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(54) DEVICE FOR LIFTING LOADS

(57) Device for lifting loads (1), comprising a support frame (2), a fixed tube (3), mechanically fixed to the support frame (2), a movable tube (4), telescopically engaged with the fixed tube (3), and a lifting platform (5), fixed to the movable tube (4). The device also comprises first thrust means (6) acts thrustingly against the movable tube (4) in order to bring it towards a raised position, and a manual actuator (7) actuatable in order to move, by means of drive means (8), the movable tube (4) towards a lowered position. The device for lifting loads (1) also comprises a compensation device (11) mounted on the movable tube (4), which comprises second elastic thrust means (12) mechanically connected to the movable tube (4) in order to aid the lowering of the latter when the operator actuates the manual actuator (7).

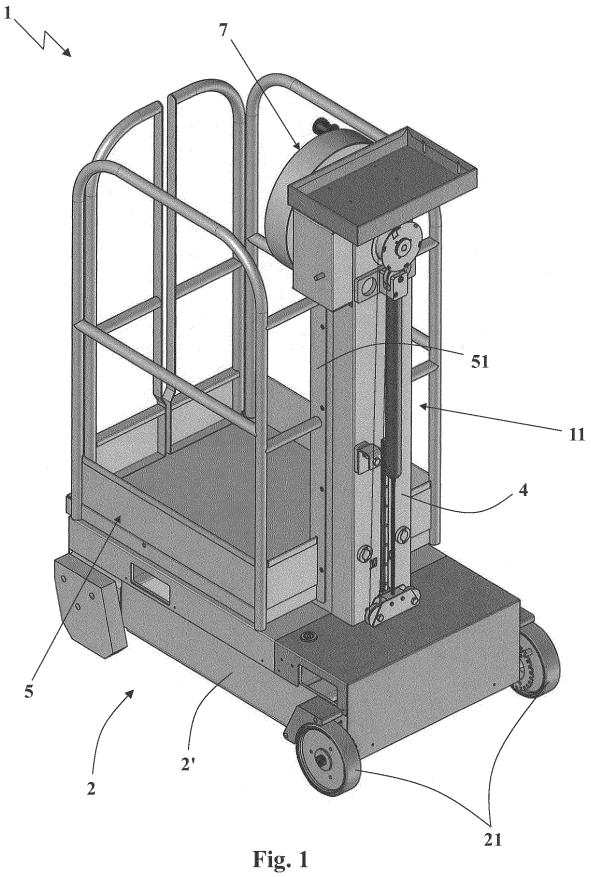

Fig. 1

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Description

Field of application

[0001] The present invention regards a device for lifting loads according to the preamble of the independent claim No. 1.

[0002] The present device for lifting loads is advantageously intended to be used for lifting people, in particular as a work platform with variable height.

[0003] The device for lifting loads, object of the present invention, is intended to be employed in applications in which it is necessary to reach high heights, for example in order to execute maintenance works, or for example in the case of vertical warehouses in business premises or in companies.

[0004] The present lifting device is therefore inserted in the industrial field of production of industrial lifts, in particular for lifting operators.

State of the art

[0005] The devices for lifting loads are usually used for allowing the lifting of a load or a person from a lowered position, in which the load or the person is placed substantially at the ground level, to a position, in which the load or the person is lifted in order to allow it/him/her to reach a point that is raised with respect to the ground.

[0006] For example, known from the patent No. EP 2828193 and from the patent No. EP 3620245 are devices for lifting loads which comprise a support frame, which is usually abutted against the ground and is for example movable by means of wheels, and a pair of telescopically engaged tubes, including a fixed tube, which is fixed to the support frame, and a movable tube, which is slidably engaged with the fixed tube and is movable into lifting and lowering position with respect to the latter.

[0007] In addition, the lifting device comprises a gas spring, which is placed as a mechanical connection between the fixed tube and the movable tube and acts thrustingly against the movable tube in order to lift if from a lowered position, in which it is placed in proximity to the ground, towards a raised position, in which it is placed lifted and spaced from the ground itself.

[0008] The devices for lifting loads of known type described briefly above have proven unsuitable for reaching high heights, since in particular the means for moving the movable tube are subjected to particularly intense shear forces.

[0009] In order to at least partly overcome this drawback, a device for lifting loads was developed which allow reaching high use heights, described for example in the Italian patent application IT 102020000031097.

[0010] In particular, the latter device of known type comprises a manual actuator with crank mounted on the lifting platform, and drive means which mechanically connect the manual actuator to the fixed tube, in a manner such that an operator, by actuating the manual actuator, can bring the movable tube back from the raised position to the lowered position.

[0011] More in detail, the drive means comprise a pulley mounted on the movable tube, connected to the manual actuator and provided with a windable cable having a free end fixed to the fixed tube, in a manner such that the operator, by acting on the manual actuator, can actuate the pulley to wind the cable therearound, forcing the lowering of the movable tube.

[0012] In addition, the drive means comprise a speed reducer interposed between the manual actuator and the pulley, in order to allow the operator to actuate the pulley with less force.

[0013] However, even the device for lifting loads described in the patent application IT 102020000031097 has proven susceptible of improvements, above all for lifting very heavy loads.

[0014] Indeed, for such use conditions, the lifting device must be provided with gas springs that develop a very high thrust force (e.g. 2000-3000 N).

[0015] This involves that the operator, also in the presence of the speed reducer, must still exert a considerable force in order to activate in rotation the manual actuator so as to bring the movable tube into the lowered position, the operator having to overcome the force of the gas springs.

[0016] A further drawback lies in the fact that the gas springs can determine an overly high ascending speed of the movable tube in the event in which the weight loaded on the platform is much lower than the maximum flow rate, with the risk for example of making the operator placed on the platform lose his/her balance.

Presentation of the invention

[0017] In this situation, the problem underlying the present invention is therefore that of overcoming the drawbacks manifested by the above-described solutions of known type, by providing a device for lifting loads which allows lifting particularly heavy loads and simultaneously is easily actuatable by an operator.

[0018] A further object of the present invention is to provide a device for lifting loads which does not require the operator to expend high forces in order to bring the device back into the lowered position.

[0019] A further object of the present invention is to provide a device for lifting loads which is completely safe during the operation thereof.

[0020] A further object of the present invention is to provide a device for lifting loads which is simple and inexpensive to attain.

[0021] A further object of the present finding is to provide a device for lifting loads which is entirely reliable in operation.

Brief description of the drawings

[0022] The technical characteristics of the invention,

according to the aforesaid objects, are clearly seen in the below-reported claims and the advantages thereof will be more evident from the following detailed description, made with reference to the enclosed drawings, which represent a merely exemplifying and non-limiting embodiment of the invention, in which:

- figure 1 shows a perspective view of the device for lifting loads, object of the present invention, placed in a lowered position;
- figure 2 shows a perspective view of the device for lifting loads of figure 1, placed in a raised position;
- figure 3 shows a rear view of the device for lifting loads of figure 1;
- figure 4 shows a perspective view of a detail of the device for lifting loads of figure 1, relative to a compensation device;
- figures 5 and 6 show two different details of the compensation device of figure 4;
- figure 7 shows a perspective view of the detail illustrated in figure 5, partially in exploded view and with several parts removed in order to better illustrate other parts;
- figure 8 shows a perspective view of the detail illustrated in figure 6, with several parts removed in order to better illustrate other parts;
- figure 9 shows a further detail of the present lifting device, relative to drive means and to a manual actuator of the lifting device itself, with several parts removed in order to better illustrate other parts and;
- figure 10 shows a sectional view of the detail of figure 9, according to trace SX-SX of figure 9 itself.

Detailed description of a preferred embodiment

[0023] With reference to the enclosed drawings, reference number 1 indicates the device for lifting loads, object of the present invention.

[0024] The device for lifting loads 1 according to the present invention is intended to be employed for lifting loads between a lowered position, in which such loads are placed in proximity to the ground, and a raised position, in which they are placed raised from the ground itself, for example in order to be placed at a point to be reached that is lifted above the ground, e.g. in the case of raised shelves in warehouses.

[0025] Preferably, the present device 1 is arranged for lifting people, and is advantageously employed in an industrial setting, for example for allowing the execution of operations at high heights from the ground.

[0026] In accordance with the invention, the device for lifting loads 1 comprises a support frame 2, which is preferably at least partially made of metal material and is susceptible of being abutted against the ground.

[0027] The support frame 2 advantageously comprises a plurality of wheels 21 in order to be abutted and easily moved on the ground.

[0028] Preferably, the support frame 2 comprises at least one abutment base 2' (on which the wheels 21 are advantageously mounted), which is mainly extended on a reference plane intended to be placed parallel to the ground, in particular horizontally.

[0029] The device for lifting loads 1 also comprises a fixed tube 3, preferably metallic, which is mechanically fixed to the support frame 2 and is advantageously and projecting extended upward from the latter, in particular away from the abutment base 2' and orthogonal to the latter.

[0030] In addition, the device for lifting loads 1 comprises at least one movable tube 4, telescopically engaged with the fixed tube 3.

[0031] Hereinbelow with the term "tube", it will be intended a substantially hollow element, provided with a mainly axial extension and provided with polygonal or circular plan section.

[0032] Advantageously, the fixed tube 3 and the movable tube 4 are extended, parallel to each other, along an extension axis X, preferably orthogonal to the reference plane of the abutment base 2' and in particular vertical.

[0033] As described in detail hereinbelow, in accordance with the preferred embodiment, illustrated in the enclosed figure 2, multiple movable tubes 4 are provided for and in particular two movable tubes (including the movable tube 4 and a further intermediate movable tube 15) are provided in order to reach higher heights. In the immediate continuation of the description, reference will be made to the movable tube 4 for the sake of description simplicity, however it being intended that multiple movable tubes can be present. In accordance with the preferred embodiment illustrated in the enclosed figures, the tubes 3, 4 are hollow elements that are extended coaxially along the extension axis X and adapted to slide inside each other.

[0034] Of course, without departing from the protective scope of the present patent, the tubes 3, 4 might not be coaxial and can for example be extended along the extension axis X parallel to and side-by-side each other.

[0035] In accordance with the preferred embodiment, the fixed tube 3 is provided with a section of smaller size with respect to that of the movable tube 4 so as to be slidably placed within the movable tube 4. Of course, without departing from the protective scope of the present invention, it is also possible to provide that the fixed tube 3 be provided with a section of greater size than that of the movable tube 4, hence providing that the movable tube 4 be susceptible of sliding within the fixed tube 3.

[0036] The device for lifting loads 1 also comprises a lifting platform 5, which is fixed to the movable tube 4 and is arranged for supporting a load, such as for example a person.

[0037] In accordance with the embodiment illustrated in figures 1 and 2, the lifting platform 5 comprises an anchorage bracket 51, which is fixed to the movable tube 4. Preferably, the anchorage bracket 51 is substantially C-shaped and is placed to partially enclose the movable

tube 4.

[0038] Advantageously, the lifting platform 5 comprises an abutment base 52, placed substantially orthogonal to the extension axis X of the movable tube 4 and arranged for receiving a load and/or a person in abutment.

[0039] Preferably, the lifting platform 5 also comprises at least one perimeter parapet 53, which is projectingly extended from the abutment base 52, in order to delimit a safety cage for the load and/or the person abutted against the abutment base 52.

[0040] As anticipated above, in accordance with the embodiment illustrated in the enclosed figures, the device 1 comprises two movable tubes, of which one is the movable tube 4, which is fixed to the lifting platform 5, and the other is the intermediate movable tube 15, which is interposed, preferably telescopically, between the fixed tube 3 and the movable tube 4. Advantageously, the intermediate movable tube 15 is at least partially housed within the movable tube 4 and is advantageously coaxial with the fixed and movable tube 3, 4.

[0041] The lifting device 1 also comprises first extensible thrust means 6, which are placed as a mechanical connection between the fixed tube 3 and the movable tube 4. Such first thrust means 6 thrustingly act against the movable tube 4 in order to move it, along a lifting direction Y (preferably parallel to the extension axis X), from a lowered position, in which the movable tube 4 is adapted to be placed in proximity to the ground, to a raised position, in which the movable tube 4 is adapted to be placed lifted and spaced from the ground.

[0042] In particular, the thrust of the first thrust means 6 induces the sliding of the at least one movable tube 4 along the fixed tube 3 and the consequent lifting of the same movable tube 4 and of the lifting platform 5 towards the raised position.

[0043] Preferably, in the lowered position, the movable tube 4 (with the lifting platform 5) is placed at the abutment base 2', and in the raised position the movable tube 4 is placed spaced from the abutment base 2' itself.

[0044] Advantageously, the first thrust means 6 comprise at least one gas spring, which is well-known to the man skilled in the art and therefore will not be described in detail hereinbelow.

[0045] Advantageously, the first thrust means 6 comprise a first thrust element 61 (for example comprising a first gas spring), placed as a mechanical connection between the fixed tube 3 and the intermediate movable tube 15, and a second thrust element 62 (for example comprising a second gas spring), placed as a mechanical connection between the movable tube 4 and the intermediate movable tube 15.

[0046] The lifting device 1 also comprises at least one manual actuator 7 accessible from the lifting platform 5 in order to be manually actuated by an operator and mechanically connected to the movable tube 4.

[0047] In particular, the manual actuator 7 is mounted (directly or indirectly) on the movable tube 4 and is supported by the latter at the lifting platform 5, in order to be easily actuated by the operator placed on the lifting platform 5 itself.

[0048] The device for lifting loads 1 also comprises drive means 8, which are mechanically and kinematically connected to the manual actuator 7 and to the fixed tube 3.

[0049] More in detail, the drive means 8 advantageously allow, following the actuation of the manual actuator 7, lowering the lifting platform 5 itself against the action of the first thrust means 6.

[0050] With reference to figure 10, the aforesaid drive means 8 comprise a drive shaft 9 mechanically connected to the manual actuator 7, and a first motion transformation mechanism 10 placed as a kinematic connection between the drive shaft 9 and the fixed tube 3.

[0051] The aforesaid first motion transformation mechanism 10 is arranged for executing a motion conversion between a rotary motion associated with the drive shaft 9 and a linear motion associated with the movable tube 4, so as to kinematically connect the movement of the latter, as discussed in detail hereinbelow.

[0052] The drive shaft 9 is actuatable, by means of the manual actuator 7, to rotate axially around a rotation axis W, preferably orthogonal to the extension axis X of the tubes 3, 4. More in detail, the drive shaft 9 is actuatable to rotate in a first rotation direction R' in order to move, through the first motion transformation mechanism 10, the movable tube 4 towards the lowered position.

[0053] In addition, when the movable tube 4 is moved towards the raised position by the first thrust means 6, the movable tube 4 is adapted to rotate, through the first motion transformation mechanism 10, the drive shaft 9 in a second rotation direction R" opposite the aforesaid first rotation direction R'.

[0054] In accordance with the idea underlying the present invention, the device for lifting loads 1 comprises a compensation device 11 mounted on the movable tube 4.

[0055] More in detail, the aforesaid compensation device 11 comprises second elastic thrust means 12, which are mechanically connected to the movable tube 4 and are extensible in an elastic manner along an extension direction Z.

[0056] The compensation device 11 also comprises a second motion transformation mechanism 13, which is placed as a kinematic connection between the second thrust means 12 and the drive shaft 9.

[0057] The aforesaid second motion transformation mechanism 13 is arranged for executing a motion conversion between a rotary motion associated with the drive shaft 9 and a linear motion associated with the second thrust means 12, so as to kinematically connect the movement of the drive shaft 9 and of the second thrust means 12 themselves.

[0058] In addition, the second thrust means 12 are loaded in order to apply, by means of the second motion transformation mechanism 13, a compensation torque to the drive shaft 9 which tends to rotate the drive shaft

9 in the first rotation direction R', in order to facilitate the lowering of the movable tube 4 when the operator actuates the manual actuator 7 in order to lower the lifting platform 5.

[0059] In particular, the compensation torque generated by the second thrust means 12 on the drive shaft 9, inducing the latter to rotate in the first rotation direction R', by means of the second motion transformation mechanism 13, applies a force on the movable tube 4 that tends to make the latter descend towards the lowered position.

[0060] In this manner, the compensation device 11 advantageously allows reducing the torque necessary for moving the movable tube 4 through the manual actuator 7 so as to allow lowering the lifting platform 5 with a reduced force of the operator.

[0061] Preferably, the aforesaid second thrust means 12 are loaded (e.g. by means of compression), thus accumulating mechanical energy, when the movable tube 4 is moved towards the raised position by the first thrust means 6 and the drive shaft 9 rotates in the second rotation direction R". Advantageously, the second thrust means 12 are unloaded, releasing the accumulated mechanical force, when the operator actuates the manual actuator 7 in order to move the movable tube 4 towards the lowered position, hence aiding the action of the operator.

[0062] Advantageously, the compensation torque that the second thrust means 12 determine on the drive shaft 9 is lower than a torque (having opposite sense) determined by the first thrust means 6 on the drive shaft 9 itself, in order to allow the lifting of the lifting platform 5.

[0063] Suitably, the second thrust means 12 are configured for being moved in compression when the movable tube 4 is moved towards the raised position (being loaded), and in order to be moved in extension when the movable tube 4 is moved towards the lowered position (being at least partially unloaded).

[0064] Advantageously, the extension direction Z, along which the second thrust means 12 are extensible in an elastic manner, is substantially parallel to the lifting direction Y, along which the first thrust means 6 thrustingly act against the movable tube 4.

[0065] Preferably, the second thrust means 12 comprise at least one gas spring 12'. In particular, such gas spring 12' has an axis (defined by the aforesaid extension direction Z) parallel to the lifting axis Y and, preferably, comprises a first component 12A (e.g. a jacket) fixed to the movable tube 4 and a second component 12B (e.g. a stem) slidably mounted on the first component 12A and engaged with the second motion transformation mechanism 13 (as described in detail hereinbelow).

[0066] Advantageously, the gas spring 12' of the second thrust means 12 is arranged for being contracted when the first and the second gas spring of the first thrust means 6 are extended, moving the tube 4 towards the raised position. When the movable tube 4 is brought towards the lowered position, the gas spring 12' of the second thrust means 12 is arranged for being extended, contrary to the first and to the second gas spring of the first thrust means 6, which are contracted, being loaded.

[0067] Preferably, the compensation device 11 is placed on an external surface of the movable tube 4, in particular on a side of the latter opposite that on which the manual actuator 7 is placed.

[0068] Advantageously, the compensation device comprises a fixing bracket 16, which is fixed to the movable tube 4 and carries the second thrust means 12 mounted thereon, and in particular carries fixed thereto the first component 12A of the gas spring 12' of the latter.

[0069] Advantageously, with reference to figure 4, the compensation device 11 comprises at least one guide rail 132, which is placed on the movable tube 4 and is extended along the extension direction Z, in particular parallel to the lifting direction Y.

[0070] Preferably, the second component 12B of the gas spring 12' is slidably constrained to the guide rail 132 which guides the movement thereof along the extension direction Z. Suitably, the guide rail 132 is rigidly fixed to the external surface of the movable tube 4 and, in particular, is placed behind the gas spring 12' of the second thrust means 12. Advantageously, the compensation device 11 comprises a trolley 133, which is slidably mounted on the guide rail 132 and is connected to the second thrust means 12. Preferably, with reference for example to figures 4, 6 and 8, the trolley 133 is fixed to the second component 12B of the gas spring 12' in order to slidably constrain such second component 12B to the guide rail 132.

[0071] Advantageously, the second thrust means 12 are loaded in order to slide the trolley 133 along the guide rail 132 in a first sliding direction V1 (preferably directed downward). Following the movement in such first sliding direction V1, the trolley 133 actuates the second motion transformation mechanism 13 in order to apply the aforesaid compensation torque to the drive shaft 9 in order to aid the lowering of the movable tube 4.

[0072] In particular, the trolley 133 is actuated to be moved in the first sliding direction V1 when the second thrust means 12 (and in particular their gas spring 12') is moved in extension (when the movable tube 4 is lowered).

[0073] Preferably, the trolley 133 is connected, by means of the second motion transformation mechanism 13, to the drive shaft 9. When the drive shaft 9 is actuated to rotate in the second rotation direction R", this is adapted to slide, through the second motion transformation mechanism 13, the trolley 133 in a second sliding direction V2 opposite the first sliding direction V1.

[0074] More in detail, when the movable tube 4 is moved towards the raised position, and hence the drive shaft 9 is actuated to rotate in the second rotation direction R", the latter, by means of the second motion transformation mechanism 13, forces the trolley 133 to slide along the guide rail 132 in the second sliding direction V2, in order to overcome the elastic force of the second

thrust means 12.

[0075] In particular, the trolley 133 moved in the aforesaid second sliding direction V2 brings the second thrust means 12 to load, for example by moving them in compression.

[0076] Advantageously, with reference to figures 3-6, the second motion transformation mechanism 13 comprises at least one first flexible element 131, which is provided with a first end 131' connected to the drive shaft 9 and is preferably windable around the latter.

[0077] Preferably, the first flexible element 131 is a first metal cable, but for such purpose it is possible to provide for the use of a different flexible element, such as for example a chain or a belt.

[0078] With the term "flexible" it is intended the capacity of the flexible element 131 to be bend in order to be wound, for example around the drive shaft 9, independent of the properties of the material constituting the flexible element 131.

[0079] Advantageously, the first flexible element 131 is mechanically engaged with the second thrust means 12 in a manner such to transmit the motion between the latter and the drive shaft 9.

[0080] Preferably, the first flexible element 131 is mechanically engaged with the trolley 133. Advantageously, the second motion transformation mechanism 13 comprises a first winding pulley 14, which is connected to the drive shaft 9 in order to connect the latter to the first flexible element 131.

[0081] Preferably, in accordance with the embodiment illustrated in the enclosed figures, the first winding pulley 14 is mounted coaxial on the drive shaft 9 and is arranged for being rotated around the rotation axis W of the latter. For example, the first winding pulley 14 can be directly fixed on the drive shaft 9.

[0082] Alternatively, without departing from the protective scope of the present invention, between the drive shaft 9 and the first winding pulley 14, various motion drive means can be interposed (with mechanical connection), such as for example further drive shafts or transmission systems.

[0083] Preferably, the first end 131' of the first flexible element 131 is mechanically connected (e.g. fixed) to the first winding pulley 14, in a manner such that the first flexible element 131 is windable around the first winding pulley 14 itself.

[0084] More in detail, the first flexible element 131 is actuatable to be unwound on the first winding pulley 14 when the drive shaft 9 rotates in the first rotation direction R' (when the movable tube 4 is lowered), and to be wound on the first winding pulley 14 when the drive shaft 9 rotates in the second rotation direction R" (when the movable tube 4 is lifted).

[0085] In this manner, in particular, the first flexible element 131, through the unwinding and winding around the winding pulley 14, forces the trolley 133 to slide on the guide rail 132, allowing the second thrust means 12 to be unloaded and loaded, respectively. Advantageously, with reference to figures 3 and 6, the second motion transformation mechanism 13 comprises a first transmission pulley 17. More in detail, the first transmission pulley 17 intercepts the first flexible element 131 between the first end 131' connected to the drive shaft 9 and the second thrust means 12, and defines a substantially U-shaped first bend 111 of the first flexible element 131.

[0086] Preferably, the first transmission pulley 17 is positioned, along the extension direction Z, at a fourth height of the drive shaft 9 and of the first winding pulley 14, in particular defining the first bend 111 that defines a first transmission of the flexible element 131 from bottom to top.

[0087] Advantageously, the first transmission pulley 17 is mounted on the trolley 133, preferably in a lateral portion of the trolley 133 with respect to the extension direction Z.

[0088] Advantageously, the second motion transformation mechanism 13 comprises a second transmission pulley 18, which is mounted on the movable tube 4, and is positioned in particular at a higher height of the first transmission pulley 17.

[0089] Advantageously, the second transmission pulley 18 is placed substantially along the extension direction Z, more in detail between the second thrust means 12 and the first winding pulley 14.

[0090] In addition, the second motion transformation mechanism 13 advantageously comprises a third transmission pulley 19, which is mounted on the trolley 133. Preferably, the third transmission pulley 19 is placed side-by-side the first transmission pulley 17 on the trolley 133, preferably on a side opposite the latter with respect to the extension direction Z.

[0091] In particular, the first and the third transmission pulley 17, 19 are placed on two lateral portions of the trolley 133, preferably in distal position and equidistant with respect to the guide rail 132.

[0092] Advantageously, the second transmission pulley 18 intercepts the first flexible element 131 between the first transmission pulley 17 and the third transmission pulley 19 and defines a substantially U-shaped second bend 222 of the first flexible element 131 with opposite direction with respect to the first bend 111.

[0093] Preferably, the third transmission pulley 19 intercepts the first flexible element 131, defining a substantially U-shaped third bend 333 with opposite direction with respect to the second bend 222.

[0094] In particular, the second bend 222 defines a second transmission of the flexible element 131 from top to bottom, and the third bend 333 defines a third transmission of the flexible element 131 from bottom to top.

[0095] Advantageously, the first flexible element 131 comprises a second end 131" fixed to the movable tube 4. With the claimed expression "fixed to the movable tube" it must be intended fixed to any one part of the movable tube 4 or to a part integral with the movable tube 4 itself, such as for example the second thrust element 62.

[0096] In accordance with such embodiment, the first flexible element 131 is taut (following the action of the second thrust means 12) between its second end 131" integral with the movable tube 4 and its first end 131' at which the first flexible element 131 is windable around the first winding pulley 14.

[0097] In operation, when, following the extension of the gas spring 12' of the second thrust means 12, the trolley 133 is moved in the first sliding direction V1 along the guide rail 132, the first flexible element 131, by means of the transmission pulleys 17, 18, 19, is brought to be unwound from the first winding pulley 14 (in order to facilitate the rotation of the drive shaft 9 in the first rotation direction R').

[0098] When, following the rotation of the drive shaft 9 in the second rotation direction R", the first flexible element 131 is wound around the first winding pulley 14, the trolley 133, by means of the transmission pulleys 17, 18, 19, is brought to slide in the second sliding direction V2 along the guide rail 132, in order to load the gas spring 12' of the second thrust means 12.

[0099] Advantageously, with reference to the example of figure 10, the drive shaft 9 is connected to the manual actuator 7 by means of further motion drive means, such as for example a speed reducer 92.

[0100] Alternatively, in accordance with a non-illustrated embodiment, the drive shaft 9 is directly connected to the manual actuator 7.

[0101] Preferably, the manual actuator 7 is of shank type and comprises an inlet shaft 91 rotatably mounted on the movable tube 4 and mechanically connected to the drive shaft 9, for example by means of the speed reducer 92.

[0102] Suitable, the inlet shaft 91 has axis parallel to the rotation axis W of the drive shaft, and is in particular placed coaxially with the latter.

[0103] Advantageously, the manual actuator 7 comprises a rotary element 71, for example in disc form, which is rotatably connected to the inlet shaft 91 in order to rotate it and is provided with a handle 72, which is placed in radially distal position from the inlet shaft 91, and can be gripped by an operator in order to rotate the rotary element 71 and the inlet shaft 91.

[0104] Advantageously, in addition, the handle 72 is susceptible of being axially moved between a blocking position in order to prevent the rotation of the rotary element 71, and a release position for allowing the rotation of the rotary element 71. In particular, for such purpose, the manual actuator 7 is provided with safety means adapted to allow the aforesaid blocking and releasing of the rotary element 71, described in detail for example in the patent application IT 102020000031097 from page 13 line 12 to page 16 line 1.

[0105] Preferably, the first motion transformation mechanism 10, which transforms the rotary motion of the drive shaft 9 into the linear motion of the movable tube 4 (and vice versa), comprises a second flexible element 101 (such as a second cable), provided with a first end 102 mechanically connected to the drive shaft 9 and with a second end 103 connected (and in particular fixed) to the fixed tube 3.

[0106] Advantageously, the first motion transformation mechanism 10 also comprises a second winding pulley 81, which is fixed to the first end 102 of the second flexible element 101.

[0107] Advantageously, the second winding pulley 81 is connected to the drive shaft 9, preferably mounted thereon, and is arranged for being rotatably constrained to the drive shaft 9 itself.

[0108] In operation, when the first thrust means 6 move the movable tube 4 towards the raised position, the second flexible element 101 is unwound from the second winding pulley 81 carrying the latter and hence the drive shaft 9 to rotate in the second rotation direction R".

[0109] When, following the actuation by the operator of the manual actuator 7, the drive shaft 9 is brought to rotate in the first rotation direction R', the second flexible element 101 is wound around the second winding pulley 81, forcing the movable tube 4 to be lowered towards the lowered position.

[0110] As mentioned above, the second thrust means 12 of the compensation device 11, generating the aforesaid compensation torque on the drive shaft 9, aid the rotation of the latter in the first rotation direction R', ensuring that the operator can exert lower force on the manual actuator 7 for bringing the movable tube 4 towards the lowered position in order to lower the lifting platform 5.

[0111] The invention thus conceived therefore attains the pre-established objects.

Claims

1. Device for lifting loads (1), which comprises:

- a support frame (2), susceptible of being abutted against the ground;
- a fixed tube (3), mechanically fixed to said support frame (2);
- at least one movable tube (4), telescopically engaged with said fixed tube (3);
- a lifting platform (5), fixed to said movable tube (4) and arranged for supporting a load;
- first extensible thrust means (6), which are placed as a mechanical connection between said fixed tube (3) and said movable tube (4), and thrustingly act against said movable tube (4) in order to move it, along a lifting direction (Y), from a lowered position, in which said movable tube (4) is adapted to be placed in proximity to the ground, towards a lifted position, in which said movable tube (4) is adapted to be placed lifted and spaced from the ground;
- at least one manual actuator (7) accessible from said lifting platform (5) and mechanically connected to said movable tube (4);

- drive means (8) mechanically kinematically connected to said manual actuator (7) and to said fixed tube (3) and comprising:

  • a drive shaft (9) mechanically connected to said manual actuator (7);
  • a first motion transformation mechanism (10), placed as a kinematic connection between said drive shaft (9) and said fixed tube (3), and arranged for executing a motion conversation between a rotary motion associated with said drive shaft (9) and a linear motion associated with said movable tube (4);

wherein said drive shaft (9) is actuatable by means of said manual actuator (7) to rotate in a first rotation direction (R') in order to move, through said first motion transformation mechanism (10), said movable tube (4) towards said lowered position, and wherein said movable tube (4), when it is moved towards said lifted position by said first thrust means (6), is adapted to rotate, through said first motion transformation mechanism (10), said drive shaft (9) in a second rotation direction (R") opposite said first rotation direction (R');
characterized in that said device for lifting loads (1) comprises a compensation device (11) mounted on said movable tube (4) and comprising:

- second elastic thrust means (12), which are mechanically connected to said movable tube (4) and are extensible in an elastic manner along an extension direction (Z);
- a second motion transformation mechanism (13), placed as a kinematic connection between said second thrust means (12) and said drive shaft (9), and arranged for executing a motion transformation between a rotary motion associated with said drive shaft (9) and a linear motion associated with said second thrust means (12);

wherein said second thrust means (12) are loaded in order to apply, by means of said second motion transformation mechanism (13), to said drive shaft (9), a compensation torque that tends to rotate said drive shaft (9) in said first rotation direction (R').

2. Device for lifting loads (1) according to claim 1, **characterized in that** said extension direction (Z), along which said second thrust means (12) are extensible in an elastic manner, is substantially parallel to said lifting direction (Y), along which said first thrust means (6) act thrustingly against said movable tube (4).

3. Device for lifting loads (1) according to claim 2, **characterized in that** said compensation device (11) comprises:

- at least one guide rail (132), which is placed on said movable tube (4) and is extended along said extension direction (Z);
- at least one trolley (133) which is slidably mounted on said guide rail (132), is connected to said second thrust means (12) which are loaded in order to slide said trolley (133) along said guide rail (132) in a first slide direction (V1), and is connected, by means of said second motion transformation mechanism (13), to said drive shaft (9), which, when it is actuated to rotate in said second rotation direction (R"), is adapted to slide, through said second motion transformation mechanism (13), said trolley (133) in a second slide direction (V2) opposite said first slide direction (V1).

4. Device for lifting loads (1) according to any one of the preceding claims, **characterized in that** said second motion transformation mechanism (13) comprises at least one first flexible element (131), which is provided with a first end (131') connected to said drive shaft (9), and is mechanically engaged with said second thrust means (12).

5. Device for lifting loads (1) according to claim 4, **characterized in that** said second motion transformation mechanism (13) comprises at least one first winding pulley (14) connected to said drive shaft (9), and mechanically connected to said first winding pulley (14) is said first end (131') of said first flexible element (131) which is windable around said first winding pulley (14);
wherein said first flexible element (131) is actuatable to be unwound on said first winding pulley (14) when said drive shaft (9) rotates in said first rotation direction (R'), and to be wound on said first winding pulley (14) when said drive shaft (9) rotates in said second rotation direction (R").

6. Device for lifting loads (1) according to claim 4, **characterized in that** said second motion transformation mechanism (13) comprises at least one first transmission pulley (17) which intercepts said first flexible element (131) between said first end (131') connected to said drive shaft (9) and said second thrust means (12), and defines a substantially U-shaped first bend (111) of said first flexible element (131).

7. Device for lifting loads (1) according to claims 3 and 6, **characterized in that** said first transmission pulley (17) is mounted on said trolley (133).

8. Device for lifting loads (1) according to claim 7, **characterized in that** said second motion transformation mechanism (13) comprises:

- at least one second transmission pulley (18), which is mounted on said movable tube (4);
- at least one third transmission pulley (19), which is mounted on said trolley (133); wherein said second transmission pulley (18) intercepts said first flexible element (131) between said first transmission pulley (17) and said third transmission pulley (19) and defines a second substantially U-shaped bend (222) of said first flexible element (131) with opposite direction with respect to said first bend (111);

wherein said third transmission pulley (19) intercepts said first flexible element (131), defining a substantially U-shaped third bend (333) with opposite direction with respect to said second bend (222).

9. Device for lifting loads (1) according to any one of the preceding claims, **characterized in that** said first flexible element (131) comprises a second end (131") fixed to said movable tube (4).

10. Device for lifting loads (1) according to any one of the preceding claims, **characterized in that** said second thrust means (12) comprise at least one gas spring.

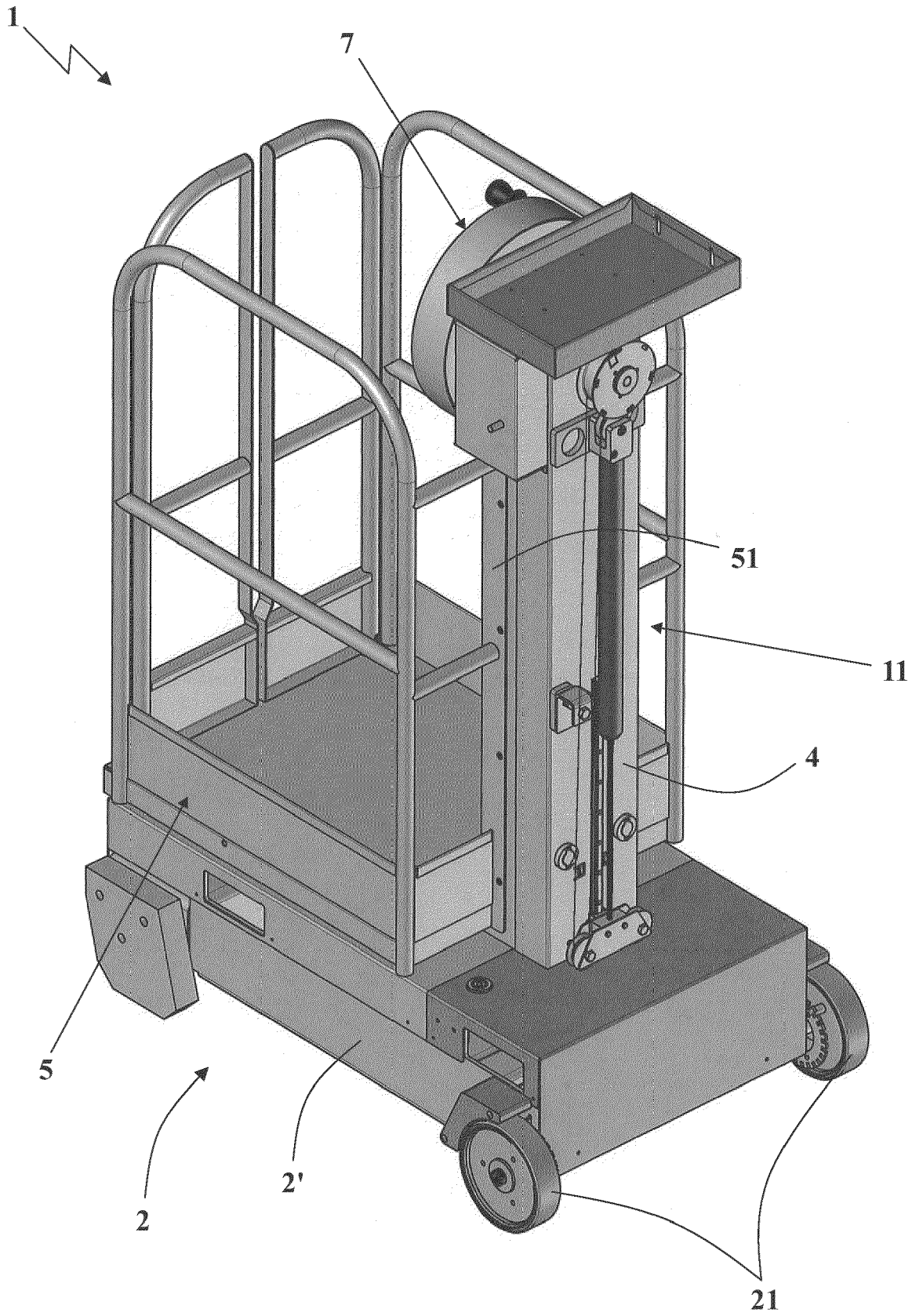

Fig. 1

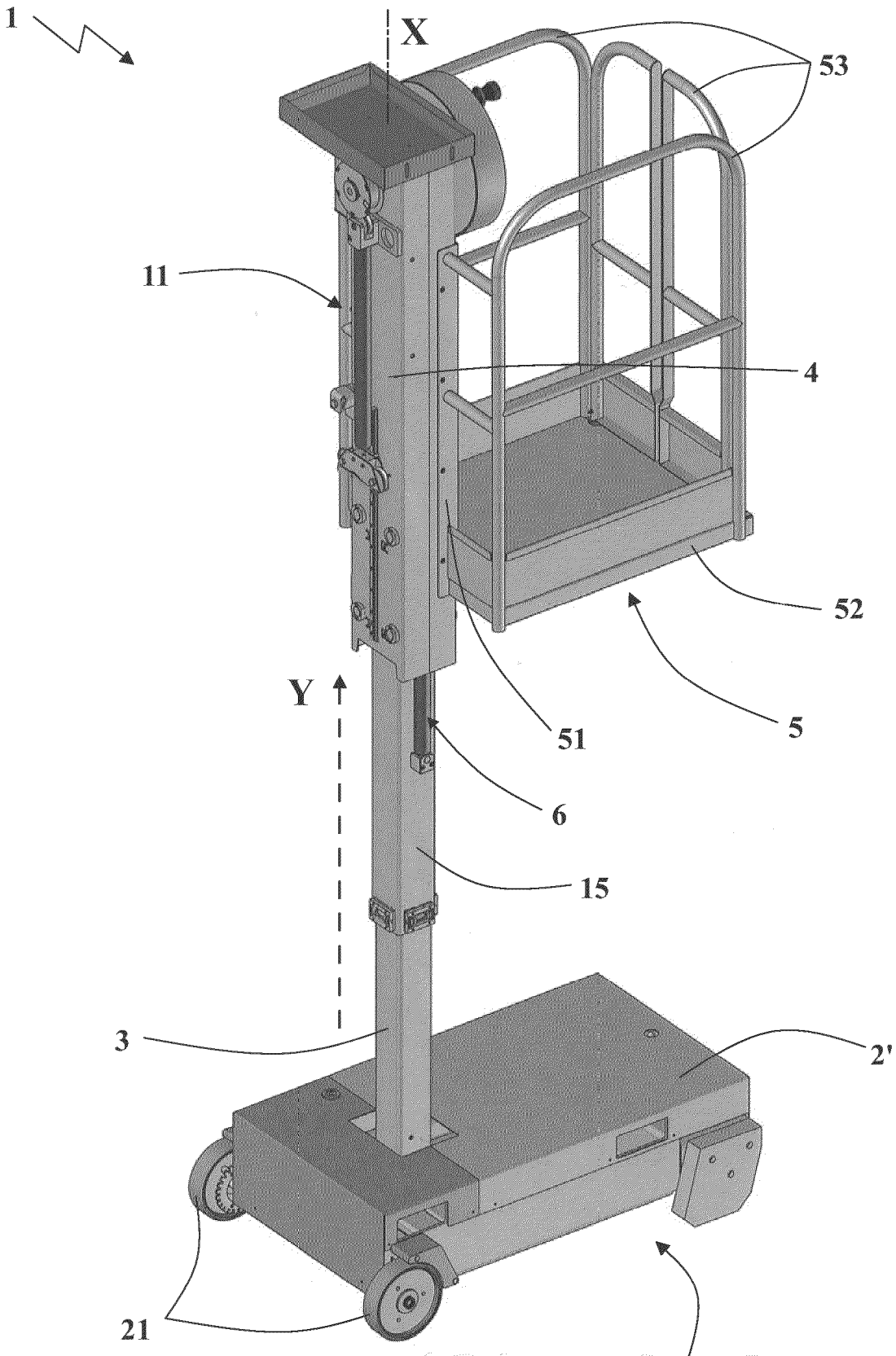

Fig. 2

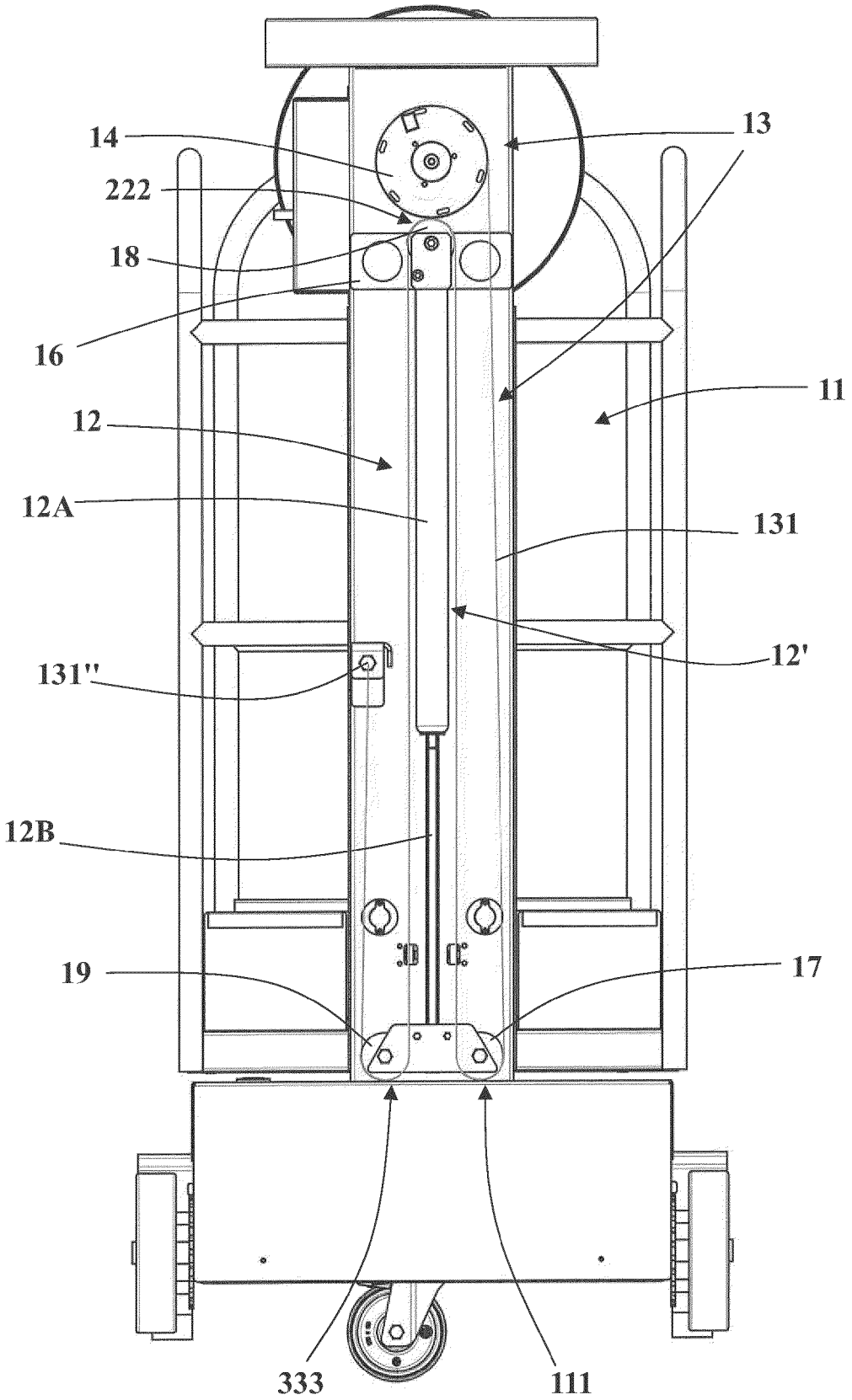

Fig. 3

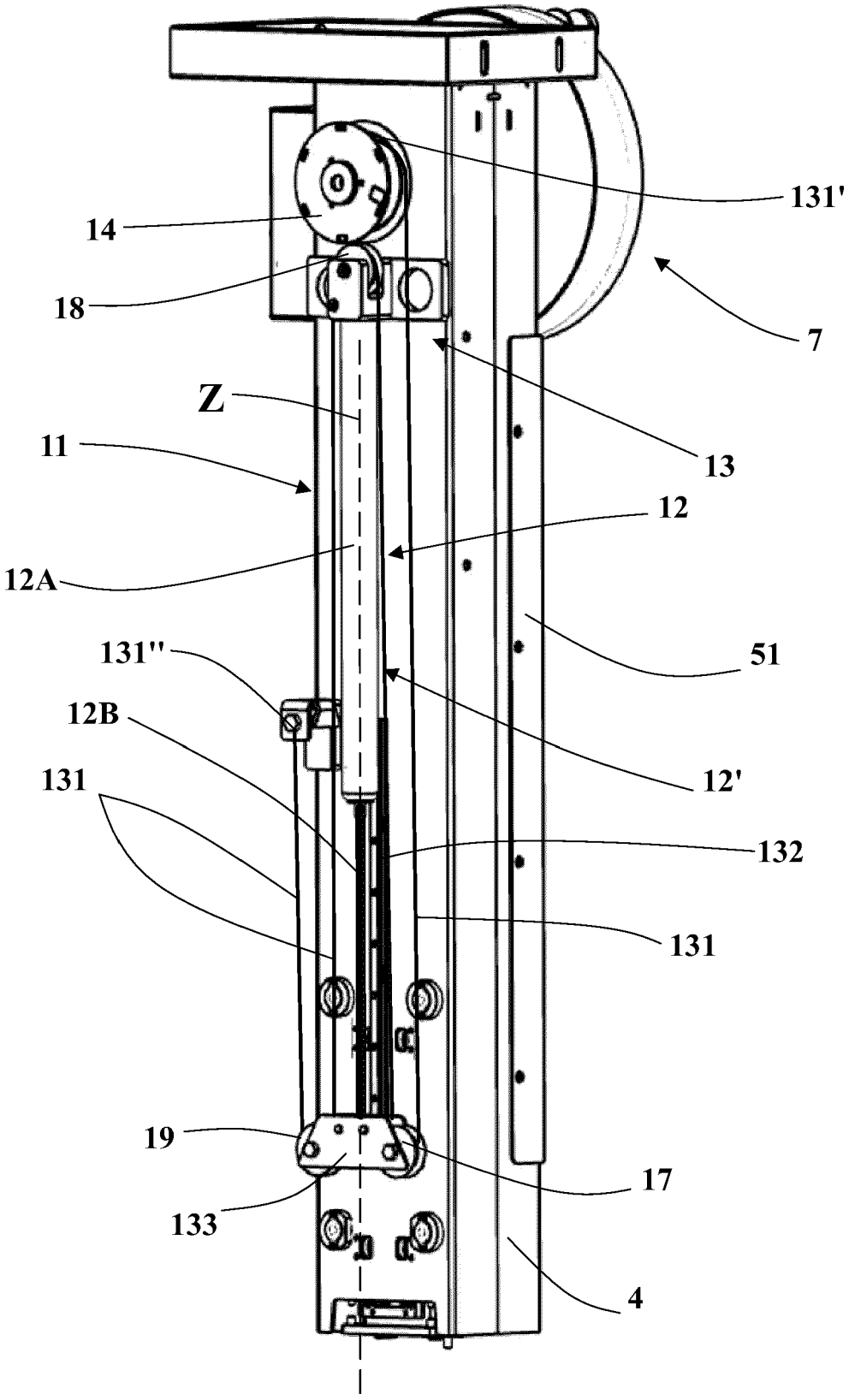

Fig. 4

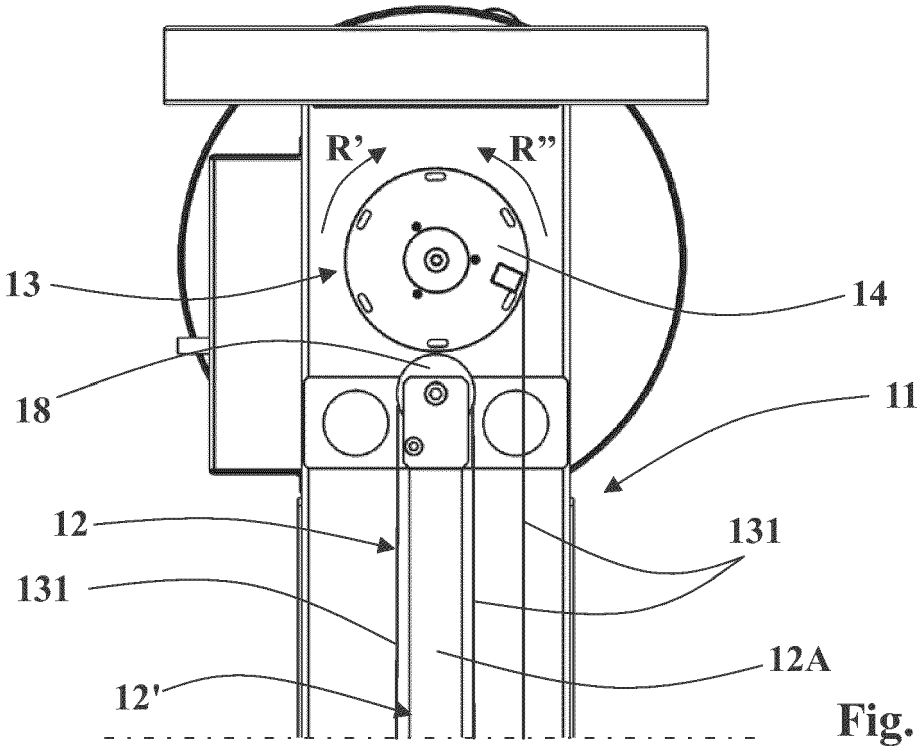
R'
R"
13
14
18
11
12
131
131
12A
12'

Fig. 5

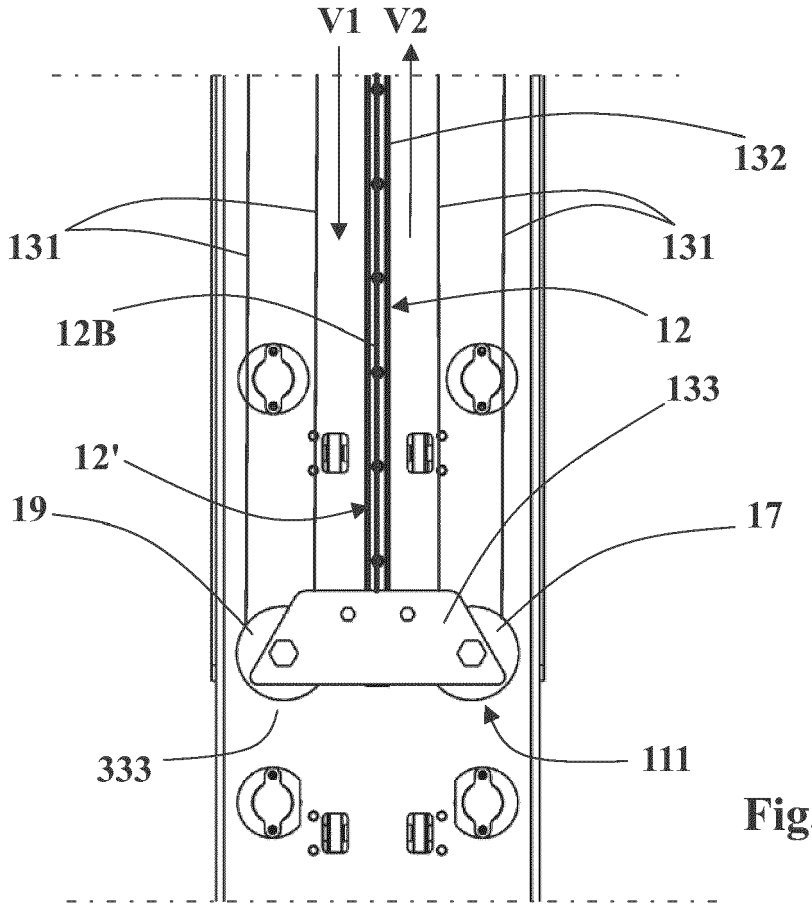
V1
V2
132
131
131
12B
12
133
12'
19
17
333
111

Fig. 6

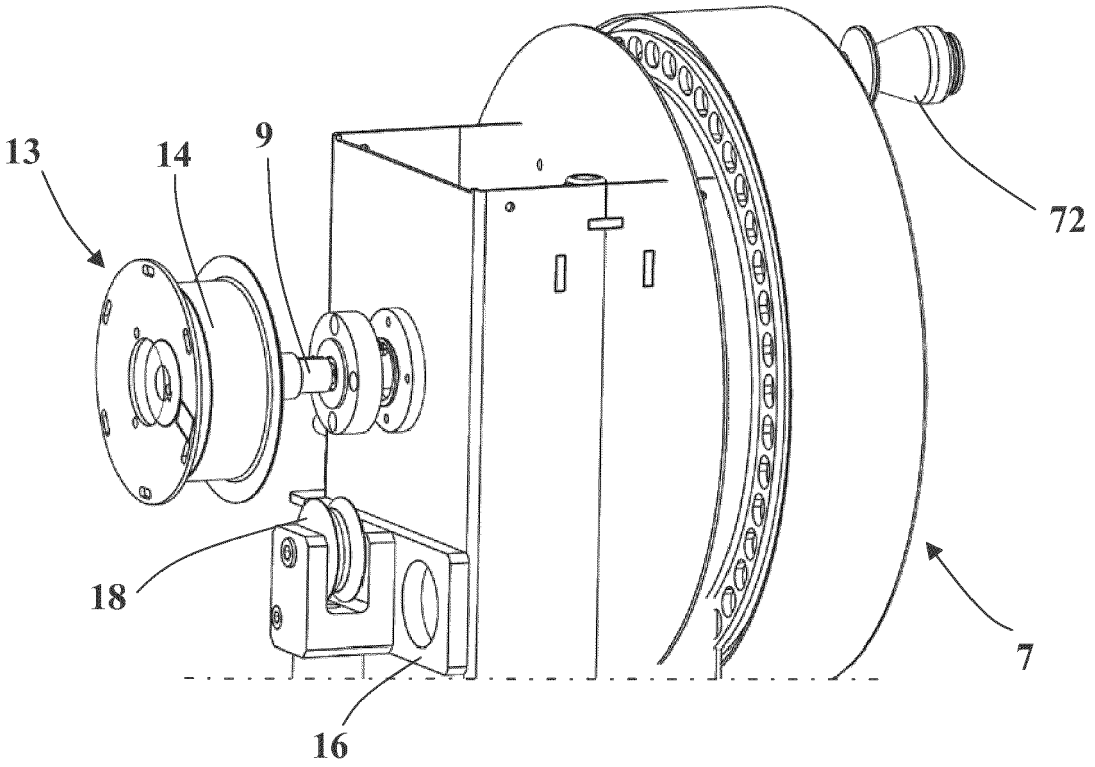

Fig. 7

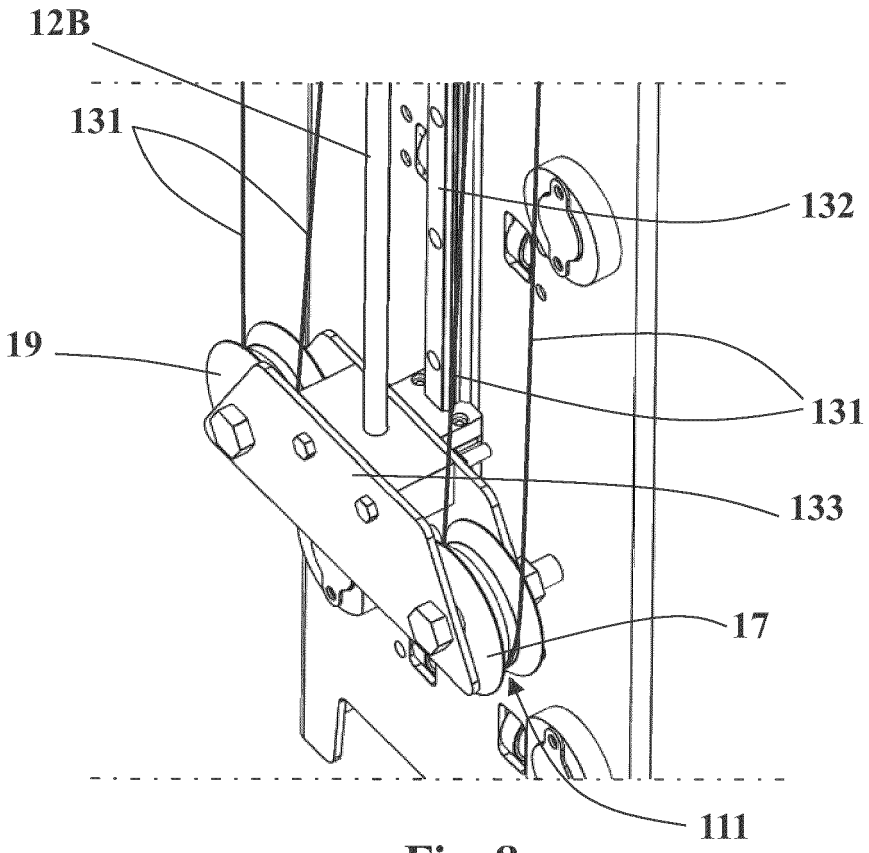

Fig. 8

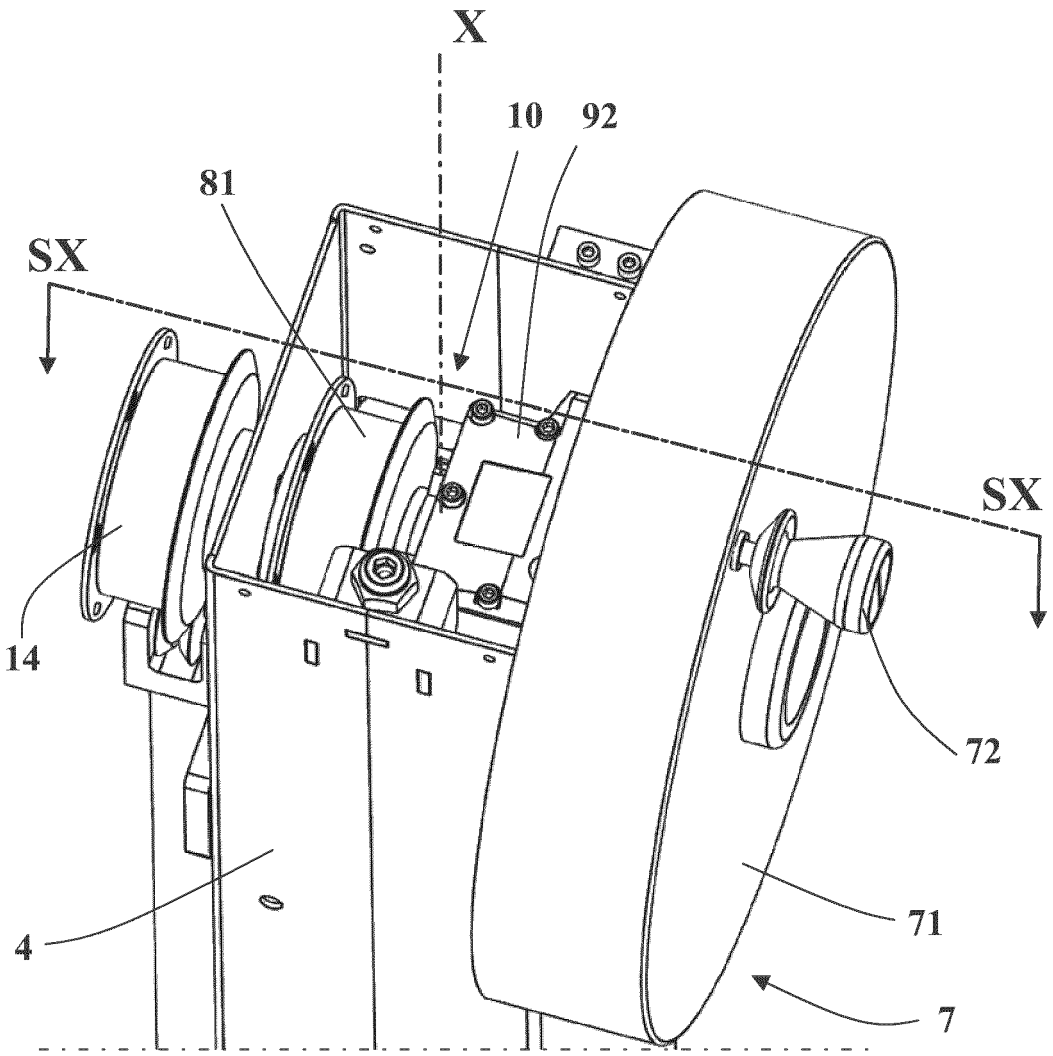

Fig. 9

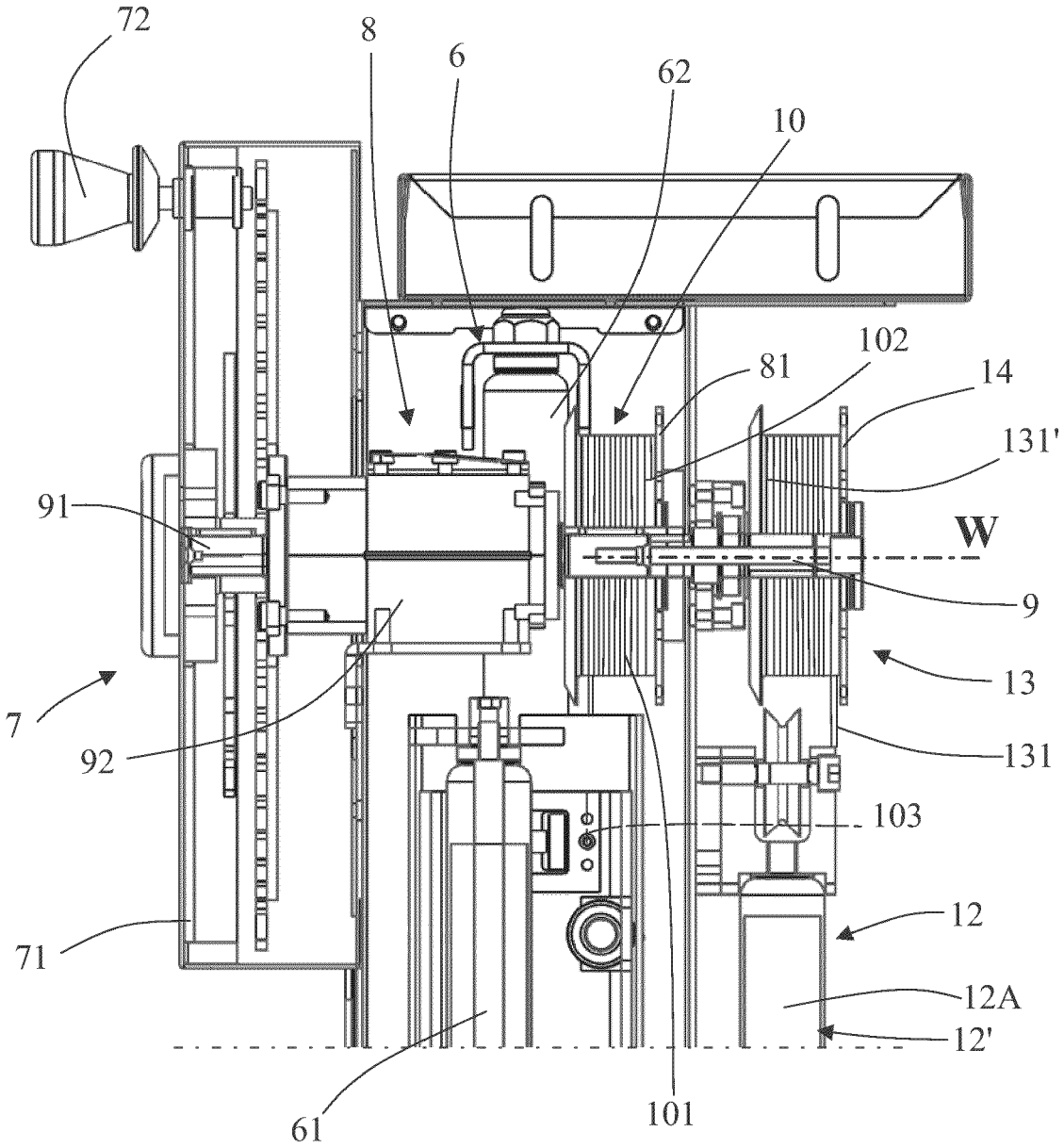

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 22 21 6641

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	EP 3 620 425 A1 (ZARGES GMBH [DE]) 11 March 2020 (2020-03-11) * abstract * * figures *	1-10	INV. B66F11/04
A,D	EP 2 828 193 A1 (POWER TOWERS LTD [GB]) 28 January 2015 (2015-01-28) * abstract * * figures *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

B66F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 April 2023	Colletti, Roberta

CATEGORY OF CITED DOCUMENTS

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19-04-2023

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- IT 102020000031097 **[0009] [0013] [0104]**