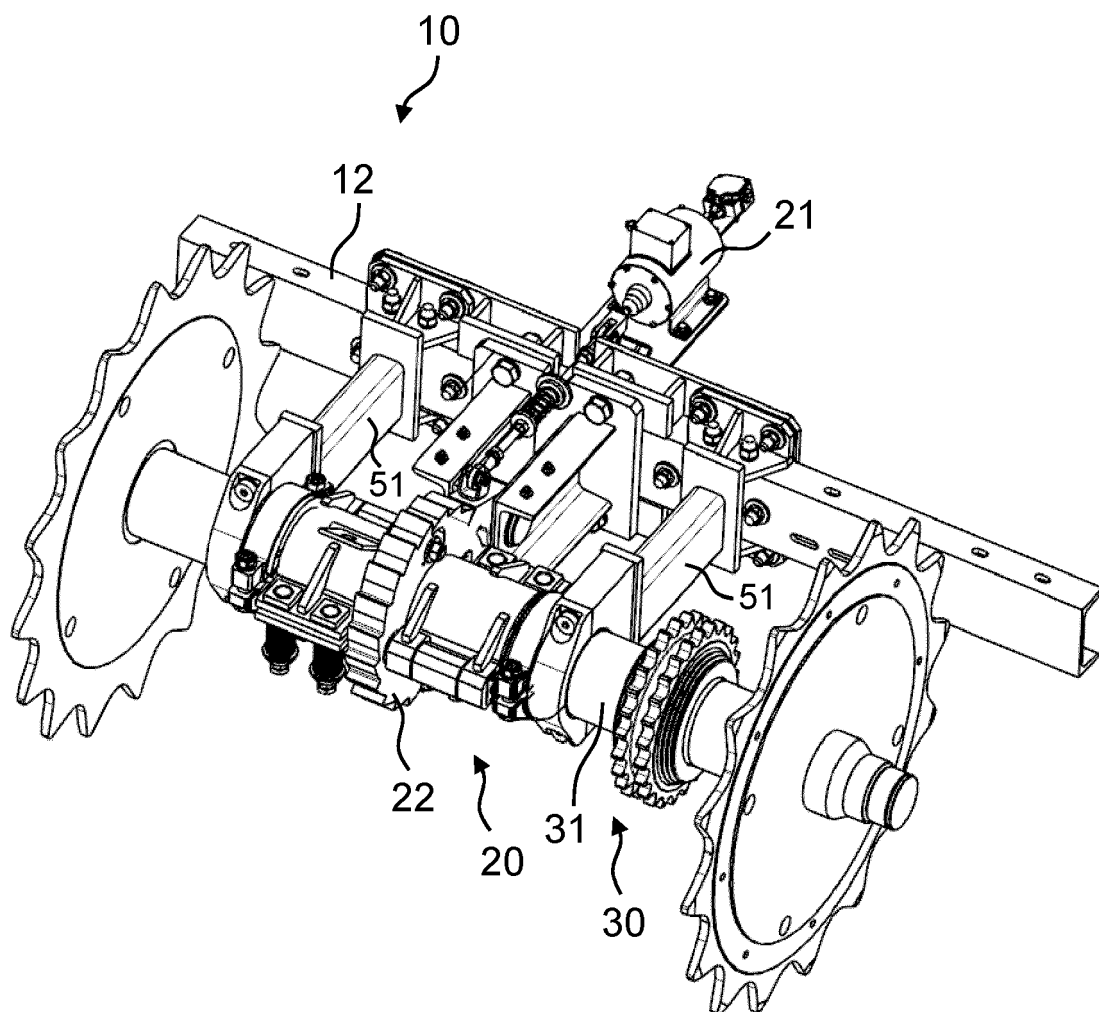


Fig. 2

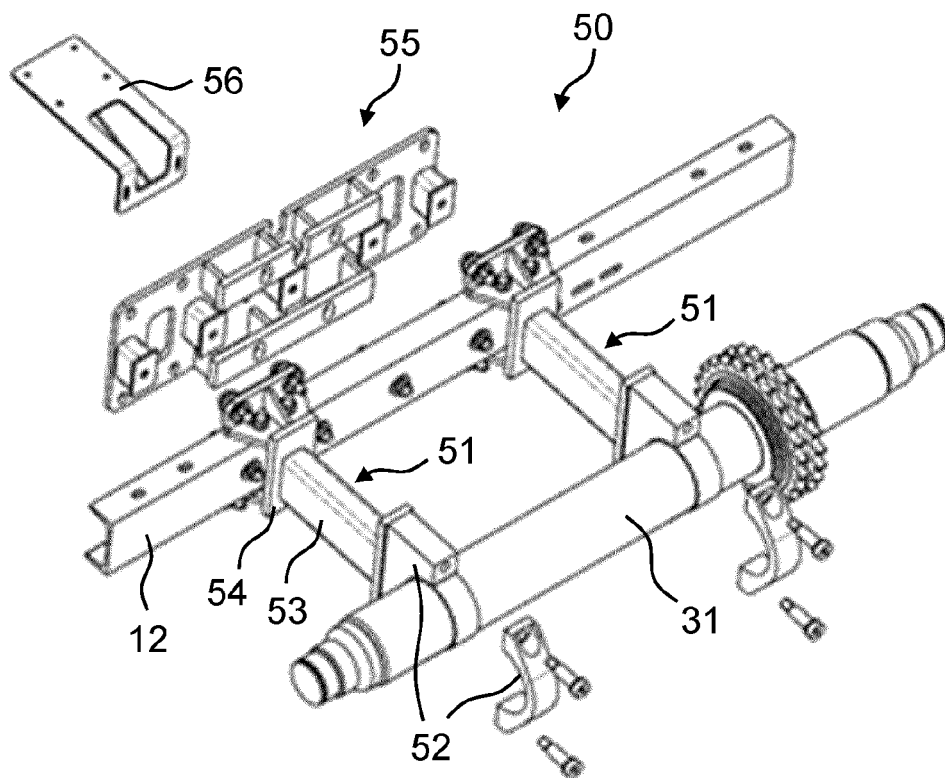


Fig. 3

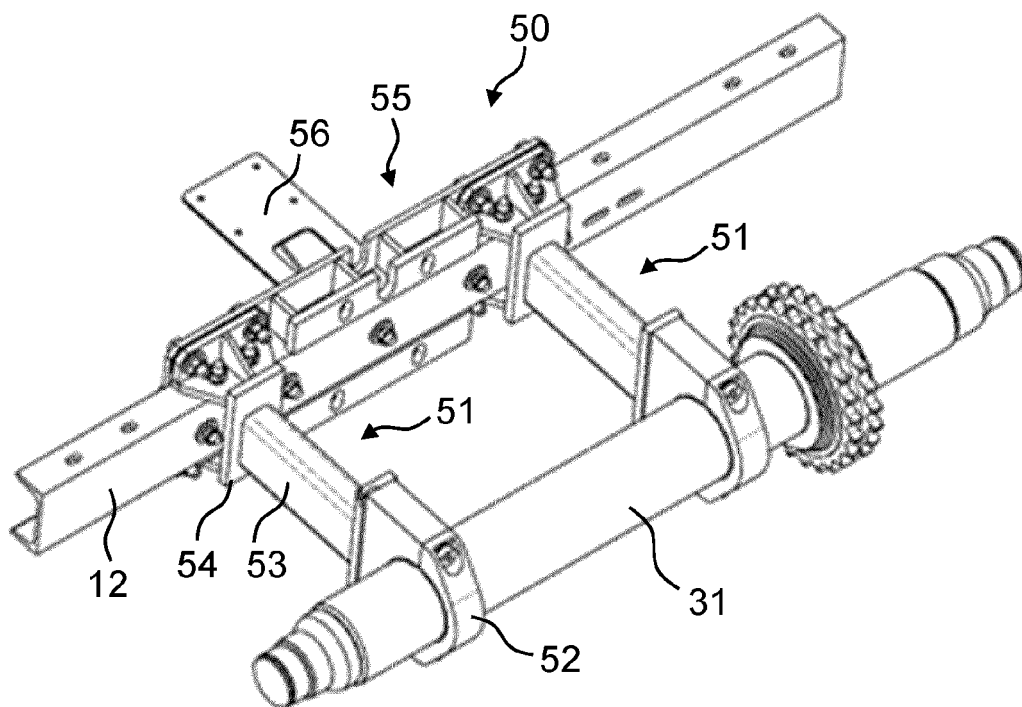
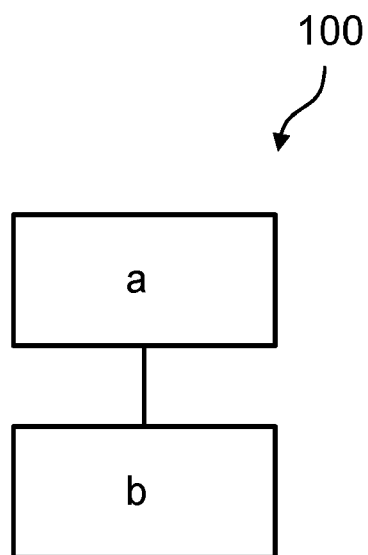


Fig. 4





EUROPEAN SEARCH REPORT

Application Number

EP 23 38 2009

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	KR 2022 0028738 A (HPNRT CO LTD [KR]) 8 March 2022 (2022-03-08)	1-11	INV. B66B23/02
Y	* figures 1-3 *	12, 13	
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A	* paragraphs [0055] - [0058], [0071] - [0131] * * figures 3-6 *	12, 13	
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			TECHNICAL FIELDS SEARCHED (IPC)
			B66B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 May 2023	Examiner Dijoux, Adrien
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 23 38 2009

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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