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(54) **Apparatus and method for fixing a wrapping film**

(57) Apparatus associable with a wrapping machine (100; 110) for fixing an end tab (20a) of a wrapping film (20) to a film portion (20b) wrapped around a load (50) at the end of a wrapping process of the latter, comprises frame means (5), abutting means (2) and fixing means (3), the abutting means (2) and the fixing means (3) being supported by the frame means (5), cooperating with one another to grasp and fix the end tab (20a) to the film portion (20b) and being movable between respective operating positions (W1, W2), wherein they interact with the film (20), and respective non-operating positions (R1), wherein they do not interact with the film (20); the apparatus (1) comprises carriage means (4), rotatably supporting said abutting means (2) and being linearly movable along a movement direction (A), first driving

means (11; 41) for moving the carriage means (4) along the movement direction (A), and second driving means (12; 42) arranged for interconnecting and linking the abutting means (2) to the carriage means (4) and/or to the frame means (5) and for rotating the abutting means (2) when the carriage means (4) is moved along the movement direction (A), the abutting means (2) being thus moved with respect to the load (50) with a composite translation and rotation motion having a set motion composition ratio; the second driving means (12; 42) comprises an interchangeable transmission element (32; 22), in particular replaceable with at least one further transmission element, such as to enable the motion composition ratio and a desired motion trajectory of the abutting means (2) to be modified.

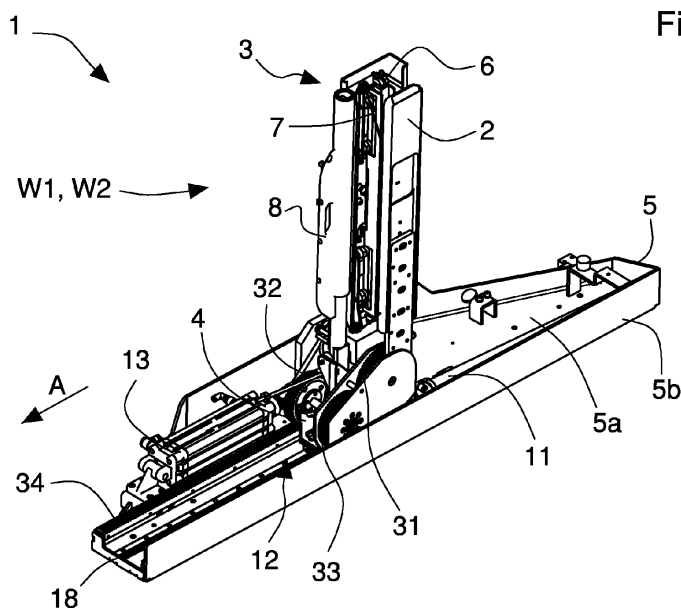


Fig. 1

Description

[0001] The invention relates to machines and methods for wrapping or binding a load with a film of stretchable plastic material. In particular, the invention refers to an apparatus and a method for fixing an end tab of the film to the load at the end of wrapping.

[0002] In known wrapping machines, the film of plastic material, typically cold stretchable plastic material, is unwound from a reel supported by a reel-holding unit and is wrapped around a load, generally arranged on a pallet, such as to form a series of plaited bands or coils, owing to the combination of a movement in a vertical direction of said reel-holding unit and of the relative rotation between the latter and the product.

[0003] In wrapping machines provided with a rotating load-supporting table, the load is rotated around a vertical wrapping axis, whilst the reel-holding unit is moved vertically with reciprocal motion.

[0004] In wrapping machines with a rotating ring or arm, the product remains fixed during wrapping, whilst the reel-holding unit is moved with respect to the load both in rotation around the vertical wrapping axis and in translation along the latter.

[0005] The reel-holding unit supports a reel of film and an unwinding apparatus provided with one or more deflecting rollers or gear rollers arranged for deflecting the film unwound from the reel to the load.

[0006] At the end of wrapping, i.e. when the load has been wrapped with a set number of plaited bands of film, the relative rotation stops between the reel-holding unit and the load for fixing an end tab of the film to a film portion already wrapped on the load and for separating this end tab from the film unwound from the reel by cutting.

[0007] Apparatuses are known, so-called film-welding and cutting apparatuses, that enable the film to be grasped at a zone comprised between the reel-holding unit and the load and an end tab thereof to be welded to the film already wrapped on the load. More precisely, an end tab of film coming from the reel is pressed by a welding element against a film portion wrapped on the load, which is supported by an abutting element, previously inserted inside the film wrapping. Once the end tab and the film portion have been welded they immobilise the film wrapped on the load.

[0008] After welding, the end tab is separated by cutting from the film unwound from the reel. In particular, by cutting the film, the end tab remains fixed to the load and a further end tab, so obtained, is retained by suitable grippers of the machine, the film being ready to be wrapped around a further load.

[0009] The abutting element is movable, in particular it is able to rotate between a non-operating position, in which it is generally folded and spaced apart from the load to enable the film to be wrapped around the load, and an operating position in which said abutting element is interposed between the reel-holding unit and the load

such as to enable the film to be wrapped thereupon, in an end step of wrapping. In this step, the abutting element is arranged substantially vertical and parallel to the wrapping axis, preferably positioned near and in contact with a side wall of the load, such that a subsequent disengagement thereof from the wrapping (rotation in an opposite direction, in the non-operating position) does not loosen or lessen wrapping tension of the film on the load.

[0010] The abutting element and the welding element have an elongated shape and length such as to make a welded portion of suitable dimensions, which is able to ensure the stability and resistance of the fixing.

[0011] In rotating-ring wrapping machines the welding and cutting apparatus is fixed to the movable frame that supports and moves the rotating ring vertically. In wrapping machines with a rotating arm or in machines with a rotating table, the welding and cutting apparatus is positioned next to the roller conveyor or to the table that supports and moves the load. One drawback of known apparatuses for fixing an end tab of wrapping film lies in the difficulty, in particular operating positions, of disengaging the abutting element from the film wrapped on the load at the end of welding. Such difficulties typically occur in the case of loads having limited transverse dimensions (more precisely a limited width of the wall of the load on which the welding and cutting apparatus of the film works). In these cases, due to the geometrical constraints, once the film has been wrapped the abutting element is unable to rotate from the operating position to the non-operating position such as to disengage from the wrapped film.

[0012] In rotating-ring wrapping machines the drawback can be overcome by moving the welding and cutting apparatus (fixed to the supporting frame of the rotating ring) vertically such as to slip, at least partially, the abutting element off the film wrapped on the load. This movement requires a certain time and thus determines an increase in the duration of the load-wrapping cycle and consequently a decrease in the productivity of the wrapping machine.

[0013] In rotating-table or rotating-arm wrapping machines the apparatus is fixed and cannot be moved vertically with respect to the machine. In this case it is necessary to reduce the length of the abutting element such as to enable the abutting element to rotate and disengage from the wrapped film. Nevertheless, reducing the length of the abutting element leads to another type of problem.

[0014] In order to perform optimum welding, the abutting element and the welding element have to press and clamp the film along the entire width thereof. In other words, the length of these elements should be the same or greater than the strip width of the film.

[0015] With abutting and welding elements of limited length, (to permit the disengagement thereof) complete welding is thus achieved only in the case of films of reduced strip width (e.g. 125- 300mm), whereas welding is partial in the case of films with a large width (400-500mm). Partial welding does not ensure stability and

resistance to wrapping: the end tab of the film can, in fact, detach, causing incomplete and untight wrapping of the load.

[0016] In order to overcome this drawback, apparatuses are known that enable the width of the film to be reduced by substantially corrugating and narrowing the end tab and the film portion to be welded. For this purpose, the welding and cutting apparatus comprises a gripping element (typically a spring) that grasps and corrugates the film.

[0017] When the film is excessively corrugated and narrowed (in the case of a film of great width), the quality of the welding is poor, as at many points the film is not completely welded because of folds and pleats. The stability and resistance of the fixing of the film may thus be poor. Further, the film-gripping element may fail to grip the film and/or reduce the width of the latter incompletely, this determining incomplete welding.

[0018] One object of the invention is to improve known apparatuses and methods, in particular apparatuses and methods for fixing an end tab of a wrapping film of plastic material around a load.

[0019] Another object is to obtain an apparatus and a method that enable an end tab of a wrapping film to be made and fixed in a stable and permanent manner.

[0020] A further object is to make an apparatus and a method that enable the duration of a load wrapping cycle to be reduced and the productivity of the wrapping machine to be thus increased on which said apparatus can be mounted.

[0021] Still another object is to obtain a simple and cheap apparatus having precise, effective and reliable operation.

[0022] In a first aspect of the invention an apparatus according to claim 1 is provided.

[0023] In a second aspect of the invention a wrapping machine is provided comprising the apparatus of the first aspect and according to claim 13.

[0024] In a third aspect of the invention a method according to claim 14 is provided.

[0025] Owing to these aspects of the invention, and in particular owing to the composite translation and rotation motion of the abutting means of the apparatus, which can be modified and adjusted according to the specific needs, it is possible to simplify and accelerate a welding and cutting step of an end tab of the film at the end of the procedure of wrapping or binding the load with the film, noticeably reducing the overall time of execution of the aforesaid procedure.

[0026] Further, it is possible to choose and set a motion composition ratio consisting of translation and rotation of the abutting means such as to obtain a desired motion trajectory of the latter, in particular during the step of disengagement from the film. This motion trajectory can be defined and set according to the features of the wrapping machine, of the wrapping film, of the load to be wrapped.

[0027] Using the apparatus of the invention in a rotating-ring wrapping machine enables moving a slidable

frame to be avoided that supports the rotating ring and the apparatus in order to disengage the abutting means at the end of the wrapping procedure. It is thus possible to reduce the total time necessary for wrapping a load with the film and increasing the productivity of the wrapping machine.

[0028] The abutting means of the apparatus of the invention can be disengaged from the film wrapped on the load even if the latter has reduced dimensions or anyway dimensions that are such as not to enable the abutting element to be disengaged in the manner of known apparatuses.

[0029] The length of the abutting means and of the fixing means of the apparatus enables the entire width of the film to be grasped, clamped and welded, also if the film has a large strip width. It is thus possible to weld the entire width of the end tab to the film portion wrapped on the load, making continuous welds of great quality and resistance.

[0030] The invention can be better understood and implemented with reference to the attached drawings that illustrate some embodiments thereof by way of non-limiting example, in which:

Figure 1 is a perspective view of the film welding and cutting apparatus of the invention in one operating configuration;

Figure 2 is a frontal view of the apparatus in Figure 1; Figure 3 is a fragmentary and enlarged plan view of the apparatus in Figure 1;

Figure 4 is an enlarged side view of the apparatus in Figure 1 associated with a load to be wrapped, in the operating configuration and wrapped by a film; Figures 5 and 6 are perspective views of the apparatus in Figure 1 that illustrate abutting means in an intermediate position and in a non-operating position, respectively;

Figure 7 is a schematic frontal view of the apparatus of the invention associated with a horizontal rotating-ring wrapping machine, with the abutting means in an operating position and, represented by a dashed line, in successive intermediate positions and in the non-operating position;

Figure 8 is a schematic perspective view of the apparatus of the invention associated with a rotating-arms wrapping machine;

Figure 9 is a frontal view of the apparatus and of the wrapping machine in Figure 8;

Figure 10 is a perspective view of one version of the apparatus of the invention;

Figure 11 is a frontal view of the apparatus in Figure 10.

Figure 12 is a perspective view of another version of the apparatus in Figure 1;

Figure 13 is a perspective view of a further version of the apparatus in Figure 1.

[0031] With reference to Figures 1 to 6, the apparatus

1 of the invention is illustrated that is associable with a wrapping machine 100 for wrapping a load 50 with a film 20 for fixing an end tab 20a of the aforesaid film 20 to the load 50 at the end of wrapping or binding.

[0032] The apparatus 1 comprises abutting means 2 and fixing means 3, connected and supported by frame means 5, and cooperating with one another to clamp the end tab 20a of the film 20 and fix the end tab 20a to a film portion 20b already wrapped on the load 50. The abutting means 2 and the welding means 3 are movable (with respect to the frame means 5) independently and separately between respective operating positions W1, W2, in which they interact with the film 20 (to clamp and fix the end tab 20a) and respective non-operating positions R1, in which said abutting means 2 and said fixing means 3 do not interfere with the film 20 and enable the film 3 to be wrapped freely around the load 101. The apparatus 1 comprises carriage means 4 that rotatably supports the abutting means 2 and is linearly movable along a movement direction A, first driving means 11 for moving the carriage means 4 along the movement direction A and second driving means 12 for interconnecting and connecting the abutting means 2 to the carriage means 4 and/or to the frame means 5 and for rotating the abutting means 2 when the carriage means 4 is moved along the movement direction A, such that the abutting means 2 is moved with respect to the load 50 with a composite translation and rotation motion having a set motion composition ratio, as explained better further on in the description.

[0033] The second driving means 12 comprises an interchangeable transmission element 32, which is in particular replaceable with at least one further transmission element, for modifying the motion composition ratio and varying and obtaining a desired motion trajectory of said abutting means 2, in particular during disengagement from the film.

[0034] The frame means 5, which comprises a shaped and elongated supporting plate 5a, provided with a peripheral frame 5b, supports the carriage means 4 slidably and the fixing means 3 rotatably.

[0035] In particular, the carriage means 4 comprises a carriage or cursor or shuttle or other equivalent element, mounted slidably on linear guides or rails 18 fixed to the supporting plate 5a, parallel to one another and to the movement direction A. The carriage 4 is movable in both directions along the movement direction A and performs an operating stroke L.

[0036] The abutting means comprises an abutting element 2 of substantially flat and elongated shape, which is mounted on the carriage 4, such as to rotate around a first rotation axis X1 between a first operating position W1, in which it is substantially orthogonal to the supporting plate 5a, i.e. almost vertical, such as to intercept the film 20 (Figures 1-4), and a first non-operating position R1, in which said abutting element 2 is folded, almost parallel and adjacent to the supporting plate 5a, such as not to interfere with wrapping of the film 20 around the

load 50 (Figure 6).

[0037] The first rotation axis X1 is transverse, in particular orthogonal, to the movement direction A.

[0038] The first driving means 11 is able to move the carriage 4 along the movement direction A, in both directions; the second driving means 12 enables the abutting element 2 to be rotated around the first rotation axis X1 when the carriage 4 is moved.

[0039] The first driving means comprises a first linear actuator 11, for example of pneumatic or hydraulic or electric type, fixed to the supporting plate 5a of the frame means 5 and acting on the carriage 4.

[0040] The second driving means 12 comprises means that is able to convert, or transform, the linear motion of the carriage 4 into rotary motion of the abutting element 2.

[0041] In the embodiment illustrated in Figures 1-6, the second driving means 12 comprises rack means 34 fixed to the frame means 5, a first gearwheel 31 fixed to the abutting element 2 and able to rotate with the latter and gear means 32, 33, 35 connected to the carriage means 4 and coupled respectively with the rack means 34 and with the first gearwheel 31 such as to rotate the latter when the carriage means 4 is moved along the movement direction A. The interchangeable transmission element comprises a second gearwheel 32 of the gear means 32, 33, 35 which is engaged with the rack means 34 and is connected to the first gearwheel 31. In this manner, the carriage means 4, when it is moved, causes the rotation, by the second gearwheel 32 engaged in the rack means 34, of the first gearwheel 31 and thus of the abutting means 2, as explained better below in the description.

[0042] The rack means 34 comprises a flat linear gear, fixed to the supporting plate 5a and arranged parallel to the movement direction A, on which the second gearwheel 32 meshes. A third gearwheel 33 of the gear means meshes in turn with the first gearwheel 31 fixed to the abutting element 2. The second gearwheel 32 and the third gearwheel 33 are mounted on the same supporting shaft 35. The number of teeth of the gearwheels 31, 32, 33 is such as to reduce the number of revolutions of the first gearwheel 31 with respect to the number of revolutions of the second gearwheel 32, which engages with the rack 34 so as to reduce the transmission ratio and obtain a suitable rotation torque acting on the abutting element 2.

[0043] In operation, when the carriage 4 is moved along the movement direction A by the first actuator 11 the second gearwheel 32 that is engaged with the rack 34 rotates by an angle that depends both on the linear movement of the carriage 4 and on the meshing or transmission ratio between the rack 34 and the second gearwheel 32. The rotation of the second gearwheel 32 determines (by the gear means, i.e. the third gearwheel 33) the rotation of the first gearwheel 31 and thus the rotation of the abutting element 2 with respect to the carriage 4. In other words, the angular movement or rotation of the abutting element 2 is correlated with and is a function of the linear movement of the carriage 4. In particular, an

operating stroke L of the carriage 4 is matched by a rotation, for example by 90°, of the abutting element 2.

[0044] With reference to the embodiment illustrated in Figures 1-6, when the carriage 4 is at the first rotation axis X1, the abutting element 2 is in the first operating position W1, raised and substantially vertical. When the carriage 4 is more distant from the first rotation axis X1, the abutting element 2 is in the first non-operating position R1, folded and substantially horizontal.

[0045] The linear force exerted by the first actuator 11 is converted into rotation torque acting on the second gearwheel 32 and on the first gearwheel 31 fixed to the abutting element 2 by the third gearwheel 33. By sizing the gearwheels 31, 32, 33 appropriately, it is thus possible to transform the thrust or linear force exerted by the first actuator 11 on the carriage 4 into torque or rotation moment applied to the abutting element 2.

[0046] In one version of the apparatus 1 that is not illustrated in the Figures, reduction gear means is interposed between the second gearwheel 32 and the third gearwheel 33 to reduce further the number of revolutions of the first gearwheel 31 with respect to the second gearwheel 32 and increase the torque acting on the abutting element 2. The reduction gear means can comprise, for example, an epicyclicoidal reduction gear mounted co-axially on the supporting shaft 35.

[0047] It should be noted that with respect to the frame means 5, and therefore to the load 50, the abutting element 2 moves according to a composite translation and rotation motion (rototranslation motion) having a defined motion composition ratio and a law that is definable with precision on the basis of the transmission ratio made by the gearwheels 31, 32, 33 and by the rack 34. This composite motion enables the abutting element 2 to move between the operating position W1 and the non-operating position R1 (and vice versa) using a manoeuvring space (swept area) of smaller dimensions than the space required by the abutting element if moved only with a rotary motion. As explained better further on in the description, it is in this way possible for the abutting element 2 of the apparatus 1 of the invention to disengage more easily from the film 20 wrapped on the load 50 once the welding and cutting operations have been performed.

[0048] The second driving means 12 in the embodiment disclosed and illustrated in Figures 1-6, enable the abutting element 2 to move according to a curved or linear motion trajectory. By varying the transmission ratio of the gearwheels 31, 32, 33, in addition to modifying the rotation torque acting on the abutting element 2, it is possible to vary the motion trajectory of the latter.

[0049] In particular, by replacing the second gearwheel 32, which acts as an interchangeable transmission element of the second driving means 12, it is possible to modify the motion composition ratio and thus vary and obtain a desired motion trajectory of the abutting element 2. The second gearwheel 32, which is reversibly and removably mounted on the supporting shaft 35, can be easily and rapidly dismantled and replaced by a further sec-

ond gearwheel, chosen between a plurality of second gearwheels, having a different number of teeth such as to vary the transmission ratio. The interchangeable transmission element 32 of the second driving means 12 thus enables a desired motion trajectory of the abutting element 2 to be designed and defined, in particular in the step of disengagement from the film. This trajectory can be defined and set according to the features of the wrapping machine, of the wrapping film, of the load to be wrapped.

[0050] The fixing means 3 is mounted on frame means 5 such as to rotate around a second rotation axis X2 between a second operating position W2, in which it is substantially orthogonal to the supporting plate 5a i.e. is vertical, such as to interact with the film 20, and a first non operating position (non illustrated), in which said fixing means 3 is folded, almost parallel and adjacent to the supporting plate 5a, such as not to interfere with wrapping of the film 20 around the load 50. The second rotation axis X2 is transverse, in particular orthogonal, to the movement direction A. The second rotation axis X2 is also parallel to the first rotation axis X1.

[0051] The fixing means 3 is rotated by further driving means 13 comprising, for example, a respective linear actuator, for example of pneumatic or hydraulic or electric type, fixed to the supporting plate 5a of the frame means 5 and acting on said fixing means 3.

[0052] In one operating configuration of the apparatus 1 (illustrated in Figures 1 to 4) the abutting means 2 and the fixing means 3 are respectively in the first operating position W1 and in the second operating position W2.

[0053] The fixing means 3 comprises welding means 6 arranged for welding the end tab 20a to the film portion 20b already wrapped on the load 50.

[0054] The fixing means 3 comprises, in particular, a supporting element 8 rotatably fixed to the supporting plate 5a such as to rotate around the second rotation axis X2. The welding means 6 is fixed to the supporting element 8.

[0055] Cutting means 7 is connected to the fixing means 3 and arranged for cutting the film 20 such as to separate the end tab 20a (fixed to the load 50) from the film portion coming from an unwinding unit of the wrapping machine. The cutting means 7, for example of the hot-wire type, is fixed to the supporting element 8.

[0056] The invention also refers to a method for wrapping a load 50 with a film 20 in a wrapping machine 100 provided with the apparatus disclosed above and comprising abutting means 2 and fixing means 3 that are movable between respective operating positions W1, W2, in which they interact with said film 20, and respective non-operating positions R1, in which they do not interact with the film 20.

[0057] The method comprises at least the following steps:

- wrapping the load 50 with the film 20;
- moving the abutting means 2 to the first operating

position W1 and wrapping the load 50 and the abutting means 2 with the film 20;

- moving the fixing means 3 to the second operating position W2 and grasping and fixing an end tab 20a of said film 20 to a film portion 20b wrapped around the load 50 and the abutting means 2;
- disengaging of the abutting means 2 from the end tab 20a and from the film portion 20b;
- said disengaging comprising moving the abutting means 2 from the first operating position W1 to the first non-operating position R1 with a composite translation and rotation motion having a set motion composition ratio;
- before said disengaging of the abutting means 2, said established motion composition ratio being set such as to obtain a desired motion trajectory of the abutting means 2 during said disengaging.

[0058] The step of setting the motion composition ratio is performed with the wrapping machine stationary by replacing the interchangeable transmission element 32 of the second driving means 12 of the apparatus 1.

[0059] The method further provides, after the gripping and fixing step and before the disengaging step, a step of cutting and separating the end tab 20a from the film 20 coming from an unwinding unit of the wrapping machine 100.

[0060] In particular, it is provided that the disengaging step of disengaging the abutting means 2 is performed by maintaining the load 50 stationary and/or maintaining the apparatus 1 stationary with respect to the wrapping machine 100. In particular, in the case of the horizontal rotating-ring wrapping machine 100 of Figure 7, in which the apparatus 1 is fixed to the slidable frame 101 that supports rotatably the rotating ring, the disengagement step can be carried out without moving vertically (lifting) the aforesaid slidable frame, which can remain in position, stationary. In other words, the wrapping machine and the apparatus 1 are stationary during the disengagement step.

[0061] In the case of the rotating-arm wrapping machine 110 of Figures 8 and 9, in which the apparatus 1 is fixed to the conveying means 114 of the load 50, the disengagement step can be carried out without moving the load 50 along the advancing direction T and/or around the wrapping axis.

[0062] Owing to the method of the invention it is possible to simplify and accelerate the fixing (welding) and cutting procedure of the end tab of the film at the end of the load-wrapping procedure, noticeably reducing overall execution time.

[0063] With reference to Figure 7, the apparatus 1 of the invention can be installed on a horizontal rotating-ring wrapping machine 100 i.e. be provided with a horizontal ring, that rotates around a vertical wrapping axis and is movable vertically, such as to wrap the load 50 with helical coils or bands of film. For this purpose, the ring is rotatably supported by a slidable frame 101 that

is movable along a movement direction that is vertical and substantially parallel to the wrapping axis. The apparatus 1 is fixed to the slidable frame 101.

[0064] As illustrated schematically in Figure 7, the abutting element 2 is moved from the operating position W1 to the non-operating position R1 (so as to disengage from the film 20 wrapped on the load 50) with a composite translation and rotation motion. Following this motion, an end 2a of the abutting element 2 moves along a curvilinear trajectory P. In Figure 7 there is illustrated also a further trajectory Q (dashed line) which would have the end 2a if the abutting element were mounted only rotatably around the first rotation axis X1, as occurs in known apparatuses.

[0065] Owing to the composite motion (rototranslation motion), the manoeuvring space (swept area E) necessary to the abutting element 2 to return to the non-operating position R1 is reduced and such as to enable said abutting element 2 to disengage from the film 20 wrapped on the load without requiring lifting of the apparatus 1, i.e. of the movable frame 101 (with a load 50 having the illustrated dimensions). As shown by the further trajectory Q, the disengagement of the abutting element would not be possible with the same load 50 without lifting of the apparatus 1 if the abutting element had only a rotary motion; in this case the necessary manoeuvring space would be greater than that made available by the dimensions (width) of the load 50.

[0066] The apparatus 1 of the invention thus enables the procedure to be simplified and accelerated for welding and cutting the end tab of the film, noticeably reducing execution time as it is not necessary to move the slidable frame 101 to disengage the abutting element 2. It is thus possible to reduce the total time required to wrap a load 50 with the film 20 and increase the productivity of the wrapping machine 100.

[0067] With reference to Figures 8 and 9, the apparatus 1 of the invention can also be installed on a rotating-arms wrapping machine 110, i.e. be provided with a pair of arms 111 that are opposite and fixed to a supporting frame 112 rotating around a vertical wrapping axis. Each arm 111 slidably supports a respective unwinding unit 113, which is movable parallel to the wrapping axis and is provided with a reel of film and with a plurality of film unwinding and pre-stretching rollers. The wrapping machine 110 is provided with conveying means 114 for conveying the load 50, comprising, for example, a motor-driven roller conveyor.

[0068] The apparatus 1 of the invention is fixed to the conveying means 114, on a side of the latter.

[0069] Owing to the composite translation and rotation movement of the abutting element 2, the abutting element 2 can be moved from the operating position W1 to the non-operating position R1 and then be disengaged from the film 20 wrapped on the load 50 even if the latter has reduced dimensions or anyway dimensions that are such as not to enable the abutting element from being disengaged (over the same length) if the latter were pro-

vided with only rotary motion, as provided in the known apparatuses. In the latter, the length of the abutting element has to be suitably limited to permit the disengagement thereof. The manoeuvring space that is available for the abutting element in fact depends on the width of the side of the load 50 on which the apparatus 1 acts and on the length of the abutting element 3.

[0070] The abutting element 2 and the fixing means 3 of the apparatus 1 of the invention can then have a length that is such as to grasp and completely clamp the film 20 even if this has a great strip width (up to 500 mm). The apparatus 1 of the invention thus enables the entire width of the end tab 20a to be welded to the film portion 20b wrapped on the load 50, achieving continuous welding of great quality and resistance. It is not necessary to reduce the width of the film, by corrugating and narrowing the end tab 20a and the film portion 20b wrapped on the load, as occurs in known apparatuses, affecting the stability and resistance of the junction.

[0071] Movement means 115 is provided for moving the apparatus 1 along an approach direction B substantially orthogonal to an advancing direction T of load 50 through the wrapping machine 110 and to the wrapping axis. The movement means 115 is connected to the conveying means 114 and enables the apparatus 1 to be moved between a work position in which it is adjacent to the load 50 to carry out the welding and cutting procedure of the film and a disengagement position in which said apparatus 1 is spaced away from the load to permit wrapping with the film and/or movement along the advancing direction T.

[0072] With reference to Figures 10 and 11, one version of the apparatus 1 of the invention is illustrated that differs from the embodiment previously disclosed for the second driving means 42 that comprises cam means 22, 23 connected to the frame means 5, coupled with the abutting means 2 and configured such as to rotate the latter around the first rotation axis X1 when the carriage means 4 is moved along the movement direction A by the first driving means 11. The latter comprises a first linear actuator arranged next to the further driving means 13 that moves the fixing means 3.

[0073] The cam means comprises a moving element 22 provided with a respective sliding guide 22a arranged for slidably receiving and guiding a follower element 23 fixed to the abutting means 2.

[0074] The moving element 22 has, for example, a flat and elongated shape and is reversibly and removably connected to the peripheral frame 5b of the frame means 5, arranged substantially orthogonal to the supporting plane 5a and parallel to the movement direction A. The sliding guide 22a comprises a groove or elongated channel made on the moving element 22. The slidable coupling between the follower element 23 and sliding guide 22a determines during the movement of the carriage 4 (and thus of the follower element 23) along the movement direction A, the rotation of the abutting element 2.

[0075] The follower element 23 comprises, in fact, a

roller rotatably fixed to the abutting element 2, which is eccentric to the first rotation axis X1 and engaged in the sliding guide 22a. The roller 23 is rotatable around an axis parallel to the first rotation axis X1 and spaced away from the latter by a distance d. The aforesaid distance d and the length of the channel 22a (or stroke L of the carriage 4) are determined so as to enable the abutting element 2 to be rotated by 90°, in both directions.

[0076] In operation, when the carriage 4 is moved along the movement direction A from the first driving means 11, the follower element 23 slides, rotating, along the sliding guide 22, which determines the movement thereof also along a direction orthogonal to the first rotation axis X1 and to the movement direction A. The movements of the follower element 23 in this orthogonal direction cause (by virtue of the distance d between the axis of the roll and the first rotation axis X1) the rotation of the abutting element 2. The rotation movement of the latter is thus a function of the linear movement of the carriage 4 and of the profile and of the geometrical features of the sliding guide 22a of the moving element 22. Also in this case the abutting means 2 is moved with a composite translation and rotation motion having a set motion composition ratio.

[0077] In this version of the apparatus 1 of the invention, the interchangeable transmission element comprises the moving element 22 with the respective sliding guide 22a. By replacing the moving element 22, it is possible to modify the motion composition ratio and thus vary and obtain a desired motion trajectory of the abutting element 2, for example a non-linear trajectory motion. The moving element 22, which is reversibly and removably connected to the frame means, can be easily and rapidly dismantled and replaced by a further moving element, chosen from between a plurality of moving elements, having a different course and profile of the sliding guide. The interchangeable transmission element 22 of the second driving means 42 thus enables a desired motion trajectory of the abutting element 2 to be designed and defined, in particular in the step of disengagement from the film. This trajectory can be defined and set according to the features of the wrapping machine, of the wrapping film, of the load to be wrapped.

[0078] Figure 12 illustrates another version of the apparatus 1 of the invention that differs from the embodiment previously disclosed and illustrated in Figures 1 to 6 by the first driving means 41 that comprises a rotating actuator, for example a rotating electric motor, fixed to the frame means 5 and coupled with the, and acting on the, second gearwheel 32. The rotating actuator 41 then rotates the aforesaid gearwheel 32, which moves the carriage 4 along the movement direction A (as the gearwheel 32 meshes with the rack 34 fixed to the frame means 5) and rotates the abutting element 2 around the first rotation axis X1 (as the gearwheel 32 meshes by means of the third gearwheel 33 with the first gearwheel 31 fixed to the abutting element 2). Reduction gear means can be interposed between the rotating actuator 41 and the

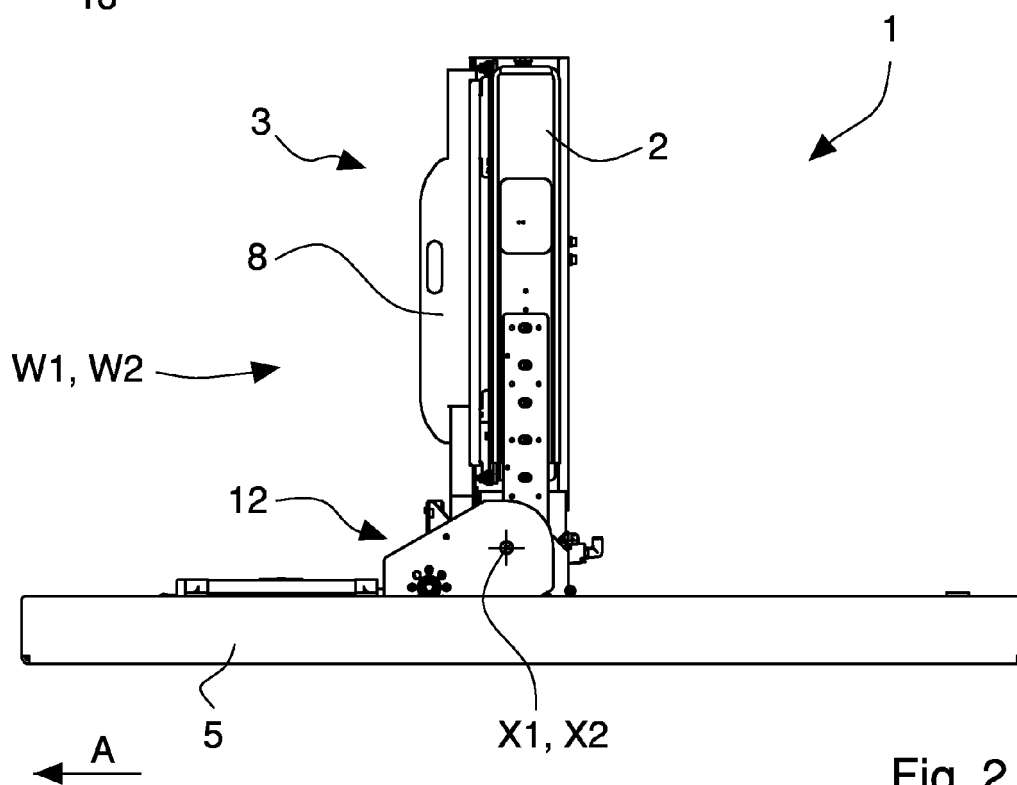
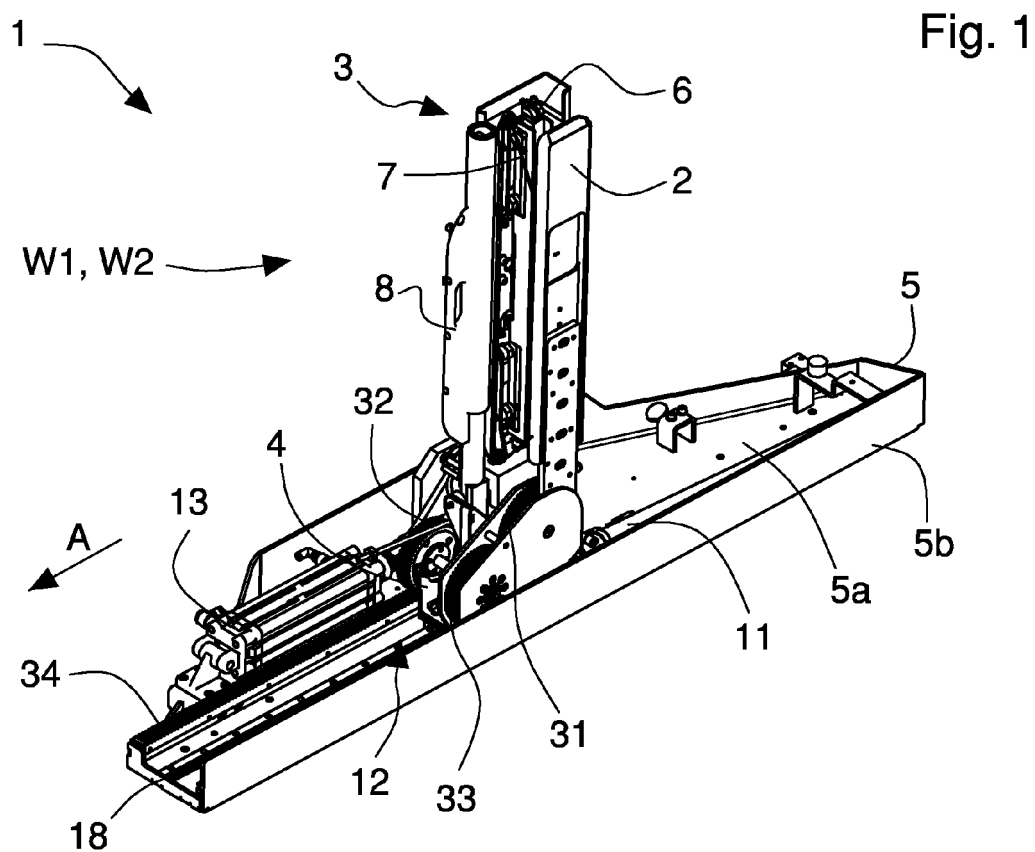
second gearwheel 32 to reduce the number of revolutions of the latter.

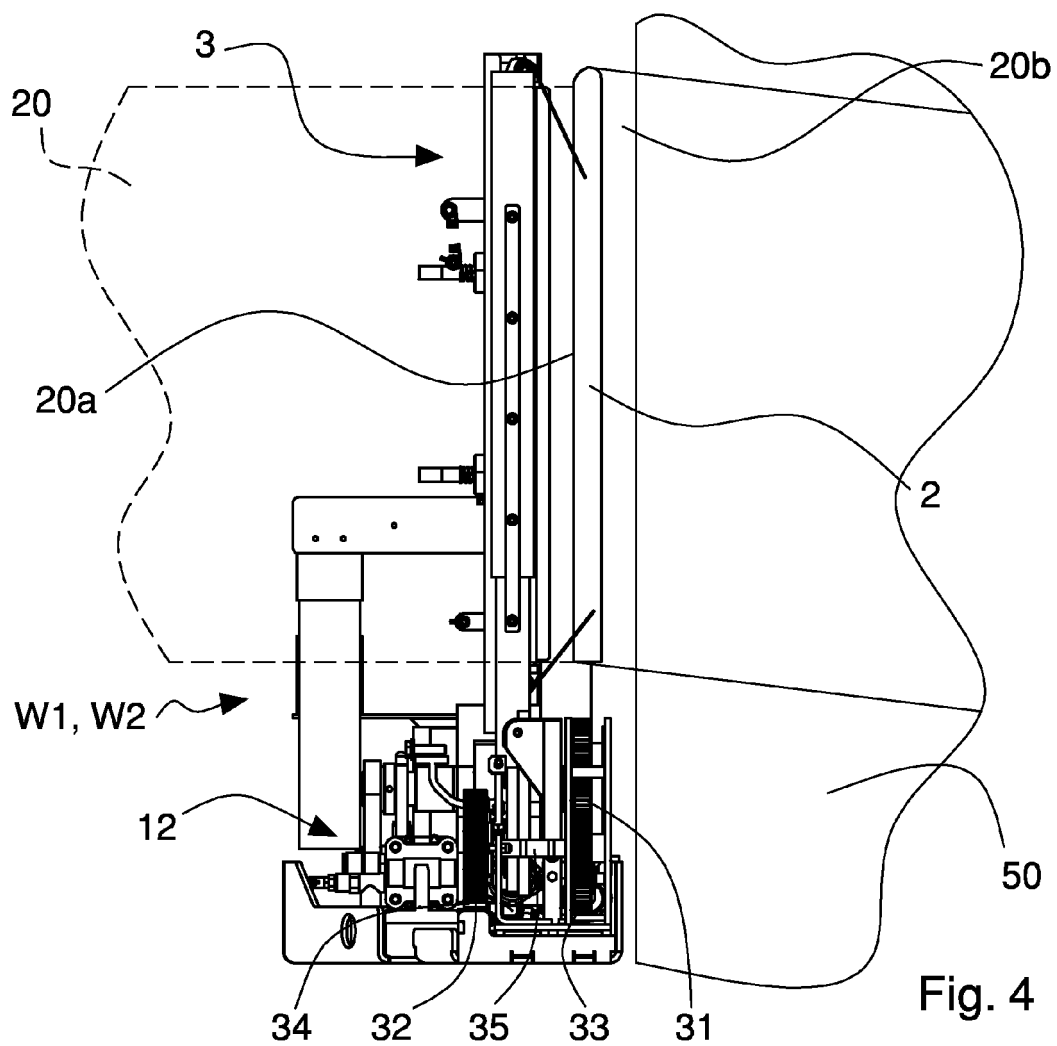
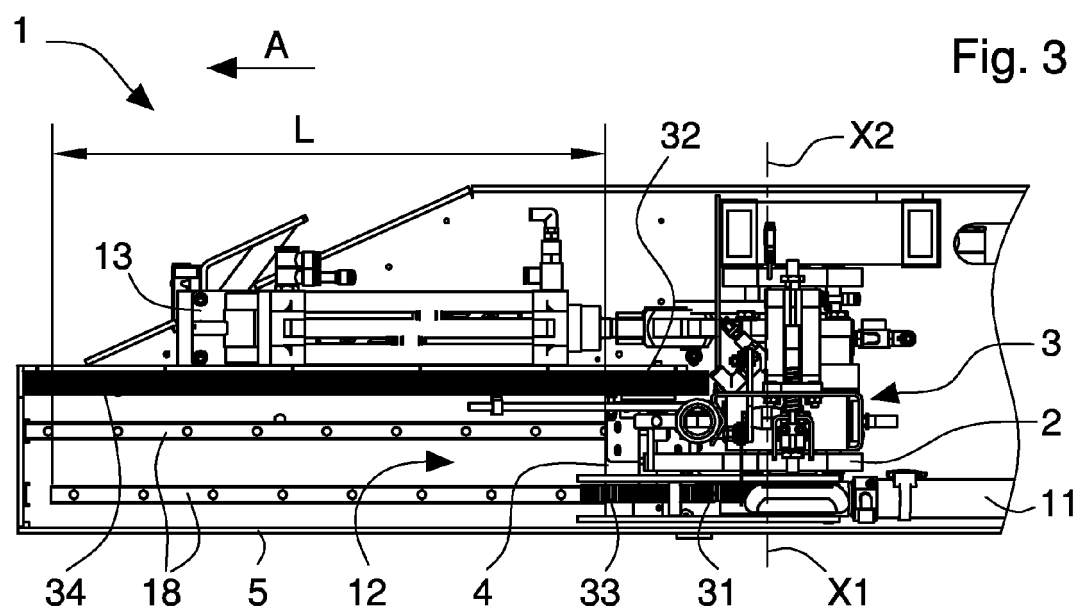
[0079] With reference to Figure 13, a further version of the apparatus 1 is illustrated that differs from the embodiment previously disclosed and illustrated in Figures 10 and 11, for the second driving means 52 that comprises a second linear actuator, for example of pneumatic or hydraulic or electric type, fixed to the frame means 5 and acting on the abutting element 2 such as to rotate the abutting element 2 around the first rotation axis X1. In this version of the apparatus, the drive of the first linear actuator 11 and of the second linear actuator 52 is controlled in a coordinated manner such as to move the abutting element 2 with a composite translation and rotation motion, along a predefined and desired curvilinear trajectory.

Claims

1. Apparatus associable with a wrapping machine (100; 110) for fixing an end tab (20a) of a wrapping film (20) to a film portion (20b) wrapped around a load (50) at the end of a wrapping process of the latter, comprising frame means (5), abutting means (2) and fixing means (3), said abutting means (2) and said fixing means (3) being supported by said frame means (5), cooperating with one another for grasping and fixing said end tab (20a) to said film portion (20b) and being movable between respective operating positions (W1, W2), wherein they interact with said film (20), and respective non-operating positions (R1), wherein they do not interact with said film (20), said apparatus (1) being **characterised by** the fact that it comprises carriage means (4), rotatably supporting said abutting means (2) and linearly movable along a movement direction (A), first driving means (11; 41) for moving said carriage means (4) along said movement direction (A), and second driving means (12; 42) arranged for interconnecting and linking said abutting means (2) to said carriage means (4) and/or to said frame means (5) and for rotating said abutting means (2) when said carriage means (4) is moved along said movement direction (A), said abutting means (2) being thus moved with respect to said load (50) with a composite translation and rotation motion having a set motion composition ratio, said second driving means (12; 42) comprising an interchangeable transmission element (32; 22), in particular replaceable with at least one further transmission element, such as to modify said motion composition ratio and obtain a desired motion trajectory of said abutting means (2).
2. Apparatus according to claim 1, wherein said frame means (5) is fixable to said wrapping machine (100; 110) and supports said carriage means (4) slidably and said fixing means (3) rotatably.
3. Apparatus according to claim 1 or 2, wherein said second driving means (12) comprises rack means (34) fixed to said frame means (5), a first gearwheel (31) fixed to said abutting means (2) and able to rotate with the latter and gear means (32, 33, 35) connected to said carriage means (4) and coupled respectively with said rack means (34) and with said first gearwheel (31) such as to rotate the latter when said carriage means (4) is moved along said movement direction (A).
4. Apparatus according to claim 3, wherein said interchangeable transmission element comprises a second gearwheel (32) of said gear means (32, 33, 35) that is engaged with said rack means (34) and connected to said first gearwheel (31), said carriage means (4), when moved, causing rotation, by said second gearwheel (32), of the first gearwheel (31) and of the abutting means (2).
5. Apparatus according to claim 4, wherein said second gearwheel (32) is removably mounted on a supporting shaft (35) of said gear means (32, 33, 35).
6. Apparatus according to any preceding claim, wherein said first driving means comprises a first linear actuator (11) fixed to said frame means (5) and acting on said carriage means (4).
7. Apparatus according to claim 4 or 5, wherein said first driving means comprises a rotating actuator (41) fixed to said frame means (5) and acting on said second gearwheel (32).
8. Apparatus according to claim 1 or 2, wherein said second driving means (42) comprises cam means (22, 23) connected to said frame means (5) and coupled with said abutting means (2), said cam means comprising a moving element (22) connected to said frame means (5) and provided with a respective sliding guide (22a) arranged for slidably receiving and guiding a follower element (23) fixed to said abutting means (2).
9. Apparatus according to claim 7, wherein said interchangeable transmission element comprises said moving element (22) fixed removably to said frame means (5).
10. Apparatus according to any preceding claim, wherein said abutting means comprises an abutting element (2) that has an elongated shape and is mounted on said carriage means (4) so as to be rotatable around a first rotation axis (X1) between a first operating position (W1) and a first non operating position (R1), said first rotation axis (X1) being transverse, in particular orthogonal, to said movement direction (A).

11. Apparatus according to any preceding claim, wherein said fixing means (3) is mounted on said frame means (5) rotatably around a second rotation axis (X2) transversely, in particular orthogonally, to said movement direction (A), said fixing means (3) being moved by further driving means (13) between a second operating position (W2) and a second non-operating position and comprising welding means (6) for welding said end tab (20a) to said film portion (20b) wrapped on the load (50) and on said abutting means (2). 5 10
12. Apparatus according to any preceding claim, comprising cutting means (7) connected to said fixing means (3) and arranged for cutting and separating said end tab (20a) from the film (20) coming from an unwinding unit of said wrapping machine (100; 110). 15
13. Wrapping machine for wrapping a load (50) with a film (20), comprising an apparatus (1) according to any preceding claim. 20
14. Method for wrapping a load (50) with a film (20) in a wrapping machine (100; 110) provided with an apparatus comprising abutting means (2) and fixing means (3) that are movable between respective operating positions (W1, W2), wherein they interact with said film (20), and respective non-operating positions (R1), wherein they do not interact with said film (20), said method comprising: 25 30
- wrapping said load (50) with said film (20);
 - moving said abutting means (2) to a first operating position (W1) and wrapping said load (50) and said abutting means (2) with said film (20); 35
 - moving said fixing means (3) to a second operating position (W2) and grasping and fixing an end tab (20a) of said film (20) to a film portion (20b) wrapped around said load (50) and around said abutting means (2); 40
 - disengaging said abutting means (2) from said end tab (20a) and from said film portion (20b); said method being **characterised in that** said disengaging comprises moving said abutting means (2) from said first operating position (W1) to a first non-operating position (R1) according to a set motion trajectory with a composite translation and rotation motion having a set motion composition ratio and **in that** before said disengaging said established motion composition ratio is set such as to obtain a desired motion trajectory of said abutting means (2) during said disengaging. 45 50
15. Method according to claim 14, comprising during said disengaging maintaining said load (50) stationary and/or maintaining stationary said apparatus (1) with respect to said wrapping machine (100; 110). 55





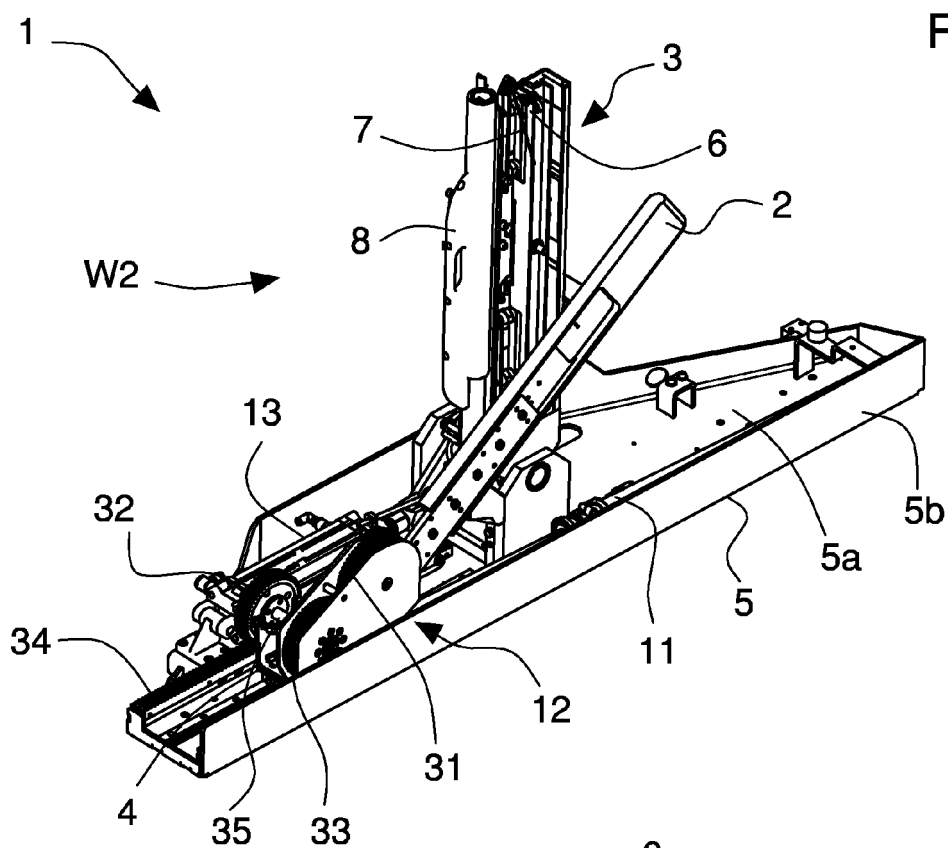


Fig. 5

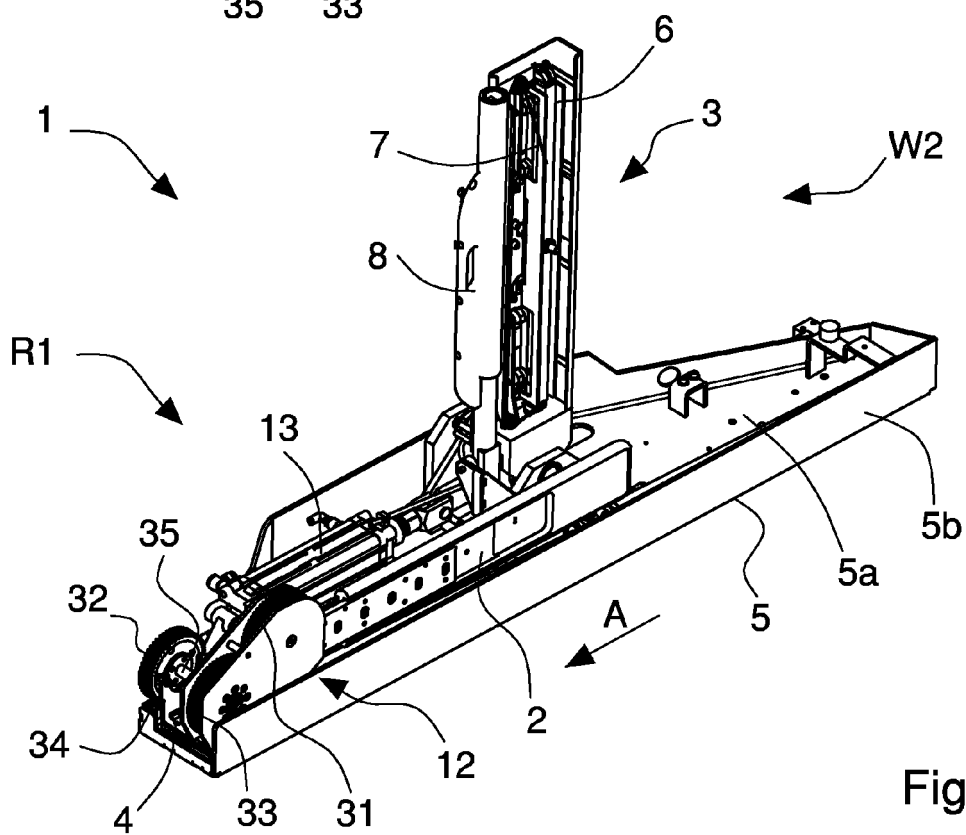


Fig. 6

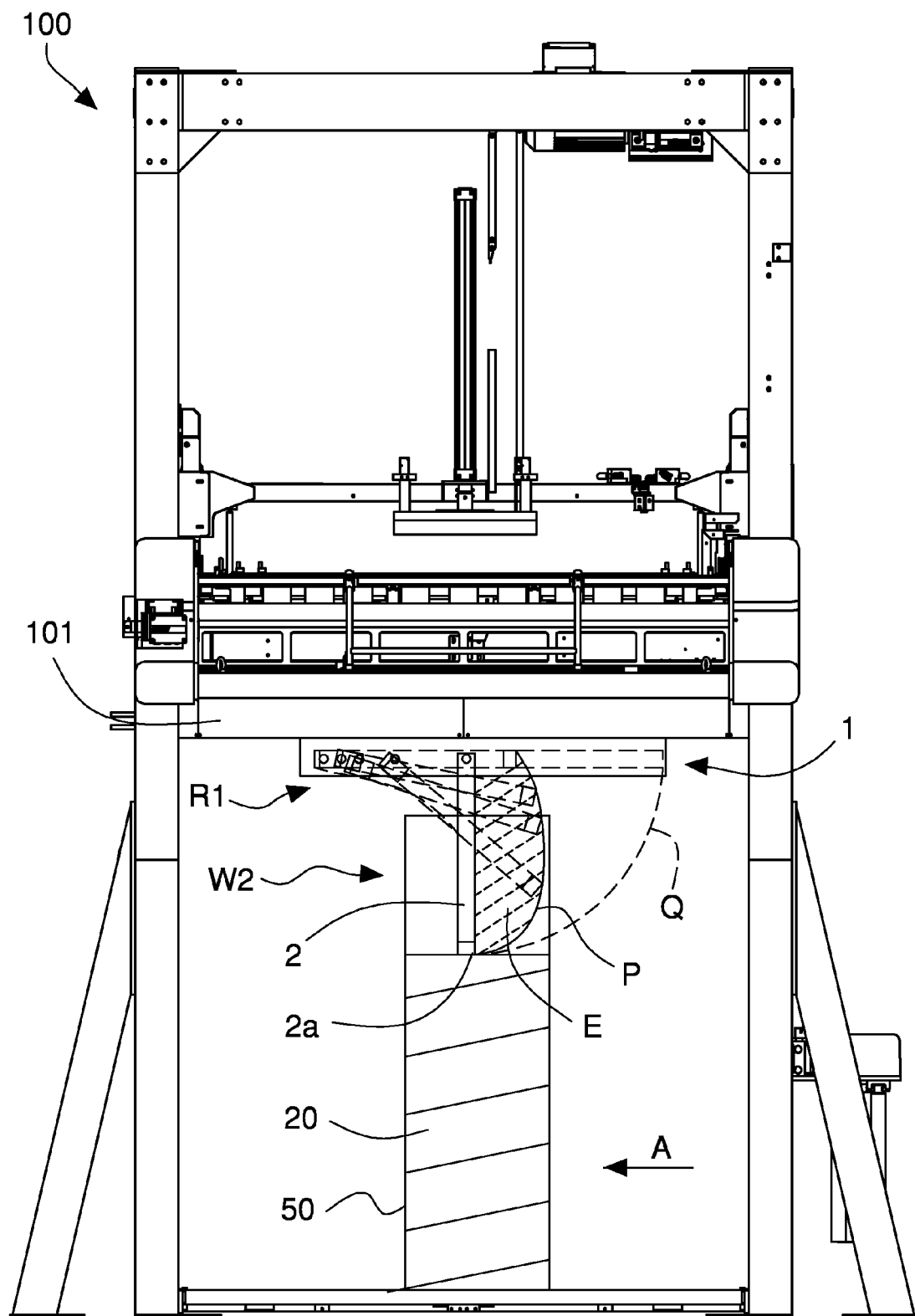


Fig. 7

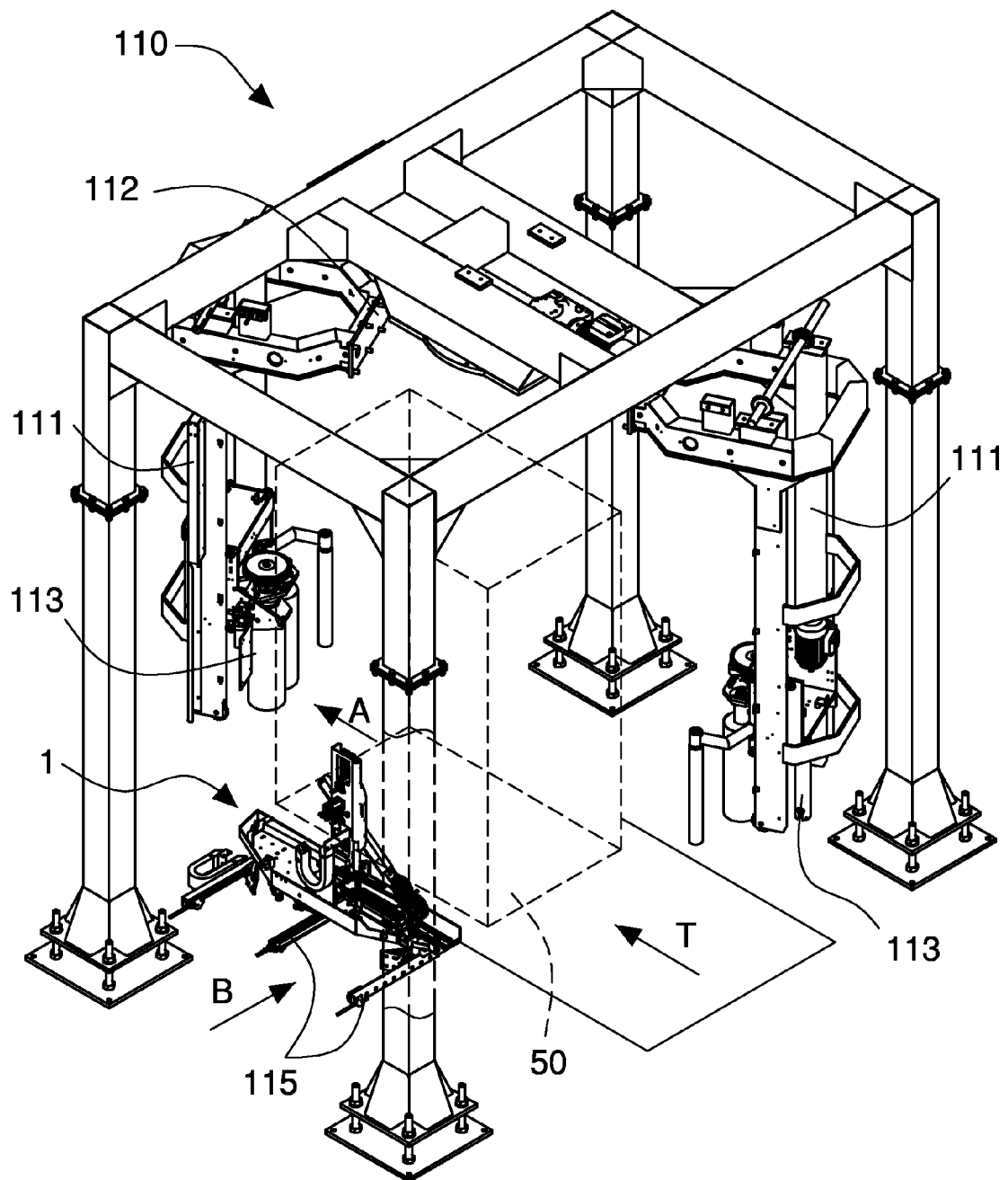


Fig. 8

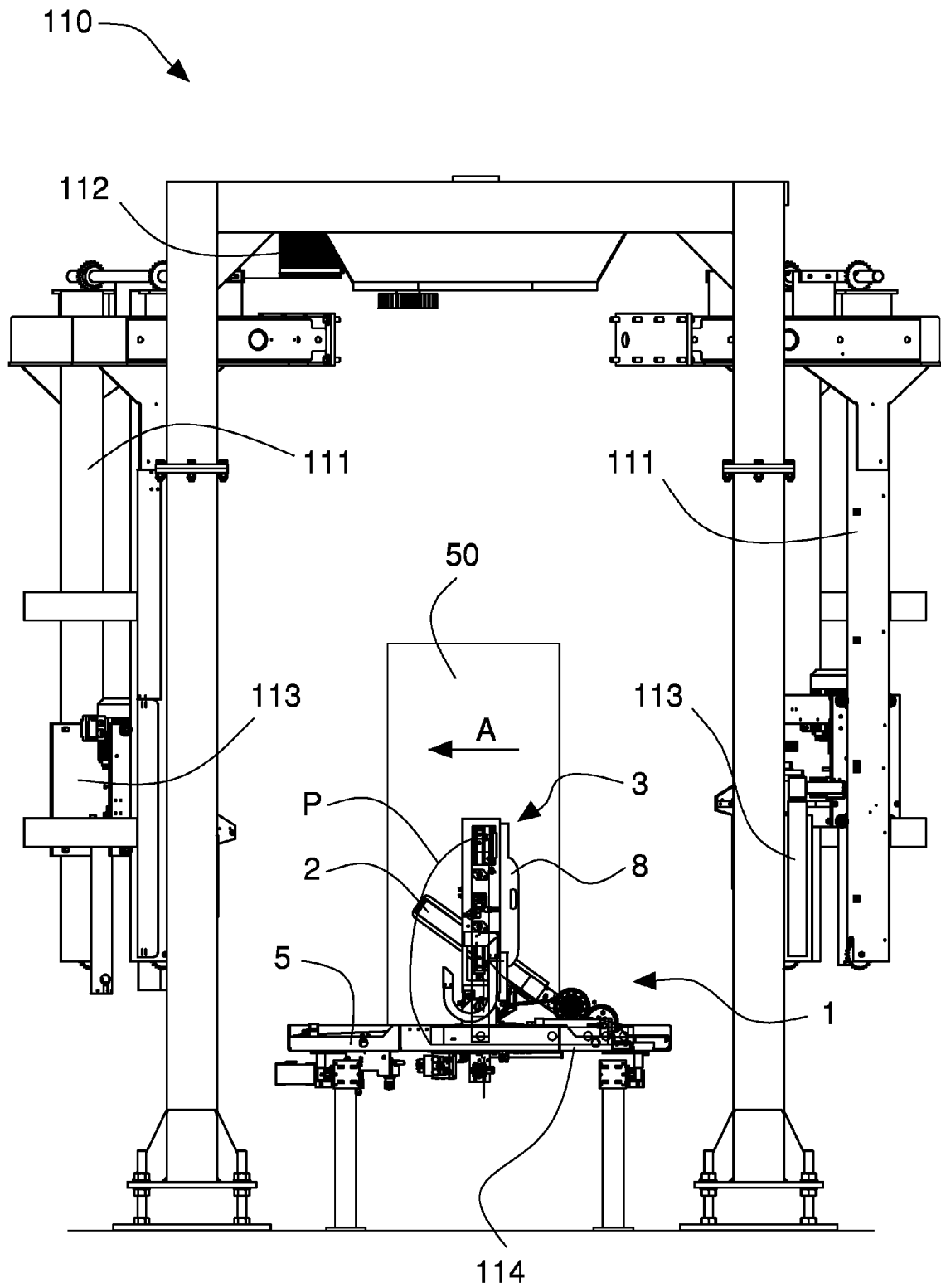


Fig. 9

Fig. 10

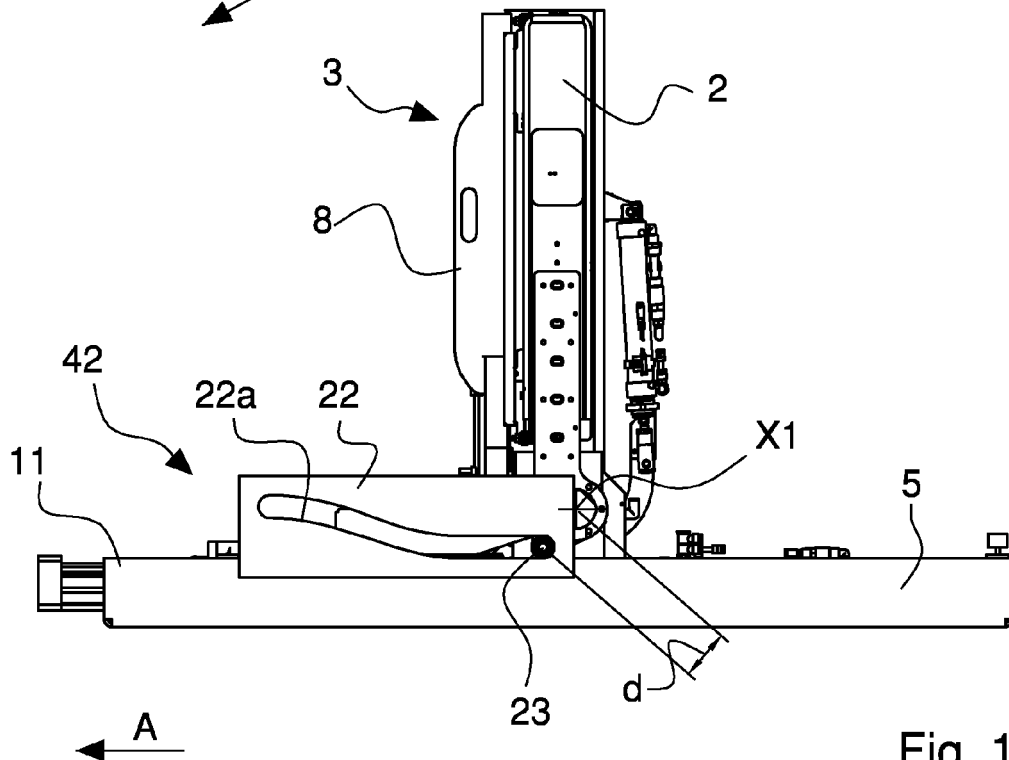
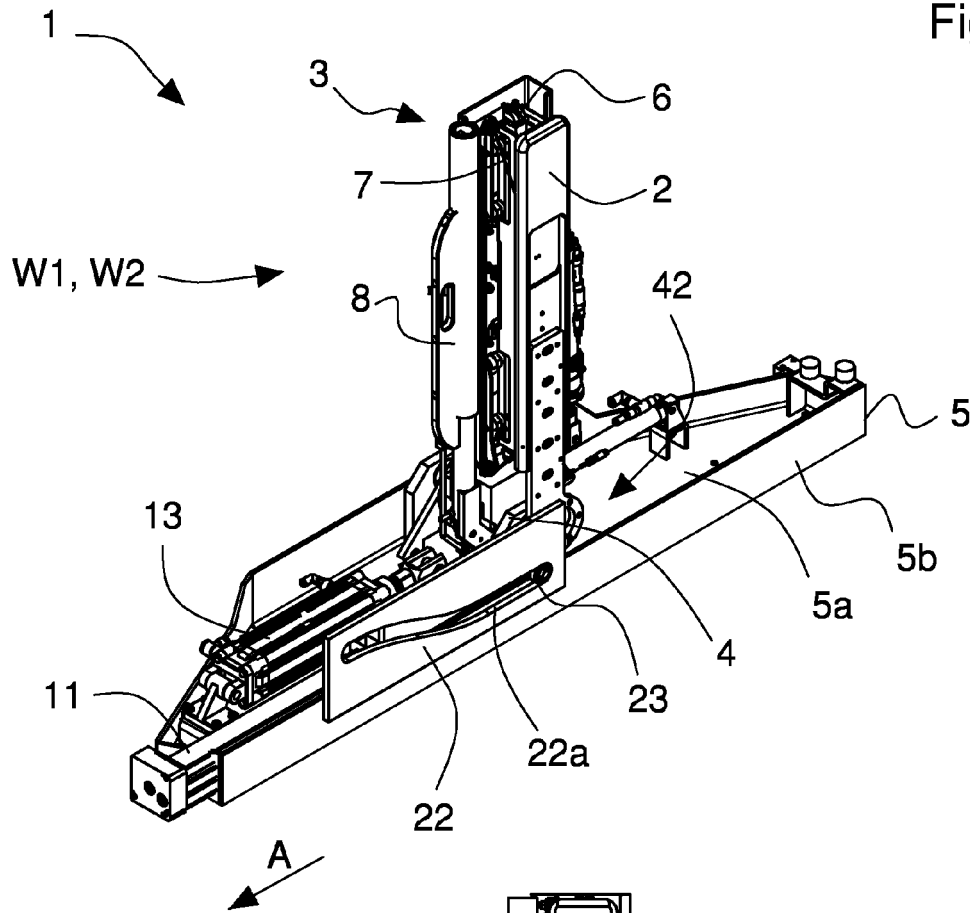


Fig. 11

Fig. 12

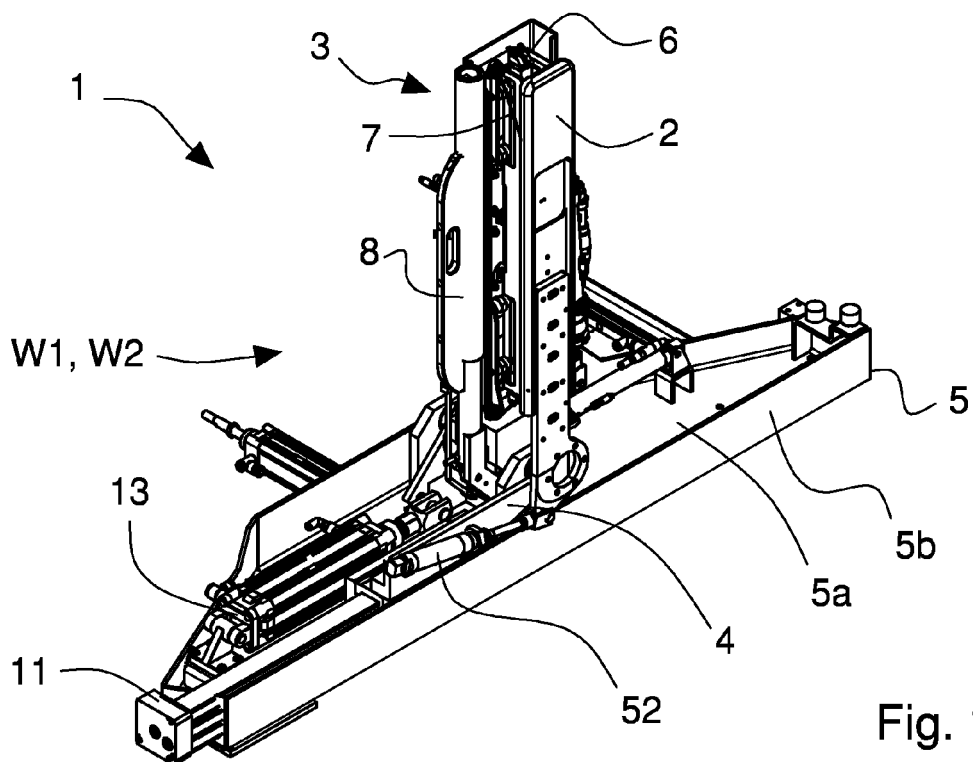
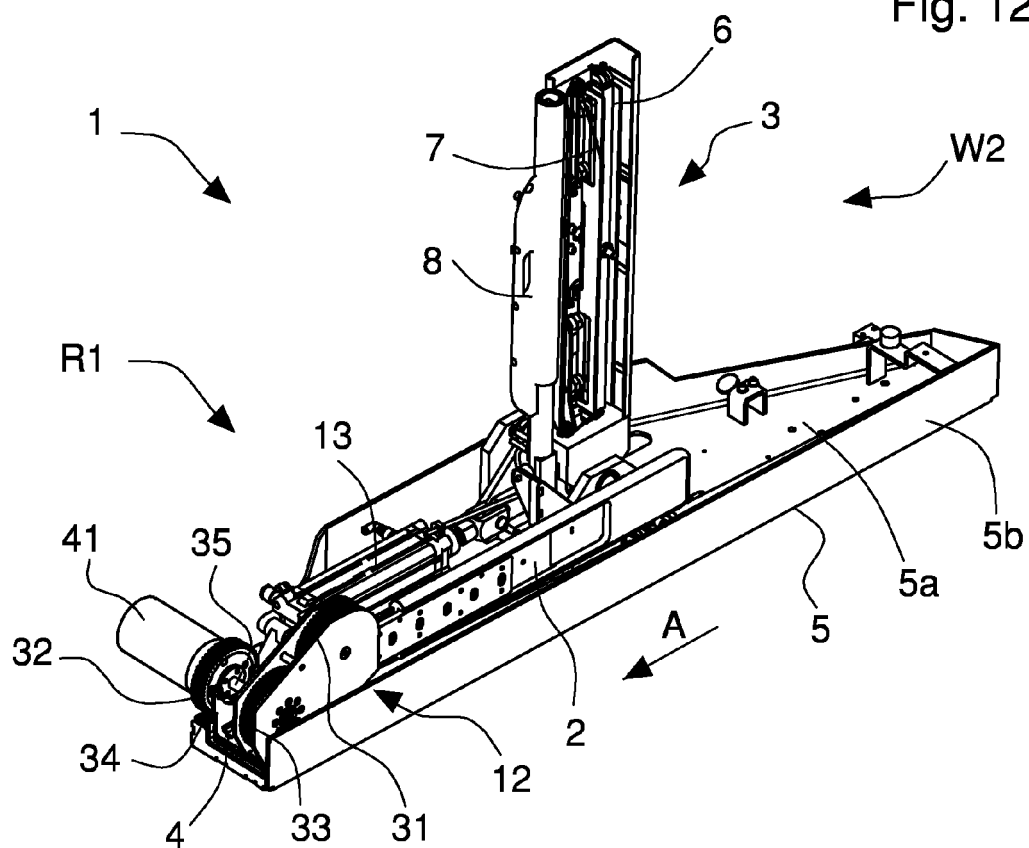


Fig. 13



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Application Number
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			B65B
1	Place of search Munich	Date of completion of the search 25 July 2013	Examiner Schelle, Joseph
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			

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