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(54) UNWINDING APPARATUS FOR A SELF-PROPELLED WRAPPING MACHINE

ABWICKELVORRICHTUNG FÜR EINE SELBSTANGETRIEBENE VERPACKUNGSMASCHINE

APPAREIL DE DÉVIDAGE DESTINÉ À UNE MACHINE D'EMBALLAGE AUTOMOTRICE

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Description

[0001] The invention relates to unwinding apparatuses that are associable to wrapping machines for dispensing and wrapping a film made of cold-stretchable plastic material around a load formed by a product or a plurality of products, which are arranged on a platform or pallet. In particular, the invention relates to an unwinding apparatus that is installable on a mobile or so-called self-propelled wrapping machine.

[0002] The self-propelled wrapping machines, also called self-propelled wrapping robots, are machines that are generally used for wrapping loads of variable shapes and sizes and in limited productions, typically used in production environments or rooms in which the fixed or static wrapping machines cannot be used.

[0003] The self-propelled wrapping machines include a carriage or cart provided with powered rear wheels and a front guiding device, which comprises a couple of steering wheels that are guided by a steering. The steering can be driven through a guiding bar by an operator for manually leading the machine in a manoeuvring configuration, or by a feeler element suitable to follow the external profile of the load in an operating configuration, in which the self-propelled machine automatically rotates around the load for wrapping the latter with the film.

[0004] The cart supports a vertical column or upright along which an unwinding or dispensing apparatus is mobile that houses a reel of plastic film and a plurality of rollers for unwinding and pre-stretching the film. More precisely, the unwind apparatus is generally provided with a couple of pre-stretching rollers arranged for unwinding from the reel and pre-stretching or elongating the film, and one or more return rollers for deflecting the film toward the load.

[0005] The combination of the reciprocating linear movement of the unwinding apparatus along the vertical upright and the rotation of the self-propelled machine around the load allows wrapping the film around the latter so as to form a series of helically interlaced bands or strips. The plastic film is wound so as to completely wrap all the sides of the load.

[0006] In order to stabilize the load when the latter is arranged on a pallet, it is also necessary to wrap the film around a base of the load itself and around an upper portion of the pallet. Without this precaution, the load, especially if formed by a group of separated products, may dangerously shift with respect to the pallet during wrapping and/or a subsequent transport.

[0007] In order to ensure a suitable tension to the film and guarantee a greater resistance thereof to the tensile forces that are originated, for example, by displacements or movements of the load, it is necessary to transversely roll up or narrow, completely or partially, the film so as to reduce a band or strip height or width thereof in order to obtain a narrowed band or a rolled or roped portion of the film, to be tightly wound around the load and around the pallet. Such narrowed band, which is obtained by

progressively wrapping or rolling on itself a longitudinal edge of the film transversely to the unwinding direction (so-called film roping), allows in fact to obtain a greater wrapping force and a shorter elastic elongation with respect to the film with full strip width. The roped film is also used for better stabilizing and reinforcing parts of the load, which are more unstable.

[0008] For this purpose, there are known different devices or mechanisms such as disclosed in patent document US 2007/204565 A1 that however are employed, because their overall dimensions, only on static wrapping machines, for example machines with rotating platform, or machines with rotating ring or arm. Furthermore, such film narrowing devices do not allow controlling precisely and/or with feedback loop the amount of the transversal narrowing or roping carried out on the exiting film during the operating cycle, and in particular to vary the strip width of the film also during the load wrapping. Typically, such devices only allow folding completely the film in the form of rope or reducing the strip width of the film up to a value that is predefined and set at the beginning of the wrapping cycle.

[0009] An object of the invention is to improve the known unwinding apparatuses associable with self-propelled wrapping machines for wrapping a load with a film made of cold stretchable plastic material.

[0010] Another object is to provide an unwinding apparatus for self-propelled wrapping machines that allows to vary in a simple, fast and effective manner a band or strip height or width of the plastic film during the wrapping thereof around the load, in particular for carrying out a rolled portion or rope on said film.

[0011] A further object is to provide an unwinding apparatus that allows controlling in real time and/or with a feedback loop, in a precise and accurate manner the strip width of the film during the whole wrapping cycle.

[0012] Another further object is to provide an unwinding apparatus having simple and economical construction and efficient and reliable operation.

[0013] These objects and others are achieved by an unwinding apparatus according to one or more of the following claims.

[0014] The invention will be better understood and implemented with reference to the attached drawings, which illustrate some exemplifying and not limitative embodiments thereof, in which:

- figure 1 is a perspective view of the unwinding apparatus of the invention associated to a self-propelled wrapping machine in an operating configuration;
- figure 2 is an enlarged perspective view of the unwinding apparatus of figure 1 that illustrates a folding element of the film in two different operating positions;
- figure 3 is a perspective view of the unwinding apparatus of figure 2 wherein some parts are removed for better illustrating the folding element of the film

and related driving means;

- figure 4 is an enlarged perspective view of the folding element and of the driving means of figure 3;
- figure 5 is a perspective view of a variant of the unwinding apparatus of the invention;
- figure 6 is an enlarged perspective view of the folding element and driving means of the apparatus of figure 5.

[0015] With reference to figures 1 to 4, there is illustrated an unwinding apparatus 1 that is associable to a self-propelled wrapping machine 100 mobile around a load (not shown) for wrapping the latter with a film 50 made of stretchable plastic material.

[0016] The self-propelled wrapping machine 100 is of known type and substantially comprises a main cart 101 that is provided with powered rear wheels 102 and with a front guiding device 103 having steering wheels that are guided by a steering 104. A vertical upright 105, along which the unwinding apparatus is slidably fixed, is fixed to the main cart 101. The apparatus 1 comprises frame means 2 for supporting a reel 60 of film 50, first roller means 11, 12, 13 for unwinding and pre-stretching the film 50 and second roller means 14 for deflecting toward the load the film 50 exiting the first roller means 11, 12, 13. The first roller means 11, 12, 13 comprise a first pre-stretching roller 11 and a second pre-stretching roller 12 rotated around respective longitudinal axes by a motor group 16, of known type and not described in detail. The pre-stretching rollers are moved with different rotation speeds so as to stretch or elongate the plastic film 50 during the reel 60 unwinding. The reel 60 is mounted free to rotate on a supporting reel-carrier 17. A return roller 13 of the first roller means directs the film 50 unwound from the reel to the first pre-stretching roller 11 (slow roller) arranged upstream of the second pre-stretching roller 12 (fast roller) arranged downstream with respect to the unwinding direction of film. The second roller means comprise a deflecting roller 14 that deflects and directs the film 50 exiting the unwinding apparatus 1 toward the load.

[0017] The apparatus 1 also comprises at least one folding element 3 and driving means 10 for moving the folding element 3 so that the latter intercepts and abuts a first longitudinal edge 50a of the film 50 and pushes said first longitudinal edge towards an opposite second longitudinal edge 50b of said film 50 so as to reduce a strip width L of film 50 exiting the unwinding apparatus 1. The folding element 3 is interposed between the first roller means 11, 12, 13 and the second roller means 14, in particular is positioned adjacent to the latter ones.

[0018] Driving means 10 comprise moving means 4 that support and move the folding element 3 along a narrowing trajectory R transversal to an unwinding direction T of the film 50 and that are driven by electric actuator means 5.

[0019] The apparatus 1 further comprises a control unit 20, which is connected to driving means 10 and arranged

for controlling and adjusting a displacement and/or a moving direction of the moving means 4, and first sensor means 30 that are coupled to the moving means 4 for continuously detecting and measuring at least a displacement of said moving means 4 and sending a related control signal to the control unit 20 so as to allow the control unit to control and adjust, during wrapping of the load, a position of folding element 3 along the narrowing direction R and thus a strip width L of film 50.

[0020] The first sensor means 30 comprise, for example, an angular position transducer that is coupled and rotated by the moving means 4.

[0021] In the illustrated embodiment, the angular position transducer 30 includes a phonic wheel 31 connected to the moving means 4, and a proximity sensor 32, in particular of inductive or capacitive or magnetic or optical type, which is associated to the phonic wheel 31 and is connected to the control unit 20. As known, the proximity sensor 32 detects the rotation of the phonic wheel 31 and sends related signals to the control unit 20 that is capable to calculate and establish position and angular speed of the phonic wheel 31 and therefore of the moving means 4 connected thereto.

[0022] In the embodiment shown in figures 1 to 4, the moving means 4 comprise screw nut means 41, which support the folding element 3, and screw means 42, which are coupled to, and support, said screw nut means 41. The screw means 42 are rotatably fixed to the frame means 2 and rotated by the electric actuator means 5 so as to move linearly the screw nut means 41, and then the folding element 3, along the narrowing trajectory R that, in this case, is a trajectory substantially linear and orthogonal to the unwinding direction T of film 50.

[0023] The screw means 42 comprise, for example, a screw with multiple threads whose ends are rotatably fixed to the frame means 2 by fixing flanges 43. The screw nut means comprise a screw nut or female screw 41, which supports the folding element 3 by means of a supporting plate 44. More precisely, the moving means 4 also comprise also an anti-rotation rod 45, which is parallel and adjacent to the screw 42 that slidably supports the supporting plate 44. More precisely, the supporting plate 44 comprises a first side portion that is fixed to the screw nut 41, a second central portion that rotatably supports the folding element 3 and a third side portion that is provided with a bush 46 slidably mounted on the rod 45. The rod 45 prevents rotation of screw nut 41, and thus of the folding element 3, around the screw 42 during the rotation thereof.

[0024] Motion transmission means 6 are provided for connecting the electric actuator means 5 to the screw means 41. In the illustrated embodiment, the electric actuator means comprise a rotary electric motor 5, for example a DC electric motor with integrated gearbox, and the motion transmission means 6 comprise a pinion of the motor 5, a toothed belt or chain 27 driven by the pinion and driving a gear wheel 18 fixed to the screw 42.

[0025] The folding element 3 comprises a respective

roll, which is rotatably fixed to the supporting plate 44, free to rotate around a respective axis and provided with a groove 3a, in particular having a conical shape, suitable to abut and receive the first longitudinal edge 50a so as to roll the latter by pushing it toward the second longitudinal edge 50b and carry out a rolled portion 50c of film or a rope, as is better explained in the following description.

[0026] In this embodiment of the moving means 4, the angular position transducer of first sensor means 30 is coupled to the screw means 41. More precisely, the phonic wheel 31 of the angular position transducer 30 is fixed to an end of screw means 41 and is rotatable therewith around a respective longitudinal axis; the proximity sensor 32 of the angular position transducer 30, which is associated to the phonic wheel 31 and connected to control unit 20, is fixed by means of a supporting bracket 33 to the frame means 2.

[0027] The control unit 20 comprises, for example, an electronic board suitable to manage the operation of electric motor 5, in particular the driving and the rotation direction and/or the speed and/or the acceleration, according to signals received by the angular position transducer 30 so as to allow controlling and adjusting the strip width L of film 50 during the whole wrapping cycle of the load.

[0028] Thanks to the first sensors 30 it is in fact possible to measure and control accurately the displacement of moving means 4, i.e. the rotation of screw means 41 and thus the position of folding element 3 along the narrowing direction R. The position of folding element 3 defines the amount of the narrowing of film 50.

[0029] Therefore, it is possible during the whole wrapping cycle to correct or adjust the strip width or to vary in a defined manner the values of the strip width of film according to the different steps of the wrapping cycle.

[0030] In fact, the control unit 20 is connected to interface means of the self-propelled wrapping machine 100, through which it is possible to enter operating data, in particular displacement or displacements of the folding element 3 and/or the value or values of the strip width L of film 50 that it is desired to obtain during the various steps of the wrapping cycle.

[0031] Second sensor means 21, 23 are fixed, for example, to the frame means 2 for detecting the stroke end positions of moving means 4, in particular of screw nut 41.

[0032] The sensor means 21, 23 include, for example, a first upper electromechanical end stop 21 and a second lower electromechanical end stop 23, both connected to the control unit 20 for sending thereto respective stop signals of the driving means 10, i.e. of the electric motor 5.

[0033] The electric motor 5 is provided with a brake 22 suitable to precisely block the motor, and thus the screw nut 41 in the desired position of the folding element 3, which can be set by the interface means of the machine.

[0034] The operation of the unwinding apparatus 1 of the invention that is mounted on the self-propelled wrapping machine 100 provides, during the wrapping cycle of the load, one or more steps in which the folding element

3 is moved by the driving means 10 for reducing the strip width of film 50 exiting the apparatus 1 and in particular for carrying out on the first longitudinal edge 50a of film 50 a rope or rolled portion 50c, i.e. for partially or even completely roping the film 50 in order to impart thereto a greater resistance to tensile stress and a lower deformability, typically in order to stabilize the load and/or for fixing the latter to the underlying pallet more firmly.

[0035] The amount of reduction of the strip width L of the film 50 and/or of the so-called roping can be set by the operator according to the load to be wrapped through the operator interface by acting on the control unit 20. On the basis of the strip width L or of the different values of the strip width L required during the various steps of the wrapping cycle, the control unit 20 determines and controls the stroke of the folding element 3 through the moving means 4 up to the required positions.

[0036] For example, thanks to the unwinding apparatus 1 of the invention it is possible to obtain a first value of the strip width of film during the wrapping of a base portion of the load, a second strip width during the wrapping of a top portion of the load and a third strip width for the end wrapping turns.

[0037] It should be noted that, thanks to the first sensor means 3, it is possible to position very accurately and precisely the moving means 4, i.e. the screw nut 41, and then the folding element 3 that is connected thereto along the narrowing direction R so as to obtain values of the strip width L that are also precise and accurate.

[0038] Therefore, thanks to the unwinding apparatus 1 of the invention, mountable on a self-propelled wrapping machine, it is possible during the whole wrapping cycle of a load with the plastic film to vary, in particular to reduce, the strip width of the film in a simple, fast and accurate manner. More precisely, according to structure and composition of the load and of the wrapping step, the apparatus allows making a narrowed band of film or a band that is provided with a rolled portion so as to form a rope to be tightly wound around the load and the pallet. Such narrowed band, which is obtained by progressively wounding or rolling on itself a longitudinal edge of the film transversely to the unwinding direction, allows obtaining a greater wrapping force with respect to the film with full-width band. The film that is rolled in rope or in a narrowed band is also used for better stabilizing and reinforce the parts of the load, which are more unstable.

[0039] The driving means 10, provided with electric actuators 5, further allow to precisely position the folding element 3 and then to obtain a desired and precise reduction of the width L of film. The value of the strip width of film can be easily entered through the user interface of the machine and processed by the control unit 20 for controlling the electric actuator means 5 and the moving means 4 of the folding element 3 in cooperation with the first sensors 30, which send signals about the position of said moving means 4 and of the folding element 3 in real-time and with a closed loop or feedback control process.

[0040] In a version of the unwinding apparatus 1 of the invention that is not illustrated in the figures, there is provided a further folding element 3 movable by driving means 10 along the narrowing trajectory R in a direction that is opposite to the moving direction of the folding element 3 so as to intercept and abut the second longitudinal edge 50b and push the second longitudinal edge towards the first longitudinal edge 50a so as to reduce, in cooperation with the folding element 3, the strip width L of film 50 exiting the apparatus 1. In this case, the further folding element is fixed through a further supporting plate to a further screw nut that is coupled to the screw means 42 so as to be linearly moved thereby in a direction that is opposite to the direction of the folding element 3. In such a manner, the two folding elements that mutually approach or move away allow reducing and/or rolling the film 50, for example creating two distinct and opposite ropes of film.

[0041] Alternatively, the further folding element can be driven by respective and separated further moving means.

[0042] With reference to figures 5 and 6 there is illustrated a variant of the unwinding apparatus of the invention that differs from the previously described embodiment for the moving means 104 that includes a carriage 144 supporting the folding element 3, a guide 145, which slidably supports the carriage 144 along the narrowing trajectory R, and operating means 141, which are moved by the electric actuator means 5 and are connected to the carriage 144 so as to move the latter along the narrowing trajectory R.

[0043] The guide 145 comprises an elongated prismatic element with which the carriage 144 slidably engages that is provided with an elongated and shaped bracket 146 to which the folding element 3 is fixed idle.

[0044] The first sensor means comprise an angular position transducer 130 that is coupled in this case to the operating means 141. In particular, the phonic wheel 131 of the angular position transducer 130 is connected to the operating means 141, rotatable around a respective axis, while the proximity sensor 132 of the angular position transducer 130, which is associated to the phonic wheel 131 and connected to the control unit 20, is fixed to the frame means 2 of the apparatus 1.

[0045] The operating means comprise a closed loop belt 141 that is wound around moving pulleys, of known type and not illustrated, which are positioned at opposite ends 145a, 145b of the guide 145, and to which the carriage 144 is fixed. From one of the ends of the guide 145, for example from an upper end 145a, a shaft protrudes which drives the moving pulley of the belt 141 and on which the phonic wheel 131 is mounted. The motion transmission means 106, which connect the electric actuator means 5 to the moving means 104, comprise a bevel gears with conical gears that connects the driving shaft of the operating means 141 to a respective motor shaft of a rotary electric motor of the electric actuator means 5. The rotary electric motor is, for example, of

self-braked type.

[0046] The second sensor means 121, 123 are fixed to the opposite ends 145a, 145b of the guide 145 for detecting the stroke end positions of the moving means 104, in particular of the carriage 144. The second sensor means include, for example, a first upper inductive sensor 121 and a second lower inductive sensor 123, both connected to the control unit 20 for sending thereto respective stop signals of the driving means 10, i.e. of the electric motor 5. In this variant of the unwinding apparatus 1, the first roller means comprise the couple of pre-stretching rollers 11, 12 rotated around respective longitudinal axes by the motor group 16 and a further return roller 15 that directs the film 50 exiting the second pre-stretching roller 12 (fast roller) towards the deflecting roller 14 of second roller means that deflects the film toward the load. The folding element 3 is interposed between the further return roller 15 and the deflecting roller 14.

[0047] The operation of this variant of the unwinding apparatus 1 of the invention is substantially similar to the operation of the embodiment shown in figures 1 to 4 and previously described.

[0048] In another variant of the apparatus that is not shown, the moving means comprise a slide fixed to and supporting the folding element 3 and the electric actuator means include a linear electric motor suitable to support and move said slide along the narrowing trajectory R. The first sensor means comprise in this case a linear position transducer, of known type, that is connected to the slide.

[0049] Still alternatively, the moving means may comprise a lever having a first end rotatably fixed to the frame means 2 and a second end that rotatably supports the folding element 3. The lever is rotated by the electric actuator means so as to move the folding element 3 along the narrowing trajectory R having arched shape.

Claims

1. Unwinding apparatus (1) associable to a self-propelled wrapping machine (100) mobile around a load for wrapping the load with a plastic material film (50), comprising:

- frame means (2) for supporting a reel (60) of said film (50);
- roller means (11, 12, 13, 14) for unwinding and pre-stretching said film (50);
- at least a folding element (3) mobile along a narrowing trajectory (R) for abutting a first longitudinal edge (50a) of said film (50) and pushing said first longitudinal edge towards a second longitudinal edge (50b) of said film (50) so as to reduce a strip width (L) of said film (50) exiting said apparatus (1);
- driving means (10) for moving said folding element (3) and comprising moving means (4);

104) supporting said folding element (3) and mobile along said narrowing trajectory (R), transversely to an unwinding direction (T) of said film (50), and electric actuator means (5) connected to, and driving, said moving means (4; 104);
 - a control unit (20) that is connected to said driving means (10) for controlling and adjusting a displacement and/or a moving direction of said moving means (4; 104);

characterized in that it comprises first sensor means (30; 130) coupled to said moving means (4; 104) for continuously detecting at least a displacement of said moving means (4; 104) and sending a related signal to said control unit (20) in order to control and adjust during wrapping said load a position of said folding element (3) along said narrowing trajectory (R) so as to control in real time and with a feedback loop a strip width (L) of said film (50).

2. Apparatus according to claim 1, comprising second sensor means (21, 23; 121, 123) for detecting stroke end positions of said moving means (4; 104), said second sensor means (21, 23; 121, 123) being connected to said control unit (20) for sending thereto respective stop signals of said driving means (10).
3. Apparatus according to claim 1 or 2, wherein said first sensor means (30; 130) comprise an angular position transducer that is coupled to and rotated by said moving means (4; 104).
4. Apparatus according to claim 3, wherein said angular position transducer comprises a phonic wheel (31; 131), which is connected to said moving means (4; 104), and a proximity sensor (32; 132) associated with said phonic wheel (31; 131) for detecting a rotation thereof and sending related signals to said control unit (20).
5. Apparatus according to any preceding claim, wherein said moving means (4) comprise screw nut means (41) supporting said folding element (3) and screw means (42) that are coupled to, and support, said screw nut means (41), said screw means (42) being rotatably fixed to said frame means (2) and rotated by said electric actuator means (5) so as to move linearly said screw nut means (41) and said folding element (3) along said narrowing trajectory (R).
6. Apparatus according to claim 3 and 5, wherein said angular position transducer (30) is coupled to said screw means (41), in particular said angular position transducer comprising a phonic wheel (31) that is fixed to said screw means (41) and is rotatable therewith, and a proximity sensor (32), which is associated with said phonic wheel (31) for detecting a rotation thereof and sending related signals to said control

unit (20).

7. Apparatus according to any of claims 1 to 4, wherein said moving means (104) comprise a carriage (144) supporting said folding element (3), a guide (145) slidably supporting said carriage (144) along said narrowing trajectory (R) and operating means (141) moved by said electric actuator means (5) and connected to said carriage (144) for moving the latter along said narrowing trajectory (R).
8. Apparatus according to claims 3 and 7, wherein said angular position transducer (130) is coupled to said operating means (141), in particular said angular position transducer (130) comprising a phonic wheel (131), which is connected to said operating means (141) and is rotatable around a respective axis, and a proximity sensor (132) that is associated with said phonic wheel (131) for detecting a rotation thereof and sending related signals to said control unit (20).
9. Apparatus according to any of claims 1 to 4, wherein said moving means comprise a slide supporting said folding element (3) and said electric actuator means comprise a linear electric motor that is suitable to support and move said slide along said narrowing trajectory (R), said first sensor means comprising a linear position transducer that is connected to said slide.
10. Apparatus according to any preceding claim, comprising motion transmission means (6; 106) for connecting said electric actuator means (5) to said moving means (4; 104).
11. Apparatus according to any preceding claim, wherein said roller means comprise first roller means (11, 12, 13) for unwinding from said reel (60) and pre-stretching said film (50) and second roller means (14) for deflecting said film (50) towards said load, said folding element (3) being interposed between said first roller means (11, 12, 13, 15) and said second roller means (14).
12. Apparatus according to any preceding claim, wherein said folding element (3) comprises a respective roll which is free to rotate around a respective axis and which is provided with a groove (3a) suitable to abut and receive said first longitudinal edge (50a) so as to roll up the latter pushing it towards the second longitudinal edge (50b) and to carry out a rolled portion (50c) of film or a rope.
13. Apparatus according to any preceding claim, comprising a further folding element (3) movable by said driving means (10) along said narrowing trajectory (R) in a direction that is opposite to said folding element (3) for abutting said second longitudinal edge

(50b) and pushing the latter towards said first longitudinal edge (50a) so as to reduce, in cooperation with said folding element (3), a strip width (L) of said film (50) exiting said apparatus (1).

14. Self-propelled wrapping machine (100) movable around a load for wrapping the load with a plastic material film and comprising an unwinding apparatus (1) of said film (50) according to any preceding claim.

Patentansprüche

1. Abwickelvorrichtung (1), die mit einer selbstfahrenden Einwickelmaschine (100) verbindbar ist, die um eine Ladung beweglich ist, um die Ladung mit einem Kunststoffmaterialfilm (50) zu umwickeln, die umfasst:

- eine Rahmeneinrichtung (2) zum Abstützen einer Spule (60) des Films (50);
- Rolleneinrichtungen (11, 12, 13, 14) zum Abwickeln und Vordehnen des Films (50);
- mindestens ein Faltelement (3), das entlang einer sich verschmälernenden Bahn (R) beweglich ist, zur Anlage an einer ersten Längskante (50a) des Films (50) und Schieben der ersten Längskante in Richtung einer zweiten Längskante (50b) des Films (50), um eine Streifenbreite (L) des Films (50) zu verringern, der die Vorrichtung (1) verlässt;
- eine Antriebseinrichtung (10) zum Bewegen des Faltelements (3) und mit einer Bewegungseinrichtung (4; 104), die das Faltelement (3) abstützt und entlang der sich verschmälernenden Bahn (R) quer zu einer Abwickelrichtung (T) des Films (50) beweglich ist, und einer elektrischen Aktuatoreinrichtung (5), die mit der Bewegungseinrichtung (4; 104) verbunden ist und diese antreibt;
- eine Steuereinheit (20), die mit der Antriebseinrichtung (10) verbunden ist, zum Steuern und Einstellen einer Verlagerung und/oder einer Bewegungsrichtung der Bewegungseinrichtung (4; 104);

dadurch gekennzeichnet, dass sie eine erste Sensoreinrichtung (30; 130), die mit der Bewegungseinrichtung (4; 104) gekoppelt ist, zum kontinuierlichen Detektieren mindestens einer Verlagerung der Bewegungseinrichtung (4; 104) und Senden eines zugehörigen Signals zur Steuereinheit (20), um eine Position des Faltelements (3) entlang der sich verschmälernenden Bahn (R) während des Umwickelns der Ladung zu steuern und einzustellen, um in Echtzeit und mit einer Rückkopplungsschleife eine Streifenbreite (L) des Films (50) zu steuern, umfasst.

2. Vorrichtung nach Anspruch 1 mit einer zweiten Sensoreinrichtung (21, 23; 121, 123) zum Detektieren von Hubendpositionen der Bewegungseinrichtung (4; 104), wobei die zweite Sensoreinrichtung (21, 23; 121, 123) mit der Steuereinheit (20) zum Senden von jeweiligen Stoppsignalen der Antriebseinrichtung (10) zu dieser verbunden ist.
3. Vorrichtung nach Anspruch 1 oder 2, wobei die erste Sensoreinrichtung (30; 130) einen Winkelpositionswandler umfasst, der mit der Bewegungseinrichtung (4; 104) gekoppelt ist und durch diese gedreht wird.
4. Vorrichtung nach Anspruch 3, wobei der Winkelpositionswandler ein phonisches Rad (31; 131), das mit der Bewegungseinrichtung (4; 104) verbunden ist, und einen Nähesensor (32; 132), der dem phonischen Rad (31; 131) zugeordnet ist, zum Detektieren einer Drehung davon und Senden von zugehörigen Signalen zur Steuereinheit (20) umfasst.
5. Vorrichtung nach einem vorhergehenden Anspruch, wobei die Bewegungseinrichtung (4) eine Schraubenmuttereinrichtung (41), die das Faltelement (3) abstützt, und eine Schraubeneinrichtung (42), die mit der Schraubenmuttereinrichtung (41) gekoppelt ist und diese abstützt, umfasst, wobei die Schraubeneinrichtung (42) drehbar an der Rahmeneinrichtung (2) befestigt ist und durch die elektrische Aktuatoreinrichtung (5) gedreht wird, um die Schraubenmuttereinrichtung (41) und das Faltelement (3) linear entlang der sich verschmälernenden Bahn (R) zu bewegen.
6. Vorrichtung nach Anspruch 3 und 5, wobei der Winkelpositionswandler (30) mit der Schraubeneinrichtung (41) gekoppelt ist, insbesondere der Winkelpositionswandler ein phonisches Rad (31), das an der Schraubeneinrichtung (41) befestigt ist und damit drehbar ist, und einen Nähesensor (32), der dem phonischen Rad (31) zugeordnet ist, zum Detektieren einer Drehung davon und Senden von zugehörigen Signalen zur Steuereinheit (20) umfasst.
7. Vorrichtung nach einem der Ansprüche 1 bis 4, wobei die Bewegungseinrichtung (104) einen Wagen (144), der das Faltelement (3) abstützt, eine Führung (145), die den Wagen (144) entlang der sich verschmälernenden Bahn (R) verschiebbar abstützt, und eine Betriebseinrichtung (141), die durch die elektrische Aktuatoreinrichtung (5) bewegt wird und mit dem Wagen (144) verbunden ist, zum Bewegen des letzteren entlang der sich verschmälernenden Bahn (R) umfasst.
8. Vorrichtung nach den Ansprüchen 3 und 7, wobei der Winkelpositionswandler (130) mit der Betriebseinrichtung (141) gekoppelt ist, insbesondere der

Winkelpositionswandler (130) ein phonisches Rad (131), das mit der Betriebseinrichtung (141) verbunden ist und um eine jeweilige Achse drehbar ist, und einen Nähesensor (132), der dem phonischen Rad (131) zugeordnet ist, zum Detektieren einer Drehung davon und Senden von zugehörigen Signalen zur Steuereinheit (20) umfasst.

9. Vorrichtung nach einem der Ansprüche 1 bis 4, wobei die Bewegungseinrichtung einen Schlitten umfasst, der das Faltelement (3) abstützt, und die elektrische Aktuatoreinrichtung einen linearen Elektromotor umfasst, der geeignet ist, um den Schlitten abzustützen und entlang der sich verschmälern Bahn (R) zu bewegen, wobei die erste Sensoreinrichtung einen linearen Positionswandler umfasst, der mit dem Schlitten verbunden ist. 10
10. Vorrichtung nach einem vorhergehenden Anspruch, die eine Bewegungsübertragungseinrichtung (6; 106) zum Verbinden der elektrischen Aktuatoreinrichtung (5) mit der Bewegungseinrichtung (4; 104) umfasst. 20
11. Vorrichtung nach einem vorhergehenden Anspruch, wobei die Rolleneinrichtungen eine erste Rolleneinrichtung (11, 12, 13) zum Abwickeln von der Spule (60) und Vordehnen des Films (50) und eine zweite Rolleneinrichtung (14) zum Ablenken des Films (50) in Richtung der Ladung umfassen, wobei das Faltelement (3) zwischen die erste Rolleneinrichtung (11, 12, 13, 15) und die zweite Rolleneinrichtung (14) eingefügt ist. 25 30
12. Vorrichtung nach einem vorhergehenden Anspruch, wobei das Faltelement (3) eine jeweilige Rolle umfasst, die sich frei um eine jeweilige Achse drehen kann und die mit einer Nut (3a) versehen ist, die geeignet ist, um an der ersten Längskante (50a) anzuliegen und diese aufzunehmen, um die letztere aufzurollen, wobei sie in Richtung der zweiten Längskante (50b) geschoben wird, und einen gerollten Abschnitt (50c) von Film oder ein Seil herauszuführen. 35 40
13. Vorrichtung nach einem vorhergehenden Anspruch, die ein weiteres Faltelement (3), das durch die Antriebseinrichtung (10) entlang der sich verschmälern Bahn (R) in einer Richtung beweglich ist, die zum Faltelement (3) entgegengesetzt ist, zur Anlage an der zweiten Längskante (50b) und Schieben der letzteren in Richtung der ersten Längskante (50a) umfasst, um in Zusammenarbeit mit dem Faltelement (3) eine Streifenbreite (L) des Films (50) zu verringern, der die Vorrichtung (1) verlässt. 45 50
14. Selbstfahrende Einwickelmaschine (100), die um eine Ladung beweglich ist, um die Ladung mit einem Kunststoffmaterialfilm zu umwickeln, und mit einer 55

Abwickelvorrichtung (1) des Films (50) nach einem vorhergehenden Anspruch.

5 Revendications

1. Appareil de dévidage (1) associable à une machine d'emballage automotrice (100) mobile autour d'une charge pour emballer la charge avec un film en matière plastique (50), comprenant : 10

- des moyens formant cadre (2) pour supporter un dévidoir (60) dudit film (50) ;
- des moyens formant rouleaux (11, 12, 13, 14) pour dévider et préétirer ledit film (50) ;
- au moins un élément pliant (3) mobile le long d'une trajectoire se rétrécissant (R) pour venir en butée contre un premier bord longitudinal (50a) dudit film (50) et pousser ledit premier bord longitudinal vers un second bord longitudinal (50b) dudit film (50) de sorte à réduire une largeur de bande (L) dudit film (50) sortant dudit appareil (1) ;
- des moyens d'entraînement (10) pour déplacer ledit élément pliant (3) et comprenant des moyens de déplacement (4 ; 104) supportant ledit élément pliant (3) et mobiles le long de ladite trajectoire se rétrécissant (R), transversalement à une direction de dévidage (T) dudit film (50), et des moyens d'actionnement électriques (5) connectés auxdits moyens de déplacement (4 ; 104) et les entraînant ;
- une unité de commande (20) qui est reliée auxdits moyens d'entraînement (10) pour commander et régler un déplacement et/ou une direction de déplacement desdits moyens de déplacement (4 ; 104) ; 25 30 35 40 45 50

caractérisé en ce qu'il comprend des premiers moyens de détection (30 ; 130) couplés auxdits moyens de déplacement (4 ; 104) pour détecter en continu au moins un déplacement desdits moyens de déplacement (4 ; 104) et envoyer un signal connexe à ladite unité de commande (20) pour commander et régler au cours de l'emballage de ladite charge une position dudit élément pliant (3) le long de ladite trajectoire se rétrécissant (R) de sorte à régler en temps réel et avec une boucle de rétroaction une largeur de bande (L) dudit film (50). 55

2. Appareil selon la revendication 1, comprenant des seconds moyens de détection (21, 23 ; 121, 123) pour détecter des positions de fin de course desdits moyens de déplacement (4 ; 104), lesdits seconds moyens de détection (21, 23 ; 121, 123) étant reliés à ladite unité de commande (20) pour lui envoyer les signaux d'arrêt respectifs desdits moyens d'entraînement (10). 60

3. Appareil selon la revendication 1 ou 2, dans lequel lesdits premiers moyens de détection (30 ; 130) comprennent un transducteur de position angulaire qui est couplé auxdits moyens de déplacement (4 ; 104) et mis en rotation par ceux-ci.
4. Appareil selon la revendication 3, dans lequel ledit transducteur de position angulaire comprend une roue phonique (31 ; 131), qui est reliée auxdits moyens de déplacement (4 ; 104), et un capteur de proximité (32 ; 132) associé à ladite roue phonique (31 ; 131) pour détecter une rotation de celle-ci et envoyer des signaux connexes à ladite unité de commande (20).
5. Appareil selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens de déplacement (4) comprennent des moyens formant vis-écrou (41) supportant ledit élément pliant (3) et des moyens formant vis (42) qui sont couplés auxdits moyens formant vis-écrou (41) et les supportent, lesdits moyens formant vis (42) étant fixés de manière rotative auxdits moyens formant cadre (2) et mis en rotation par lesdits moyens d'actionnement électriques (5) de sorte à déplacer linéairement lesdits moyens formant vis-écrou (41) et ledit élément pliant (3) le long de ladite trajectoire se rétrécissant (R).
6. Appareil selon la revendication 3 et 5, dans lequel ledit transducteur de position angulaire (30) est couplé auxdits moyens formant vis (41), en particulier ledit transducteur de position angulaire comprenant une roue phonique (31) qui est fixée auxdits moyens formant vis (41) et peut être entraînée en rotation avec eux, et un capteur de proximité (32), qui est associé à ladite roue phonique (31) pour détecter une rotation de celle-ci et envoyer des signaux connexes à ladite unité de commande (20).
7. Appareil selon l'une quelconque des revendications 1 à 4, dans lequel lesdits moyens de déplacement (104) comprennent un chariot (144) supportant ledit élément pliant (3), un guide (145) supportant de manière coulissante ledit chariot (144) le long de ladite trajectoire se rétrécissant (R) et des moyens de fonctionnement (141) déplacés par lesdits moyens d'actionnement électriques (5) et reliés audit chariot (144) pour déplacer ce dernier le long de ladite trajectoire se rétrécissant (R).
8. Appareil selon les revendications 3 et 7, dans lequel ledit transducteur de position angulaire (130) est couplé auxdits moyens de fonctionnement (141), en particulier ledit transducteur de position angulaire (130) comprenant une roue phonique (131), qui est reliée auxdits moyens de fonctionnement (141) et peut être entraînée en rotation autour d'un axe respectif, et un capteur de proximité (132) qui est associé à ladite roue phonique (131) pour détecter une rotation de celle-ci et envoyer des signaux connexes à ladite unité de commande (20).
9. Appareil selon l'une quelconque des revendications 1 à 4, dans lequel lesdits moyens de déplacement comprennent un coulisseau supportant ledit élément pliant (3) et lesdits moyens d'actionnement électriques comprennent un moteur électrique linéaire qui est approprié pour supporter et déplacer ledit coulisseau le long de ladite trajectoire se rétrécissant (R), lesdits premiers moyens de détection comprenant un transducteur de position linéaire qui est relié audit coulisseau.
10. Appareil selon l'une quelconque des revendications précédentes, comprenant des moyens de transmission de mouvement (6 ; 106) pour relier lesdits moyens d'actionnement électriques (5) auxdits moyens de déplacement (4 ; 104).
11. Appareil selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens formant rouleaux comprennent des premiers moyens formant rouleaux (11, 12, 13) pour dévider dudit dévidoir (60) et préétirer ledit film (50) et des seconds moyens formant rouleau (14) pour faire dévier ledit film vers ladite charge, ledit élément pliant (3) étant intercalé entre lesdits premiers moyens formant rouleaux (11, 12, 13, 15) et lesdits seconds moyens formant rouleau (14).
12. Appareil selon l'une quelconque des revendications précédentes, dans lequel ledit élément pliant (3) comprend un rouleau respectif qui est libre de tourner autour d'un axe respectif et qui est doté d'une gorge (3a) appropriée pour venir en butée contre et recevoir ledit premier bord longitudinal (50a) de sorte à enrouler ce dernier en le poussant vers le second bord longitudinal (50b) et pour réaliser une partie enroulée (50c) de film ou une corde.
13. Appareil selon l'une quelconque des revendications précédentes, comprenant un autre élément pliant (3) pouvant être déplacé par lesdits moyens d'entraînement (10) le long de ladite trajectoire se rétrécissant (R) dans une direction qui est opposée audit élément pliant (3) pour venir en butée contre ledit second bord longitudinal (50b) et pousser ce dernier vers ledit premier bord longitudinal (50a) de sorte à réduire, en coopération avec ledit élément pliant (3), une largeur de bande (L) dudit film (50) sortant dudit appareil (1).
14. Machine d'emballage automotrice (100) pouvant être déplacée autour d'une charge pour emballer la charge avec un film en matière plastique et comprenant un appareil de dévidage (1) dudit film (50) selon

l'une quelconque des revendications précédentes.

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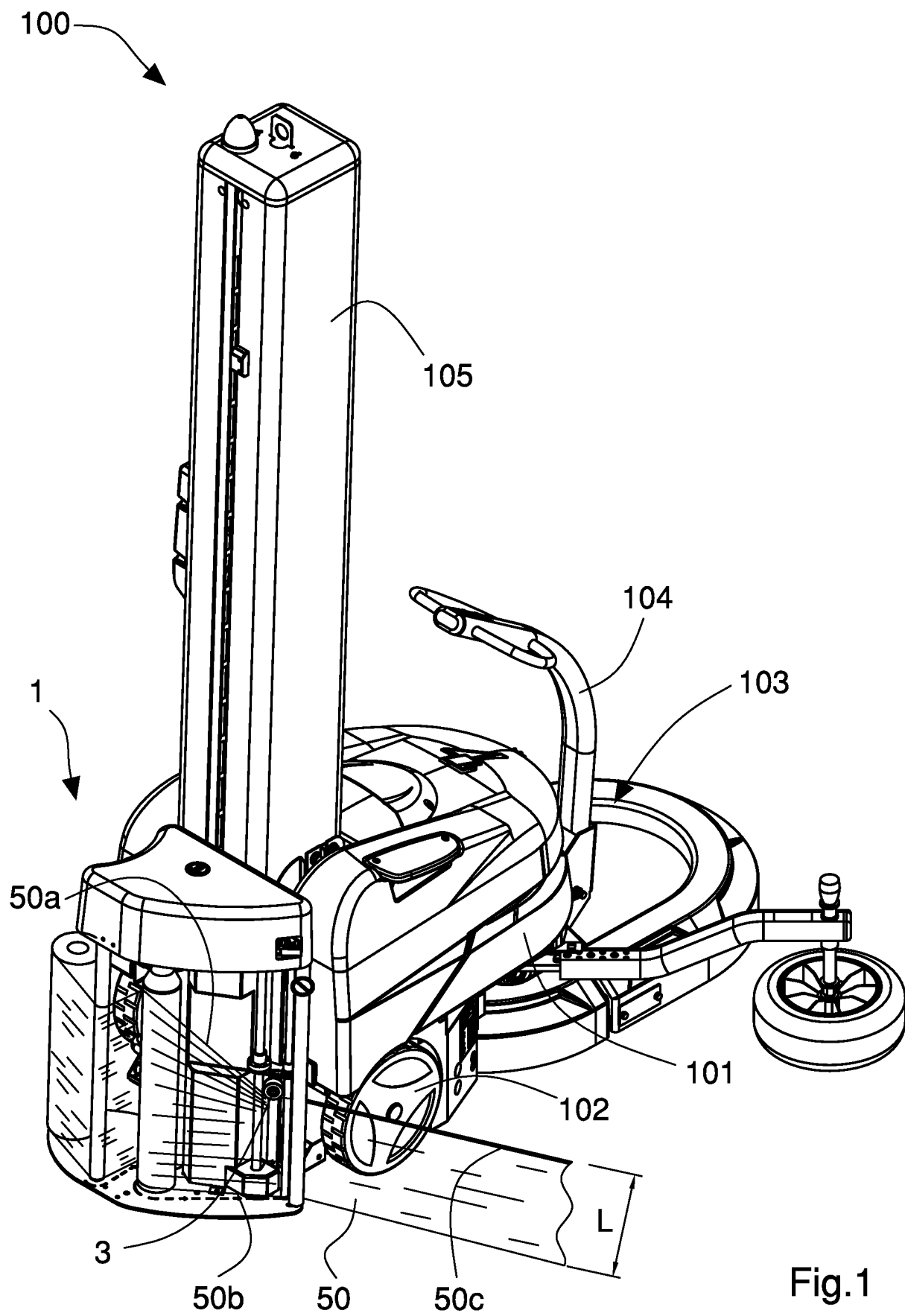


Fig.1

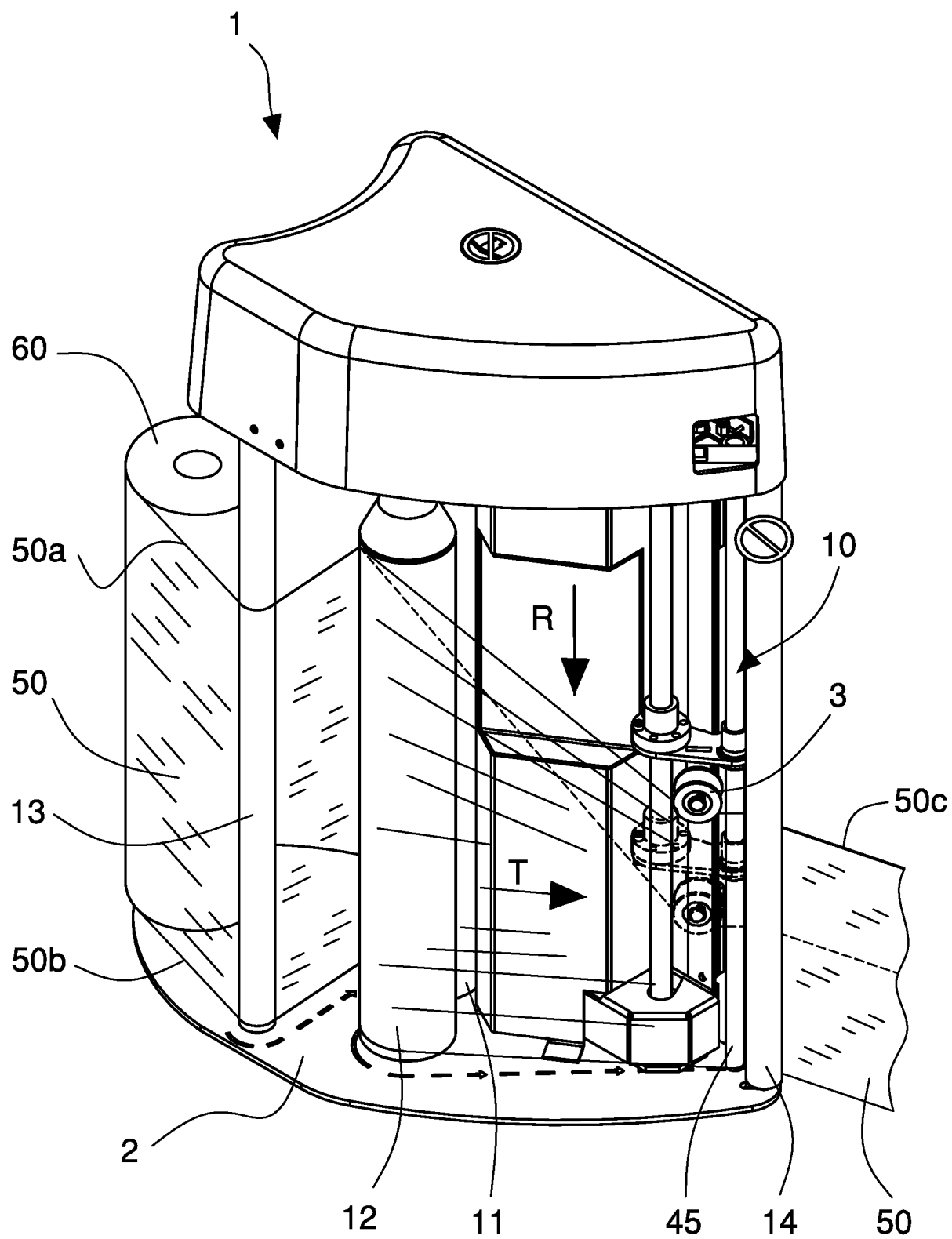


Fig. 2

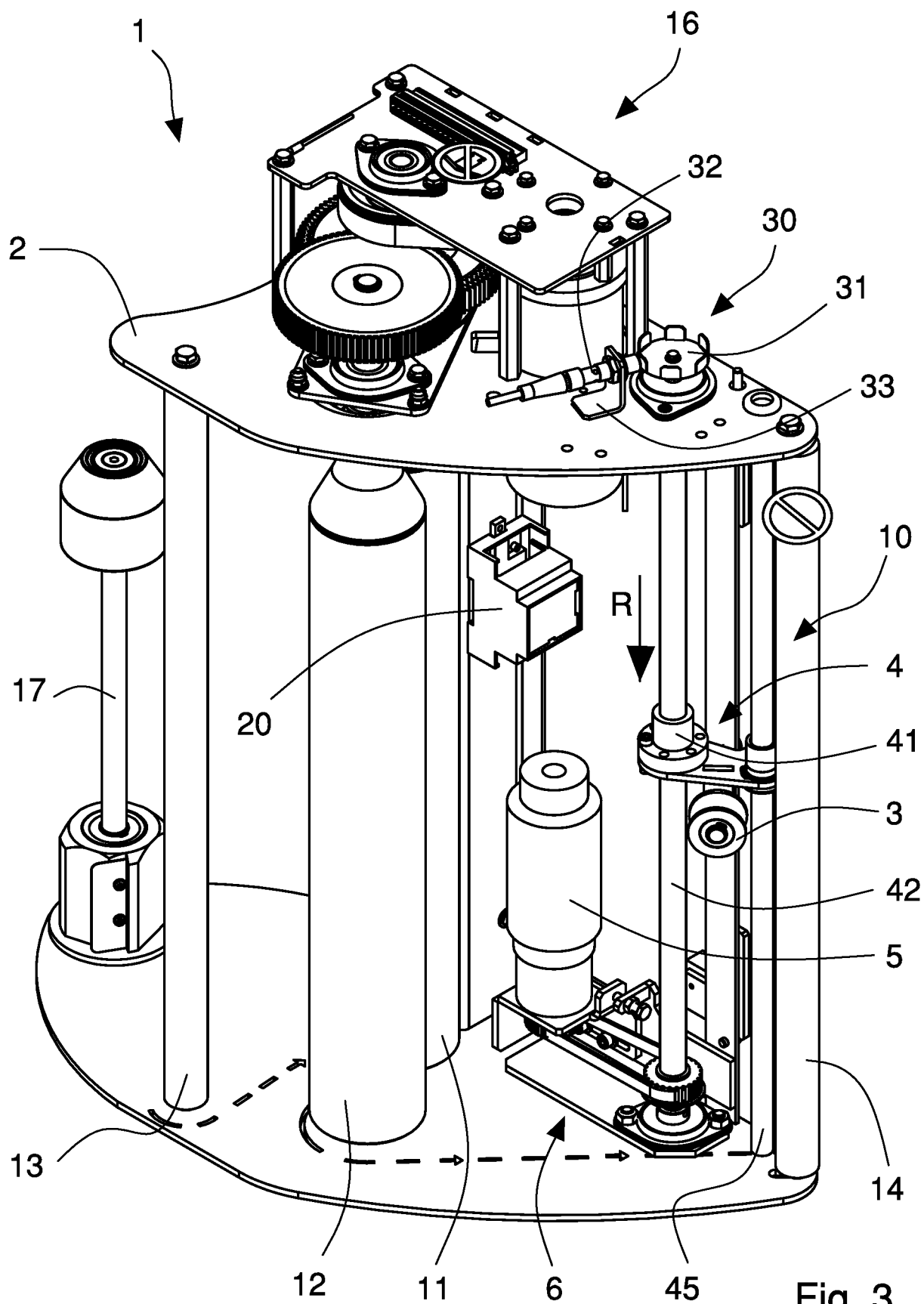


Fig. 3

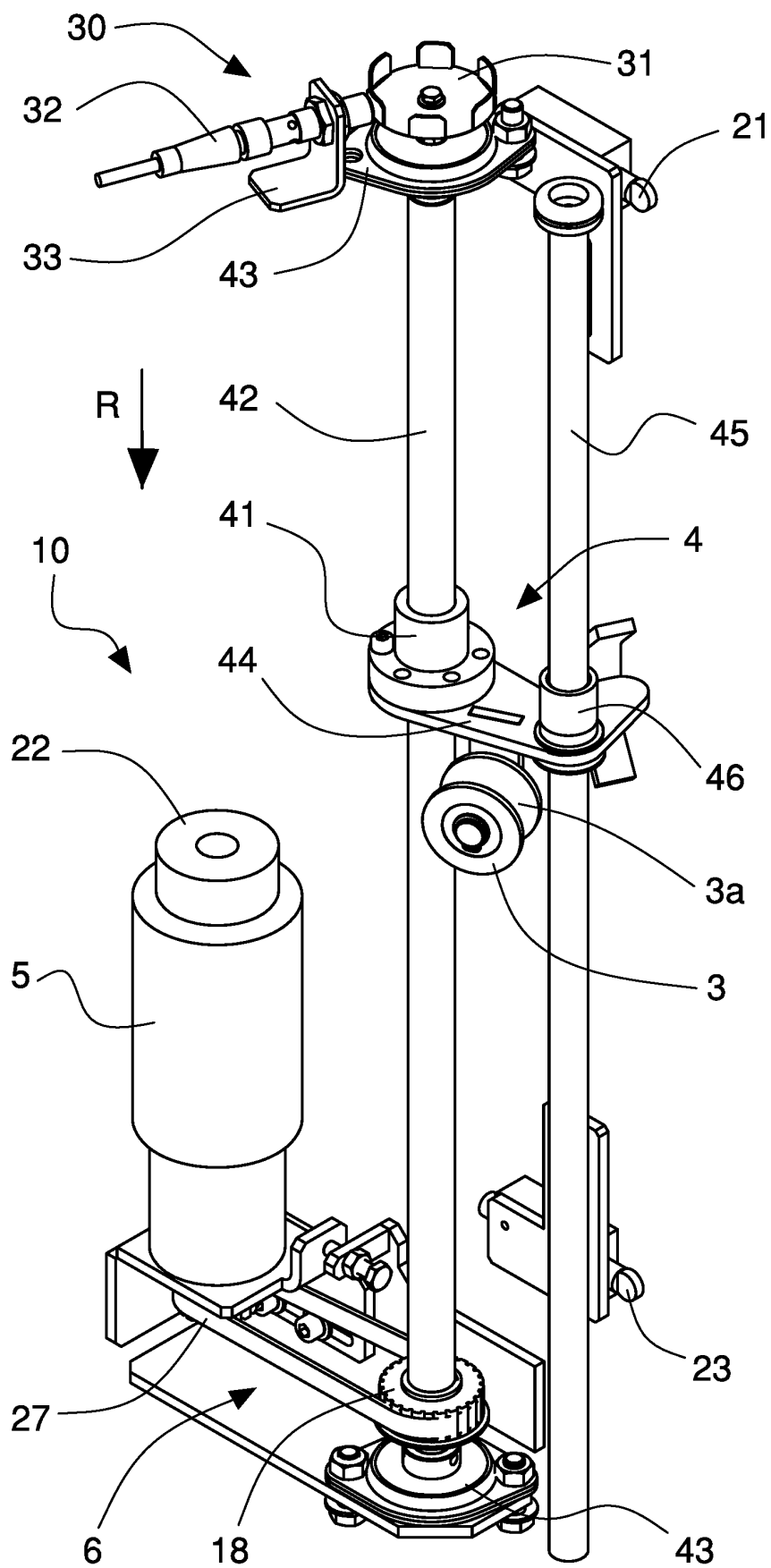


Fig. 4

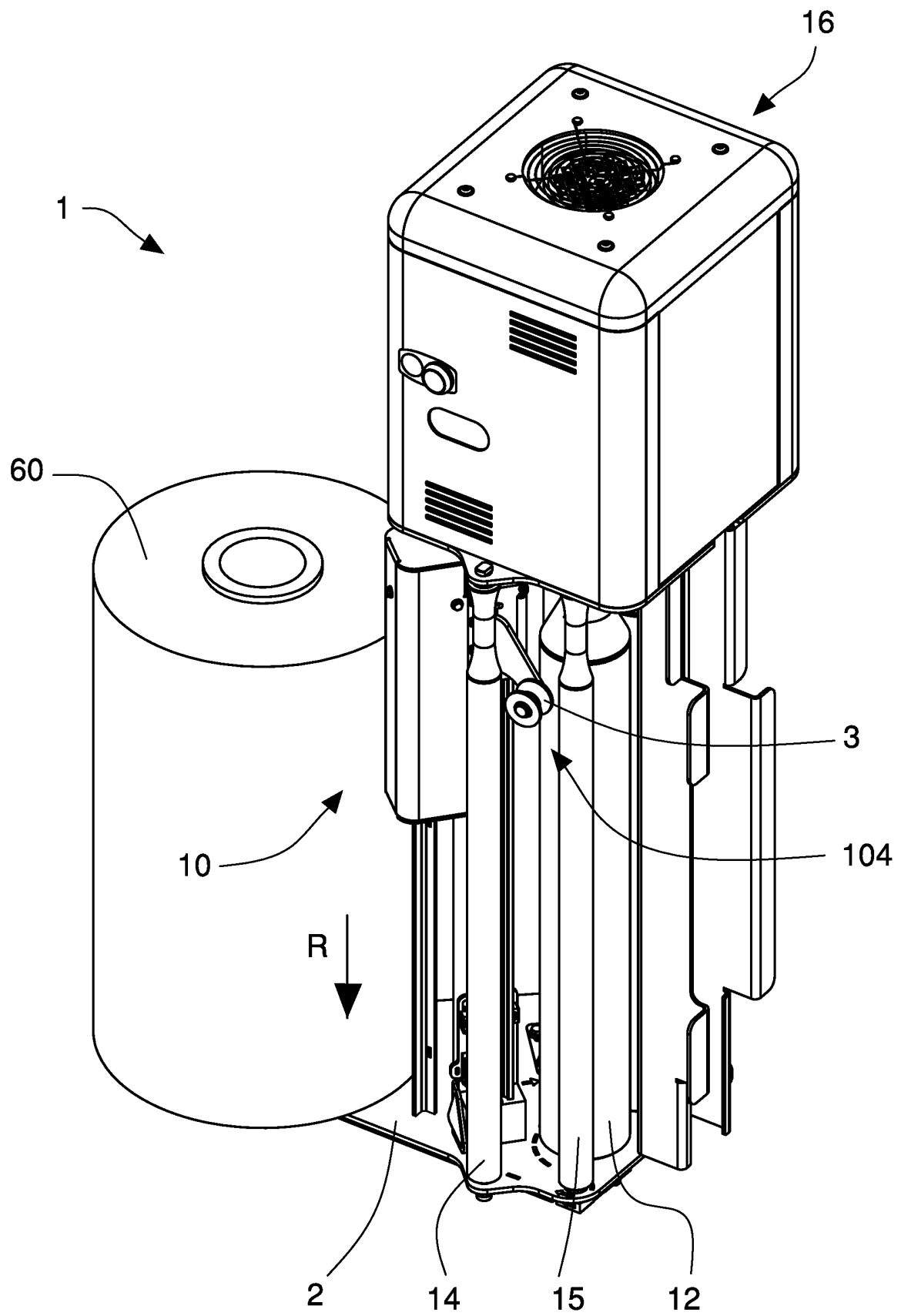


Fig. 5

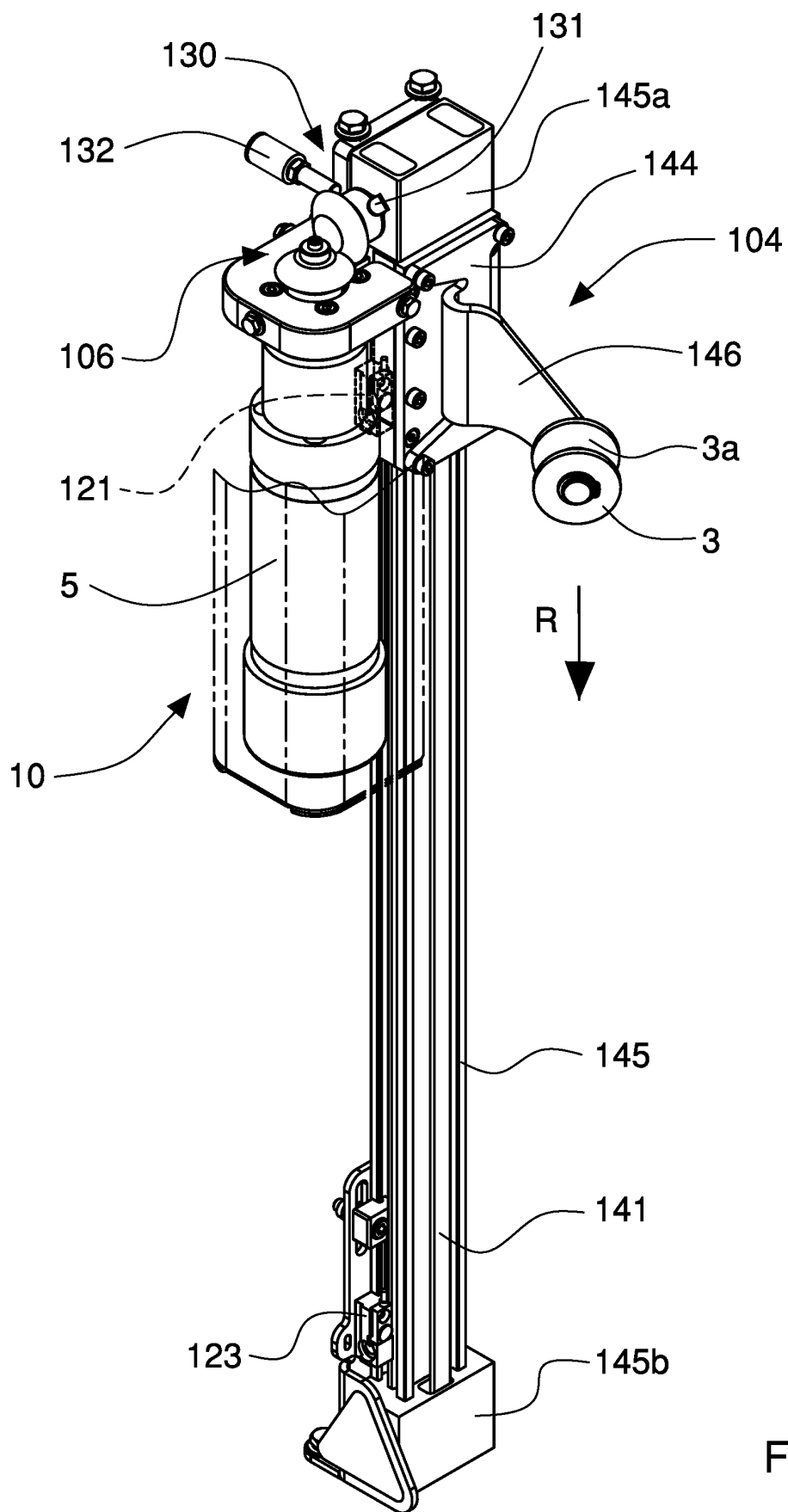


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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