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(54) CLOSING DEVICE AND WRAPPING MACHINE COMPRISING THE CLOSING DEVICE

(57) A closing device (1) is configured for a wrapping machine of the type comprising a turntable or a ring and suitable for closing an open end (2) of a wrapping (3) of thermoweldable extendible plastic film when said plastic film is wrapped around a palletised product (4) by said wrapping machine, said open end (2) being provided in a band (3A) of said wrapping (3) that projects beyond the top (5) of said palletised product (4), said closing device (1) comprising closing means (7) arranged for bringing together portions of said band (3A) and retaining means (6) cooperating with said closing means (7) and arranged for retaining said plastic film of said open end (2) and for folding said portions, said closing means (7) being provided with a welding element (8) for welding said portions of said band (3A) above said top (5), so as to close the opening of said open end (2), in which said closing means (7) comprises a pair of arms (7A, 7B), supported by a framework (9) provided in said closing device (1) and drivable in such a manner that at least respective ends (12) of said arms (7A, 7B) are movable towards and away from one another, said welding element (8) being fixed to each of said respective ends (12), and in which said retaining means (6) is connected to said closing means (7) in such a manner as to be driven by the motion of said closing means (7) between an extended configuration (E), in which said retaining means (6) maintains said portions extended and a folded configuration (K), in which retaining means (6) retains said portions substantially superimposed on one another (H).

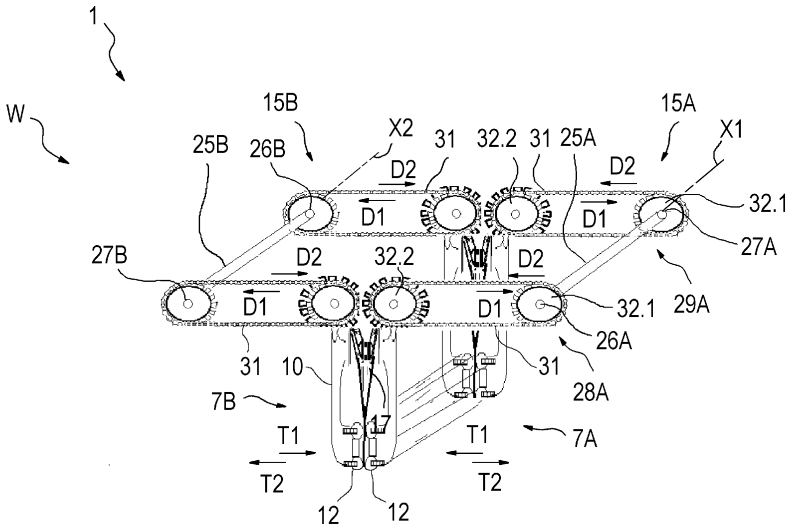

Fig.3

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Description

[0001] The invention relates to a closing device for closing an open end of a casing or wrapping of thermoweldable material, that is for example obtainable by wrapping an extendible film around a product, such as in particular a palletised product or load.

[0002] The invention further relates to a wrapping machine comprising such a closing device and a wrapping method.

[0003] It is known to protect a column or a stack of products loaded on a pallet by wrapping an extendible film by wrapping machines. The palletised load is wrapped by the film on consecutive lateral faces by a wrapping head and, on the basis of the structure of the wrapping machine, the wrapping head rotates around the palletised load covering the load of film several times or the palletised load is positioned on a turntable, which rotates the load by several revolutions so as to make the lateral faces of the load face the wrapping head.

[0004] In order to protect the top of the products loaded onto the pallet, some wrapping machines or wrapping lines have a further film unwound from a reel mounted on a bridge above the palletised load; a piece of the further film is deposited on the top of the load so as to wrap the top and cover a portion of the lateral faces of the load to which it is maintained adhering thereto by successive strips of the wrapping film.

[0005] The further film is generally of a greater thickness than the wrapping film so as to be more resistant to breakage and protect the upper surface of the products from outer agents.

[0006] Using the further film entails a certain cost in the production of the wrapping of the load on the pallet and requires the user of the wrapping machine to manage procuring and storage of the further film in addition to the wrapping film. Further, the reel of the further film needs to be replaced when it is exhausted, this entailing an additional period of machine downtime, which has to be added to the time that may be necessary to change the roller of the film used for wrapping.

[0007] DE2422000 relates to a wrapping apparatus for wrapping a palletised load for non-extendible thermoweldable film in which in a first station four lateral surfaces of the palletised load are wrapped and in a second station, associated with the first station, zones of the emerging film are folded above the upper horizontal face of the palletised load to cover the surface of the film and thus weld edges of the film. DE2422000 discloses four present tensioning fingers comprising movable vertical bars and another four folding fingers, they also comprising movable vertical bars. The solution of DE2422000 for closing the film above the horizontal face of the palletised load is very complex, requiring numerous parts to be driven. Further, the production cycle is rather slow and certainly not applicable to the case of wrapping machines with turntable or rotating ring.

[0008] One object of the invention is to improve wrapping machines and wrapping methods of known type.

[0009] A further object is to protect the top of a palletised load without the use of a further film deposited on the top, as on the other hand occurs in wrapping machines of known type. Still a further object is to obtain a palletised load wrapped by a film in which the top of the load is covered by the same film.

[0010] Another object is to provide a wrapping method that enables the top of a palletised load to be covered effectively by using the same wrapping film, without it being necessary to provide an additional film.

[0011] These and other objects are achieved by the closing device, by the wrapping machine and by the method of the appended claims.

[0012] Owing to the different aspects of the invention, it is possible to obtain a significant saving in the production of palletised loads wrapped by extendible film with a covered top, inasmuch as the number of necessary materials is reduced, simplifying the management of procurement and storage of the reels and eliminating machine downtime.

[0013] 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 an exploded schematic perspective view of a closing device for closing an open end or a casing or wrapping of thermoweldable material, from which certain parts are removed;

Figures 2 and 3 are perspective schematic views of the device in Figure 1 illustrating the closing device in two different operating positions;

Figures 4 and 5 are detailed views of a movement unit provided in the closing device;

Figure 6 is a detailed view of a welding step actuated by the closing device;

Figure 7 is a schematic plan view of a conformation adopted by the open end of the wrapping;

Figure 8 is a top view of retaining means provided in the closing device in an intermediate configuration;

Figures 9 and 10 are reduced top views of the closing device illustrating the retaining means of Figure 8 respectively in the intermediate configuration and in a folded configuration;

Figures 11 and 12 are fragmentary sections taken along the respective planes XI-XI and XII-XII of Figure 8;

Figures 13 to 18 are views of the device in Figure 1 illustrating the closing device in successive operating positions during closure of the open end of the wrapping of thermoweldable material;

Figures 19, 20 and 21 are schematic perspective views of some embodiments of a vertical movement unit provided in the closing device;

Figures 22 to 32 are schematic frontal views of successive steps of wrapping a palletised load that are performed by a wrapping machine comprising the

closing device 1;

Figure 33 is a perspective view of an alternative embodiment of the closing device of Figure 1 in a raised or rest position;

Figure 34 is a perspective view of the closing device of Figure 33 in an operating position preceding welding.

[0014] With reference to Figures 1 to 3, a closing device 1 is shown for closing an open end 2 (Figure 14) or a casing or wrapping 3 applied to a product, in particular a palletised product or load 4. The wrapping 3 is obtained from a plastic film that is wrapped around the palletised load 4, for example by a wrapping head of a wrapping machine, as will be set out in detail below.

[0015] In this description, "plastic film" must be taken to mean a film made of plastics, i.e. of polymeric material. The plastic film is extendible at ambient temperature to be prestretched and wound around the palletised load 4 by the wrapping head. The plastic film is further thermoweldable, so that parts thereof can be welded together when subject to preset pressure and temperature conditions.

[0016] The open end 2 is provided in a band 3A of the wrapping 3 that projects beyond the top 5 of the palletised load 4, i.e. in an upper portion of the wrapping 3, that is free from the product and is obtained by wrapping the plastic film around a part of the closing device 1. The closing device 1 comprises closing means 7 arranged for moving portions of the band 3A towards one another 3A. The closing means 7 is provided with at least one welding element 8 for welding to one another the portions of the band 3A brought together above the top 5 of the palletised load 4, so as to close the open end 2.

[0017] The closing device 1 further comprises retaining means 6 cooperating with the closing means 7 and arranged for supporting and possibly retaining the plastic film at the opening of the open end. The retaining means 6 is further shaped for folding portions of the band 3A until overlapping them so as to enable welding thereof by part of the welding element 8.

[0018] The band 3A is obtained from one or more layers of the plastic film that the wrapping head applies between the top 5 of the palletised load 4 and the retaining means 6. The height of the retaining means 6, with respect to the top 5 of the palletised load 4, defines a reference that is greater in height for the wrapping that the wrapping head has to perform during formation of the band 3A.

[0019] Once the band 3A has been obtained, the retaining means 6 guides portions of the band 3A to fold on themselves whilst the closing means 7 contributes to moving towards one another these portions of band 3A until the welding element 8 is enabled to interact with the portions of band 3A to weld the portions of band 3A and close the wrapping 3 on the top 5 of the palletised load 4.

[0020] The closing means 7 comprises a pair of arms 7A, 7B, supported by a framework 9.

[0021] Each arm 7A, 7B comprises a portal structure having two parallel rotation rods 10, connected to a respective first end 12 by a connecting bar 11.

[0022] Each rotation rod 10 has a respective second end 13 connected to a plate 14. A reinforcing bar 11.1 can be provided parallel to the connecting bar 11 and nearer the respective second ends 13.

[0023] The arms 7A, 7B are movable in such a manner that at least the respective first ends 12 are movable towards and away from one another so that, during operation, they can move towards one another to interact with the plastic film of the band 3A and move away from one another to move away from the plastic film of the band 3A.

[0024] As Figures 2 and 3 show, the arms 7A, 7B are rotatable around respective rotation axes X1 and X2 according to the rotation directions indicated by the arrows R1 and R2. Further, the arms 7A, 7B are movable along a translation direction indicated by the arrows T1 T2 in Figure 3, which is substantially horizontal.

[0025] The rotation axes X1 and X2 are parallel to one another and orthogonal to the translation direction T1 T2. The latter is contained on a plane parallel to a plane containing the rotation axes X1 and X2.

[0026] The arms 7A, 7B are rotatable between an upper position S, shown in Figure 2, in which the respective first end 12 is placed above the retaining means 6, and a lower position I, shown in Figure 15, in which the respective first end 12 is placed below the plane defined by the framework 9 and thus also below the retaining means 6. In the lower position I, the arms 7A, 7B extend substantially vertically towards the palletised load 4. In the upper position S the first ends 12 are thus further from a position that is intended to be occupied by the palletised load 4, whereas in the lower position I the first ends 12 are nearer the position that is intended to be occupied by the palletised load 4 during operation. In the embodiment shown, the upper position S is such that the rotation of the arms 7A, 7B is substantially 90°. Alternatively, in the upper position S the arms 7A, 7B can be arranged vertically, i.e. with the respective first end 12 placed above the framework 9, such that the rotation thereof passing between the two upper U and lower L positions, and vice versa, is greater than 90°, in particular than 180°, as in the embodiment specified in Figures 22-32. Below, the features disclosed are to be considered to be applicable regardless of these two embodiments of the closing device 1.

[0027] With reference to the Figures 2 and 3, for each arm 7A, 7B a driving unit 15A, 15B is provided. The driving unit 15A, 15B is structured in such a way that it drives the arms 7A, 7B to rotate according to the rotation directions R1 R2 and further also to translate according to the translation directions T1 T2.

[0028] For the sake of simplicity, the driving unit 15A referring to the arm 7A is disclosed, as the driving unit 15B is the same but is mounted according to a symmetry that is central with respect to the centre of the framework 9. The driving unit 15A comprises a rotating shaft 25A

having a driving end 26A and a driven end 27A. The driving end 26A is rotated through a connection to a driving element 30A, for example a fluid dynamic cylinder, shown in Figure 1, or an electric motor that is not shown. In the case of a fluid dynamic cylinder, the fluid dynamic cylinder drives the driving end 26A through a belt and pulley transmission of known type, which is not illustrated, in which a pulley is mounted coaxial with the rotating shaft 25A and the stem of the cylinder is connected to a branch of the belt.

[0029] Each driving and driven end 26A, 27A is connected to a respectively driving and driven movement unit 28A, 29A comprising a belt 31 closed in a loop around a pair of cogs 32.1, 32.2, of which a first cog 32.1 is coaxial with the rotating shaft 25A. The axis of the second cog 32.2 is parallel to the axis of the first cog 32.1, both axes being contained in a plane that is substantially horizontal.

[0030] With reference to Figures 4 and 5, the plate 14, connected to each rotation rod 10, is in turn connected in an articulated manner to the chain 31 by two connecting elements 37, 38 to which two base appendages 14.1, 14.2, provided in the plate 14 are hinged. The plate 14 is mounted in a zone of the chain 31 that is nearer the first cog 32.1, such that, during the passage between the upper position S and the lower position I, the plate 14 describes a circumferal arc. The plate 14 is shaped so as not to interfere with other parts of the closing device 1 during operation, in particular the cog 32.1. Owing to the connecting elements 37, 38 the rotation rod 10 can perform the rotation around the axis X1, keeping connected to the chain 31 even when it wraps around the first cog 32.1, i.e. along a curved path. Between the two illustrated connecting elements 37, 38, a chain 31 link is interposed. Naturally, the number of chain 31 links interposed between the two connecting elements 37, 38 is dictated by a design choice and can accordingly be different from two, in particular greater than two.

[0031] The plate 14 and the arm 7A, 7B therewith is thus driven by the chain 31.

[0032] The driving element 30A, 30B causes the rotating shaft 25A, 25B to rotate, which respectively moves respectively each driving and driven movement unit 28A, 29A and accordingly each chain 31. Considering that the upper branch of the chain 31 is moved in a movement direction D1, to the right with reference to the arm 7A shown in Figures 2 and 3, the rotation rods 10, and thus the arms 7A, 7B are rotated around the respective rotation axes X1, X2 according to the rotating direction R1 thereof. On the other hand, considering that the upper branch of the chain 31 is moved in a movement direction D2, opposite D1, i.e. to the left with reference to the arm 7A in Figure 2, the rotation rods 10, and thus the arms 7A, 7B are rotated around the respective rotation axes X1, X2 according to the rotating direction R2 thereof.

[0033] When the arms 7A, 7B reach the lower position I, the chain 31 continues to advance in the movement direction D1, this enabling the arms 7A, 7B to translate according to the translation direction T1. In this manner, the two arms 7A, 7B translate by moving towards one another until they reach a welding position W, shown in Figures 3, 6 and 18. In this welding position W, the respective first ends 12 of the two arms 7A, 7B interact together so that the respective welding elements 8 can come into contact with the plastic film to take the plastic film to softening temperature and enable the welding thereof.

[0034] In other words, in the welding position W the first ends 12 act substantially as a clamp between the jaws of which the plastic film is clamped and welded.

[0035] In an alternative embodiment, each driving unit 15A, 15B can comprise distinct driving units, one for rotating the arms 7A, 7B and the other for translating the arms 7A, 7B.

[0036] With reference to Figure 6, each first end 12 is provided with two clamping rollers 33, 34 between which the welding element 8 is mounted. The clamping rollers 33, 34 are freely rotatable rollers on respective frames that are retractable by springs 35, 36. In the welding position W of the arms 7A, 7B, the plastic film is pressed between the clamping rollers 33A, 34A of the arm 7A and the clamping rollers 33B, 34B of the arm 7B. As the respective clamping rollers 33, 34 are pressed against one another, the respective springs 35, 36 are compressed and the welding elements 8 come into contact with the plastic film and weld the plastic film. The stroke of the springs can be about 3 cm.

[0037] The clamping rollers 33, 34 protrude with respect to the welding element 8 so as to protect the welding element 8. Further, as the welding element is normally maintained at the welding temperature, the clamping rollers 33, 34 prevent the welding element 8 coming into contact with the plastic film accidentally or before time, thus preventing the plastic film being able to deteriorate because of prolonged contact with the welding element 8. The welding element 8 extends longitudinally along the connecting bar 11 and can be divided into three welding parts, the central welding part being obtained at a lower temperature than the two lateral welding parts. This is because, as will be disclosed below, the central welding part comes into contact with a smaller number of superimposed folds of the plastic film.

[0038] The retaining means 6 comprises a frame 16, having a rectangular plan shape, the dimensions of which can be substantially the same as those of the plan shape of the pallet on which the load rests. For example, considering the most used dimensions of pallet sizes expressed in millimetres, the frame 16 can have dimensions of 1200x1000; 1200x800; 600x1000; 600x800.

[0039] The frame 16 thus defines a plane that is substantially horizontal.

[0040] The frame 16, in addition to providing a support for the plastic film when the band 3A is formed by wrapping, acts as a folding guide to reduce the opening of the open end 2 by folding portions of the band 3A in a controlled manner. The frame 16, is in fact a foldable frame

comprising rods 16A, 16B, 16C, 16D (Figure 8) that are hinged between one another at the tops 18 of the frame 16. Two opposite rods 16A and 16C are foldable at a central hinge 17 that divides each rod 16A, 16C into two parts, respectively 16A.1, 16A.2 and 16C.1 and 16C.2, between which an outer angle α is definable. Another two opposite rods 16B and 16D are on the other hand continuous, for example as a single piece. The foldable rods 16A and 16C are generally provided on the shorter side of the frame 16.

[0041] The central hinge 17 is such as to enable the outer angle α to vary between 0° and 180°, but not by more than 180°. In this manner, the rods 16A and 16C can fold centrally only towards the inside of the frame 16, each central hinge 17 moving along a respective direction F1. The frame 16 can thus move from an extended configuration E, shown in Figure 1 and 2, in which the outer angle α is substantially 180°, to a folded configuration K, shown in Figure 10, in which the outer angle α is substantially 0°, passing through intermediate folding configurations J, shown in Figures 8 and 9, in which the outer angle α is comprised between 0° and 180°. When the rods 16A and 16C fold towards the centre of the frame 16, i.e. passing from the extended configuration E to the folded configuration K, the two opposite rods 16B and 16D move substantially parallel to one another according to the respective direction G1, to the centre of the frame 16, thus reducing the distance thereof from one another. On the other hand, by moving from the folded configuration K to the extended configuration E, the two opposite rods 16B and 16D move in the respective direction G2, moving away from one another, whereas the central hinges 17 move according to the respective moving away direction F2.

[0042] In the transition from the extended configuration E to the folded configuration K, the frame 16 induces the surrounding band 3A to fold following the perimeter of the frame 16; portions of the band 3A are folded and superimposed on one another to reduce the opening of the open end 2, guiding the plastic film superimposed position conformation H, shown in Figure 7. In fact, in the extended configuration E the open end 2 is maintained open by the frame 16 and in the folded configuration K portions 40, 42 of plastic film of the band 3A that surrounds the frame 16 follow the folding movement of the frame 16 and are thus folded until they substantially overlap, adopting the superimposed conformation H. In the superimposed conformation H, the portions 40 are in fact substantially superimposed on one another and interposed between end regions of the sides 41 and 43 of the band 3A, just as also the portions 42 are substantially superimposed on one another and interposed between the sides 41 and 43 of the band 3A. In the superimposed conformation H, in the end regions of the sides 41 and 43 a greater number of superimposed layers of plastic film are present than in a central region thereof.

[0043] The plastic film is not stretched by the frame 16 When induced to adopt the superimposed conformation H thus, by not stressing the elastic memory thereof, during the subsequent welding, the plastic film does not undergo undesired shrinkages.

[0044] The frame 16 is driven by the same driving units 15A, 15B that drive the arms 7A, 7B of the closing means 7.

[0045] In fact, the frame 16 is connected to the chain 31, for example at the tops 18 thereof, by connecting means 44 that transfers the motion from the chain 31 to the rods 16B, 16D. The connecting means 44 can comprise articulated elements.

[0046] The connecting means 44, driven by the chain 31, applies to the rods 16B, 16D a force in the direction G1, thus inducing the frame 16 to close and be taken to the folded configuration K.

[0047] On the other hand, starting from the folded configuration K, the connecting means 44 moves the tops 18 along the translation direction T2 and thus drives the rods 16B, 16D along the direction G2, returning the frame 16 to the extended configuration E.

[0048] In one embodiment that is not shown and not claimed here, the retaining means 6 comprises a driving unit that is distinct from the driving units 15A, 15B of the arms 7A, 7B.

[0049] The frame 16 can further comprise sucking means for sucking air between the plastic film and perimeter walls of the frame 16 so as to retain the plastic film of the band 3A. In particular, as shown in Figures 11 and 12, the rods 16A-16D of the frame 16 are tubular rods provided with an inner cavity 20. On an outer perimeter wall of the rods 16A-16D, a plurality of through holes 19 is present that place in communication the outer environment in which the closing device 1 is located with the rods 16A-16D; this inner cavity 20 is in turn connected in a known manner to an air sucking device or to an air sucking line, which are both not shown. Through the holes 19 a certain sucking force is applied that enables the plastic film of the band 3A that surrounds the frame 16 to be maintained in contact with the frame 16.

[0050] Suction can thus be of help for retaining the plastic film of the band 3A during the folding movement of the frame 16.

[0051] Optionally, the retaining means 6 is provided with bounding elements 21, arranged for bounding along the perimeter the path of the plastic film during wrapping in a zone above the top 5 of the palletised load 4 and below the frame 16. In the embodiments shown, a bounding element 21 is provided for each top 18 of the frame 16. Each bounding element 21 comprises a bar 22 that is drivable between a bounding position P, in which the bar 22 protrudes from the frame 16 below the frame, extending in a substantially vertical direction, and a concealed position Q, shown by a double dashed line in Figure 11, in which the bar 22 extends parallel to the frame 16. In particular, the bounding elements 21 are four, mounted inside the frame 16 such that in the respective concealed position Q, each bar 22 is parallel to one of the continuous rods 16B, 16D, so as to substantially not

encumber the space underneath the frame 16. In this case, each bar 22 is driven by a rotary actuator 23 of the 90° type, i.e. having two limit angular positions arranged at 90°.

[0052] In the bounding position P, the bounding elements 21 define abutting edges around which the wrapping head can wrap the plastic film and extend the wrapping 3 above the top 5 to obtain the band 3A, which extends from the top 5 until it surrounds the retaining means 6. The bounding elements 21, just like the frame 16, thus provide a support for the plastic film during formation of the band 3A.

[0053] Naturally, the number of bounding elements 21 can also be different from that illustrated, on the basis of the shape of the palletised load 4 to be wrapped. For example, only two bounding elements may be present, possibly arranged near opposite tops 18 of the frame 16, or a number of bounding elements greater in number than four.

[0054] In one embodiment that is not shown, the frame 16 comprises rods of length that is adjustable, for example telescopically, to adapt the perimeter of the frame 16 to the different most commonly used pallet sizes, for example 1200x1000, 1200x800, 600x1000, 600x800, expressed in millimetres. In this embodiment, the welding element remains of fixed length.

[0055] In Figures 13-18 a sequence of operating moments of the closing device 1 is shown, in which, after formation of the band 3A, the arms 7A, 7B leave the upper position S and direct themselves to the plastic film, rotating first towards the rotating direction R1 and subsequently translating in the translation direction T1 to the centre of the palletised load 4, until the welding position W is reached.

[0056] During translation along the translation direction T1 of the arms 7A, 7B and the resulting folding of the frame 16, and thus of the plastic film of the open end 2 to the conformation H, the framework 9 is further driven to translate vertically by a preset height ΔV according to a movement direction Z1, to move the arms 7A, 7B nearer the palletised load 4.

[0057] The framework 9 is thus moved by the preset height ΔV between a first height V1 (Figure 15), that is higher and corresponds to the lower position I, to a second height V2 (Figure 18), that is lower than the first height V1 with respect to the top 5 of the palletised load 4 and corresponding to the welding position W. If for example the first height V1 is +600mm, i.e. is about 600 mm above the top 5, V2 can be for example +150mm, i.e. about 150 mm above the top 5, to have a preset movement ΔV of 450 mm.

[0058] After the welding step, the arms 7A, 7B move away from one another, moving in the direction T2 and simultaneously the framework 9 is returned from the second height V2 to the first height V1, which is further from the palletised load 4, so as to free the palletised load 4, which can thus be removed from its position.

[0059] As Figures 19-20 show, in order to permit the vertical movement of the framework 9, a vertical movement unit 46 can be provided that is arranged for raising or lowering the framework 9 with respect to an intended position of the palletised load 4. The vertical movement unit 46 is shaped according to systems of known type, for example of the type in which a protruding support 47, to which the framework 9 is fixed, is movable vertically along a column 48 driven by a motor with a chain or belt transmission. Alternatively, the vertical movement unit 46' can be of the articulated telescopic type, as Figure 21 shows, in which an articulated telescopic frame has to be fixed to a carrying structure outside the closing device 1. In all embodiments, the vertical movement unit 46 can further be provided with rotation means, which is not shown, which can rotate the framework 9, and the frame 16 therewith, around an axis that is parallel to the vertical height movement axis. Alternatively to the vertical movement unit 46, the closing device 1 can be associated with a pressing device of known type, present in numerous wrapping machines such as, for example, those of the turntable type. The pressing device is generally present to keep the load stable on the pallet during wrapping, in particular when the palletised load is of large dimensions and considerable weight or instable and relatively light. In this embodiment, the closing device 1 is mounted in such a manner that the framework 9 surrounds the pressing device and is supported by the latter.

[0060] The movement of preset height ΔV is carried out by driving means normally present in the pressing device, which moves a pressing element of the pressing device and presses the pressing element against the top of the palletised load and, after wrapping, lifts the pressing element from the load. The driving means for driving the pressing device thus lifts or lowers the pressing element together with the framework 9 with respect to the position that it is intended be occupied by the palletised load.

[0061] In this embodiment, the closing device 1 comprises an additional driving unit that enables the framework 9 that moves vertically with respect to the pressing element of the pressing device, whilst remaining connected and supported thereto. The framework 9 is thus driven to move vertically with respect to the pressing device between two vertical positions, a raised position, in which the frame 16 does not protrude below the pressing element so as to enable the pressing element to perform its pressing action on the load or during lateral wrapping of the load, and a lowered position, in which the pressing device is raised from the top of the load and the frame 16 protrudes below the pressing element to define a perimeter edge around which the plastic film is wrapped to form the band 3A.

[0062] As is known, a pressing device can further rotate around a vertical axis. Accordingly, in this embodiment, also the framework 9 can rotate together with the pressing device.

[0063] In this embodiment with a pressing device, a modified control logic has to be provided for the driving

means for driving the generic pressing device.

[0064] Referring now to Figures 22-32, there is shown a sequence of operating moments and steps in a wrapping cycle performed by a wrapping machine of the turntable or rotating ring type, in which the top 5 of the palletised load 4 is covered by the same wrapping film used for wrapping, owing to the action of the closing device 1. In these Figures the closing device 1 is of the type in which the rotation of the arms 7A, 7B is by180°, so in the upper position S the arms 7A, 7B extend upwards from the framework 9 in a vertical direction. A wrapping head 51 starts the standard wrapping cycle from an upper edge of the palletised load 4 (Figure 22). Upon completion of wrapping of the side surface of the palletised load 4 (Figure 23), the bounding elements 21, if present, are driven from the concealed position Q to the bounding position P. In Figure 24, for the sake of simplicity of representation, the bounding elements 21 are drawn as if they had rotation axes orthogonal to the plan of the drawing, rather than parallel thereto. In the meantime, the wrapping head 51 rises until it is at the same height V1 as the retaining means 6, i.e. the frame 16. Here, the wrapping head 51 forms the band 3A by successive wrapping around the frame 16 and the gripping elements 21, if present. The sucking means of the frame 16, if present, is activated. Depending on the length of the reel holding the plastic film, the number of revolutions can vary that are necessary for the wrapping head to terminate formation of the band 3A. For example, in the case of a reel that is 750 mm or 1000 mm long, the revolutions executed are one or two, whereas in the case of a reel that is 500 mm long the revolutions executed by the wrapping head 51 to obtain the band 3A are three or four. After formation of the band 3A has been completed, the wrapping head 51 descends as far as the film cutting zone of the wrapping machine whilst simultaneously the bounding elements are driven from the bounding position P to the concealed position Q (Figure 28). Now, the closing device 1 starts the step of closing the open end 2, with rotation of the arms 7A, 7B from the upper position S to the lower position I and subsequently descent to the palletised load 4 of the preset height ΔV, until the welding position W is reached in which the welding elements 8 come into contact together for the time required to weld the layers of plastic film.

[0065] The sucking means, if present, is stopped, the arms 7A, 7B follow the reverse path to return to the upper position S whereas the closing device 1 moves away from the palletised load 4 along the movement direction Z2, opposite the direction Z1 (Figure 32).

[0066] At the same time as the step of closing the open end 2, the wrapping machine cuts the plastic film, so as to terminate the wrapping cycle that can restart on a subsequent pallet. The step of closing the plastic film is activated in the wrapping machine cutting step, taking about 3 seconds.

[0067] Joining by welding enables the top 5 of the palletised load 4 to be sealed. On the top 5, a tuft 52 of plastic film remains above the welded joint.

[0068] With reference to Figure 33, an embodiment of the closing device indicated by the reference number 101 is shown. The parts that are structurally or functionally the same as those of the closing device 1 are indicated by the same reference numbers.

[0069] As in the closing device 1, also in the closing device 101, the arms 7A, 7B are movable in such a manner that at least the respective first ends 12 are movable towards and away from one another so that, during operation, they can move towards one another to interact with the plastic film of the band 3A and move away from one another to move away from the plastic film of the band 3A.

[0070] The closing device 101 differs from the closing device 1 by the fact that the arms 7A, 7B of the closing means 7 are hinged on the framework 9 in an intermediate position of the length of two parallel sides of the framework 9. In this manner, the arms 7A, 7B can be brought up to and moved away from the band 3A only by rotation around the respective rotation axes X1 and X2, without translation movement of the arms.

[0071] Instead of the framework 9, a support plate can be provided, which is connectable to the pressing device. The support plate can also be the same plate present in the pressing device that as is known presses on the top of the load; in this case, the arms 7A, 7B are mounted rotatably directly on the plate.

[0072] Also the closing device 101 comprises retaining means 106 cooperating with the closing means 7 and 4 arranged for supporting and possibly retaining the plastic film at the opening of the open end of the wrapping 3 above the palletised load 4. The retaining means 106 is conformed for folding portions of the band 3A until the portions are superimposed to enable welding thereof by the welding element 8, provided in the closing means 7. The retaining means 106 differs from the retaining means 6 through the fact that with respect to the frame 16 it comprises only two opposite rods 116A and 116C that are foldable at a central hinge 117. The opposite rods 116A and 116C are hinged at the respective ends thereof to connecting members 144. The rods 116A, 116C are adjustable in length to adapt to the size of the palletised load 4, similarly to the rods of the retaining means 6.

[0073] The connecting members 144 connect the opposite rods 116A and 116C to the arms 7A and 7B of the closing means 7, the motion of which enables the retaining means 106 to be driven to fold similarly to the rods 16A and 16C of the frame 16 of the embodiment in the Figure 8. The arms 7A, 7B are rotatable between an upper position S', shown in Figure 33, in which the respective first end 12 is placed above the retaining means 106, and the welding position W, in which the respective first end 12 is placed below the plane defined by the framework 9 or support plate and thus also below the retaining means 106, which in the meantime takes on the folded configuration K. Passing from the upper position S' to the welding position W, the arms 7A, 7B reach and exceed

a lower position in which they extend substantially vertically towards the palletised load 4, the rotation angle being overall greater than 90°. Figure 34 shows an operating position of the closing device 101 near the welding position W, in which the respective first ends 12 of the two arms 7A, 7B interact together so that the respective welding elements 8 can come into contact with the plastic film to take the plastic film locally to softening temperature and enable the plastic film to be welded. The retaining means 106 is connected to the closing means 7 in such a manner as to be driven by the motion of the closing means 7 between the extended configuration E, in which the retaining means 106 maintains the portions of plastic film of the band 3A extended and a folded configuration K in which the retaining means 106 retains the portions substantially superimposed on one another.

[0074] The operation of a wrapping machine provided with the closing device 101 is very similar to that of the machine provided with the closing device 1, as disclosed previously.

[0075] The closing device 1, 101 enables five sides of the palletised load 4 to be wrapped, covering the top of the load with the same plastic film used for wrapping, without it being necessary to add a further sheet material to protect the top.

[0076] The plastic film is welded to the top 5, thus the palletised load 4 is sealed by the wrapping 3 on the five sides and can be exposed to the open air, to the rain or to dust without the product getting spoilt.

[0077] A consumable material is thus completely eliminated from the process of producing wrapped palletized loads, thus eliminating the need to purchase, manage, store and handle reels of this additional sheet material, permitting significant financial savings in addition to savings of material.

[0078] Owing to the closing device 1, it is further possible to reduce the dimensions of the wrapping plant, it no longer being necessary to provide production lines that are different from one another through the presence or absence of a device for depositing additional sheet material. Also the wrapping machine becomes considerably simpler than the machines that comprise the device for depositing additional sheet material onto the load, thus making the cost of the wrapping machine more moderate.

[0079] With respect to the wrapping cycles in which the additional sheet is deposited, the wrapping cycle according to the presente invention is generally faster or at most of comparable duration and does not require the turntable or the wrapping head to stop during wrapping of the load. In fact, owing to the closing device 1 and the operating method thereof, the wrapping head stops only at the end of the wrapping cycle and not also at intermediate moments.

[0080] The wrapping method according to the present invention increases by a few revolutions the number of wrapping revolutions of a cycle with depositing of an additional sheet to enable the band 3A to be formed. The number of revolutions that is necessary for forming the band 3A depends on the length of reel of plastic film used: the number of wrapping revolutions increases only by 1-2 revolutions in the case of a reel of plastic film of 1000 mm or 750 mm in height; and by only 3-4 revolutions in the case of reels of 500 mm in height.

[0081] Although the number of revolutions around the palletised load may increase, the weight of each wrapping around the wrapped palletised load remains less than the weight of the wrapping obtained with an additional covering sheet.

[0082] The closing device 1, 101 is further usable in all the automatic wrapping systems of known type, for example ring or turntable automatic wrapping systems, or with a rotating wrapping unit and with all sizes of reel.

[0083] Further, in the embodiment in which the frame 16 is adjustable, the closing device 1 is adapted or adaptable to all the standard sizes of pallet.

[0084] The closing device 1 can be fitted in automatic wrapping systems that have already been installed; in such cases, the maximum height of the palletised load to be produced must be less than a preset amount, for example 600 mm, with respect to the maximum possible wrapping height at which the wrapping machine can work.

[0085] If it is necessary to wrap the aforesaid "pallet means", i.e. loads occupying only half the surface of the pallet, an initial step is provided of rotating the closing device 1, in which the vertical movement unit 46 or the pressing device stagger rotation by 90° to offer for welding the longest side of the palletised load. In this case, the frame 16 must be adjusted in such a manner that the lengths of the rods thereof substantially correspond to the actual dimensions of the load. For example, if the long side of the frame 16 is 1200 mm, it is adjusted to 1000 mm or 800 mm, whereas if the short side of the frame 16 is 1000 mm, it is adjusted to 800 mm or 600 mm.

[0086] Owing to the invention it is thus possible to protect effectively the top of a palletised load, maintaining or even improving the current production levels of palletised loads, saving on the consumption of materials and limiting costs of installation and running of a wrapping machine and of a plant.

Claims

1. Closing device (1; 101) configured for a wrapping machine of the type comprising a turntable or a ring and suitable for closing an open end (2) of a wrapping (3) of thermoweldable extendible plastic film when said plastic film is wrapped around a palletised product (4) by said wrapping machine, said open end (2) being provided in a band (3A) of said wrapping (3) that projects beyond the top (5) of said palletised product (4), said closing device (1; 101) comprising closing means (7) arranged for bringing together portions of said band (3A) and retaining means (6; 106)

cooperating with said closing means (7) and arranged for retaining said plastic film of said open end (2) and for folding said portions, said closing means (7) being provided with a welding element (8) for welding said portions of said band (3A) above said top (5), so as to close the opening of said open end (2), wherein said closing means (7) comprises a pair of arms (7A, 7B), supported by a framework (9) and drivable in such a manner that at least respective ends (12) of said arms (7A, 7B) are movable towards and away from one another, said welding element (8) being fixed to each of said respective ends (12), and wherein said retaining means (6; 106) is connected to said arms (7A, 7B) in such a manner as to be driven by the motion of said arms (7A, 7B) between an extended configuration (E), in which said retaining means (6; 106) is suitable for maintaining said portions extended and a folded configuration (K), in which said retaining means (6) is suitable for retaining said portions substantially superimposed on one another (H).

2. Closing device (1; 101) according to claim 1, wherein said arms (7A, 7B) are rotatable around respective rotation axes (X1, X2) between an upper position (S), in which said respective ends are more distant from an intended position of said palletised product (4) and a lowered position, in which said respective ends (12) are nearer said intended position of said palletised product (4).

3. Closing device (1; 101) according to claim 1, or 2, wherein said arms are further drivable along a translation direction (T1 T2) that is substantially horizontal.

4. Closing device (1; 101) according to claim 3, as appended to claim 2, wherein said rotation axes (X1, X2) are parallel to one another and orthogonal to said translation direction (T1 T2).

5. Closing device (1; 101) according to any one of claims 1 to 4, wherein said retaining means (6; 106) comprises foldable rods (16A-16D; 116A, 116C) having a length that is adjustable to adapt said retaining means (6; 106) to the size of said palletised product (4).

6. Closing device (1; 101) according to any one of claims 1 to 5, wherein said retaining means (6; 106) is provided with sucking means arranged for sucking air between said plastic film and a surface of said retaining means (6; 106) for retaining thereon said portions of said band (3A).

7. Closing device (1; 101) according to any one of claims 1 to 6, wherein said retaining means (6; 106) is further provided with bounding elements (21) arranged for defining wrapping edges around which said band (3A) of said wrapping (3) is obtainable by wrapping said plastic film.

8. Closing device (1; 101) according to claim 7, wherein said bounding elements (21) comprise a bar (22) that is rotatable between a bounding position (P), in which said bar (22) projects from said retaining means (6; 106) below said retaining means (6; 106) in a substantially vertical direction, and a concealed position (Q), in which said bar (22) extends parallel to a plane defined by said retaining means (6; 106).

9. Closing device (1; 101) according to any one of claims 1 to 8, and further comprising a vertical movement unit (46) arranged for moving said framework (9) vertically above an intended position of said palletised product (4).

10. Wrapping machine of the type comprising a turntable or a ring configured for wrapping a thermoweldable extendible plastic film around a palletised product (4) comprising a closing device (1; 101) according to any one of claims 1 to 9, for forming a band (3A) of said plastic film provided with an open end (2) that projects above said palletised product (4) and for closing said open end (2).

11. Wrapping machine according to claim 10, and further comprising a pressing element, arranged for pressing the top (5) of said palletised product (4) to stabilise said palletised product (4) during wrapping, wherein said closing device (1; 101) is mounted on said pressing element.

12. Wrapping machine according to claim 11, wherein said closing device (1; 101) is movable vertically with respect to said pressing element between a raised position, in which closing device (1; 101) does not protrude below said pressing element so as to enable said pressing element to perform its pressing action on said top (5) during lateral wrapping of said palletised product (4), and a lowered position, in which said closing device (1; 101) protrudes below of said pressing element.

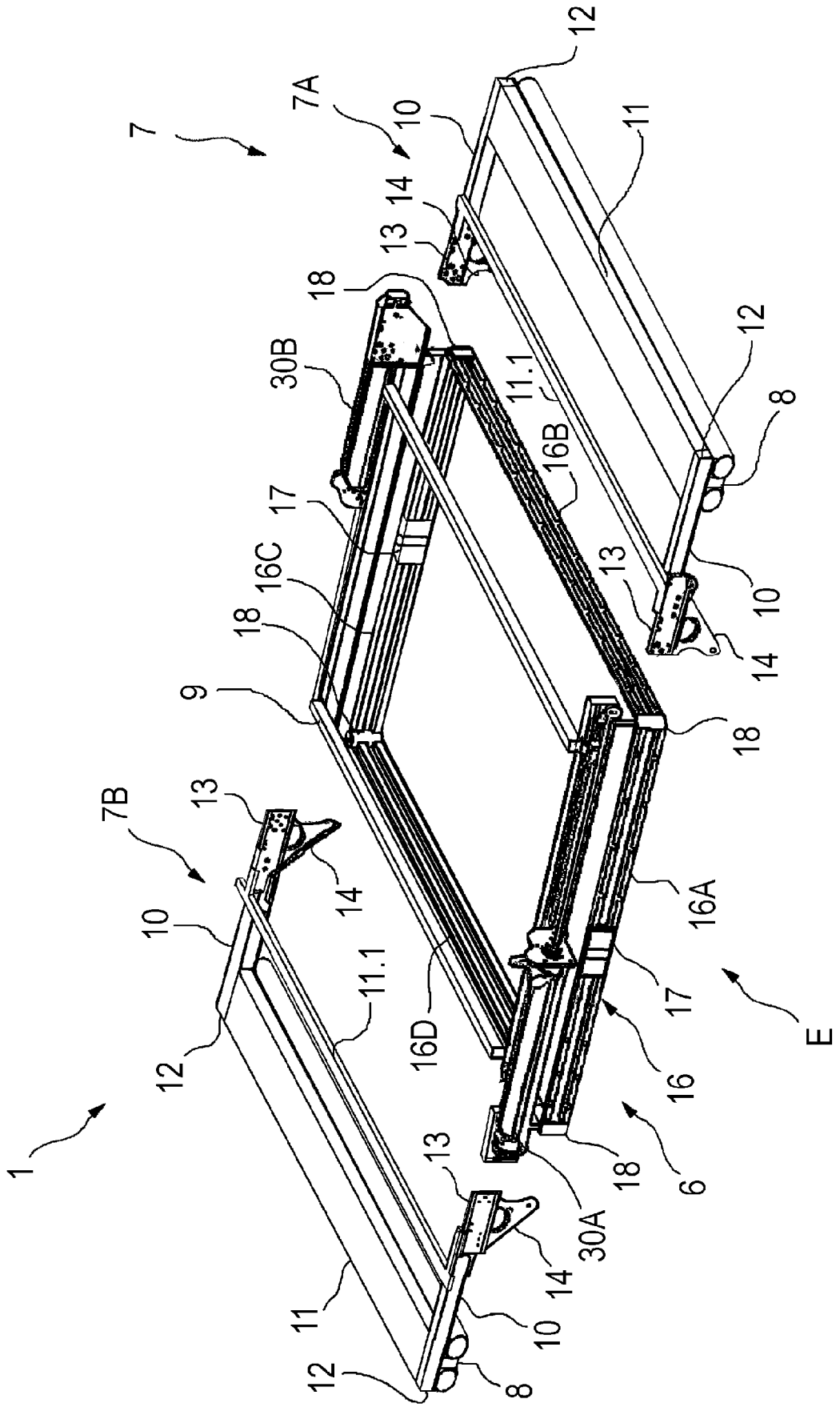


Fig.1

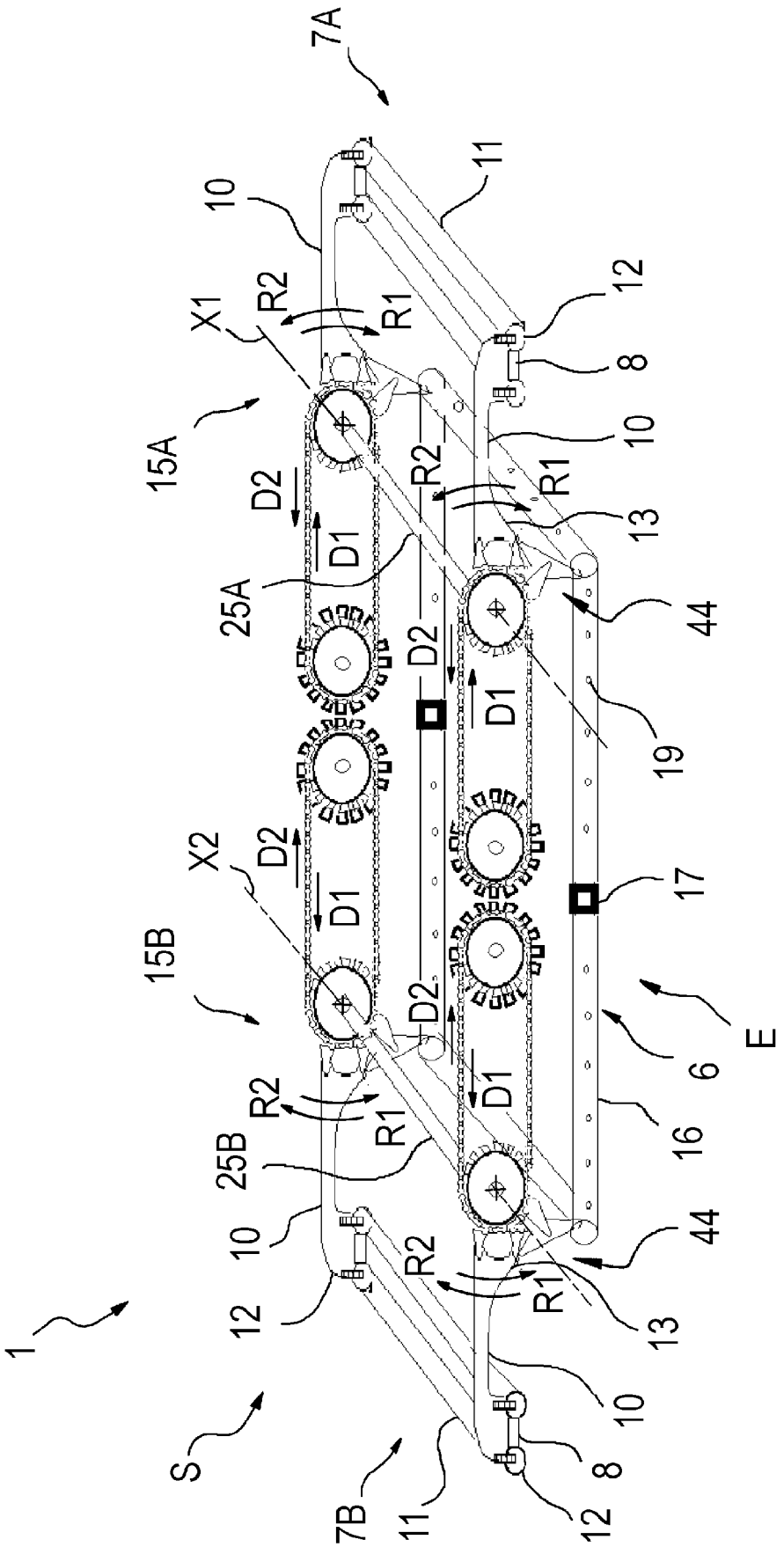


Fig.2

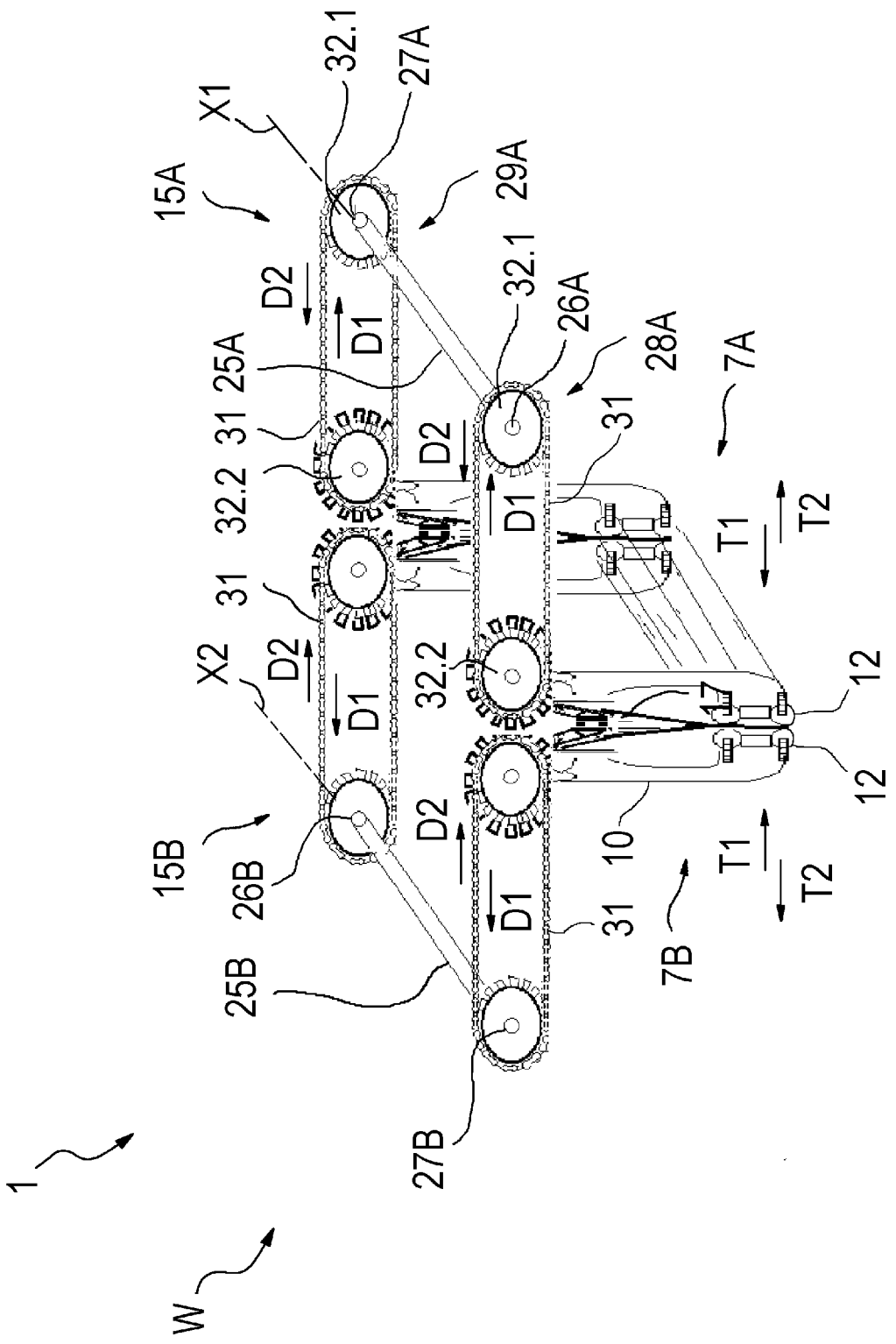

1
W
15A
15B
X1
X2
32.1
27A
29A
26A
28A
7A
7B
25A
25B
26B
27B
31
32.2
D1
D2
T1
T2
17
12
10

Fig.3

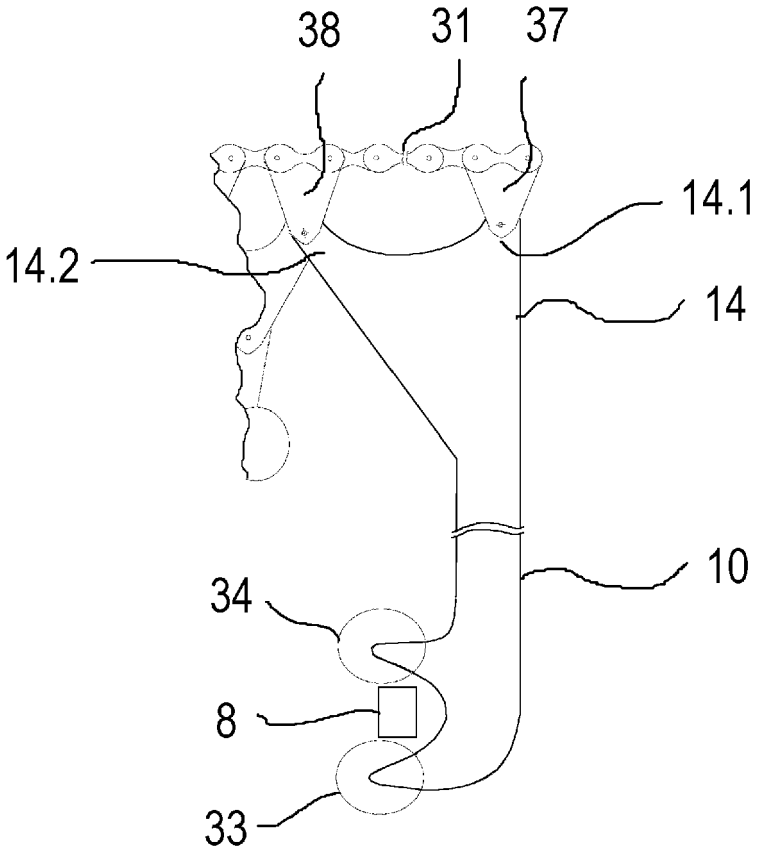


Fig.4

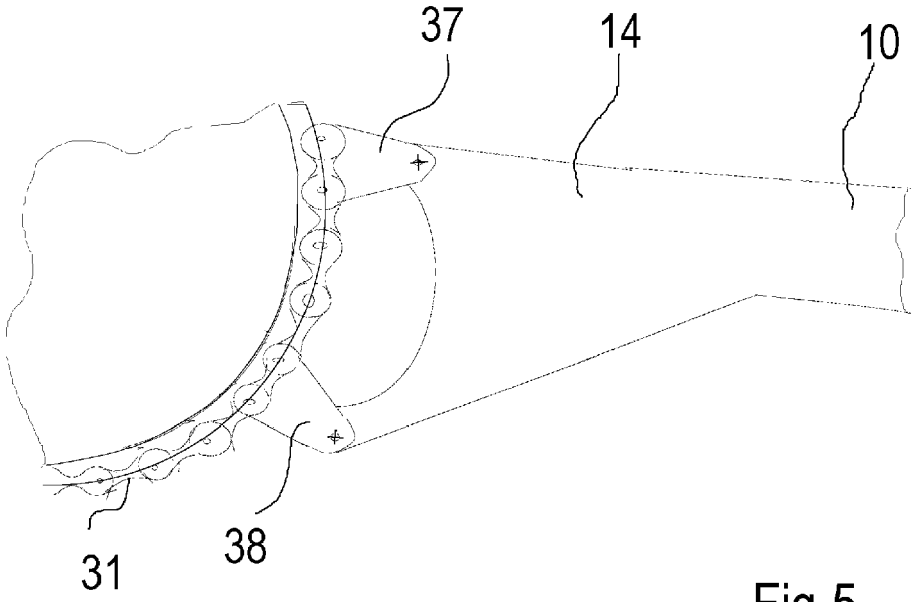


Fig.5

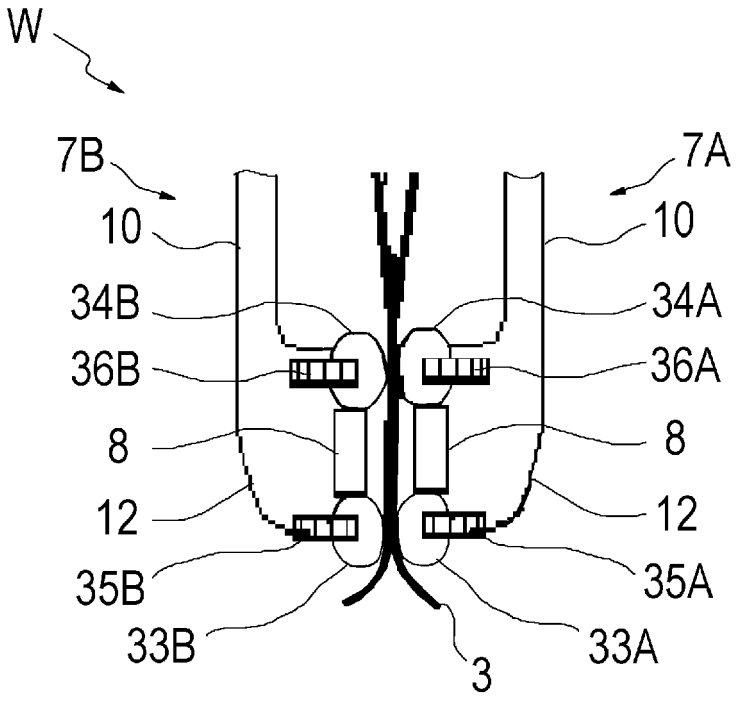

W
7B
7A
10
10
34B
34A
36B
36A
8
8
12
12
35B
35A
33B
33A
3

Fig.6

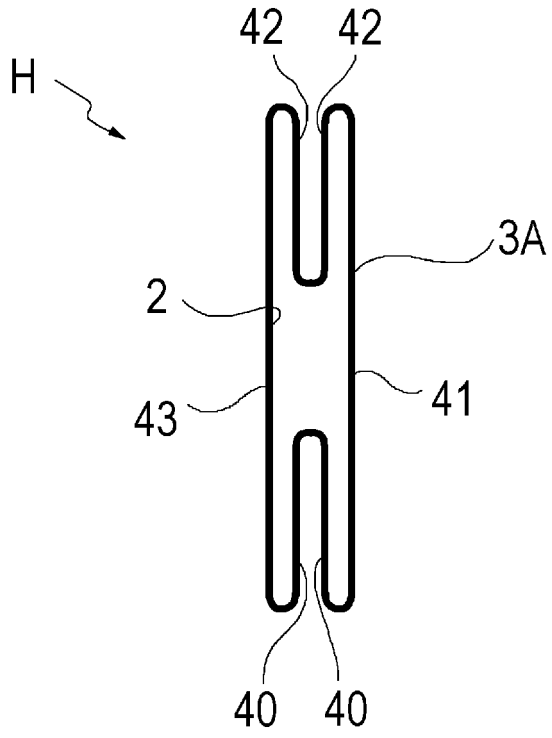

42
42
H
3A
2
41
43
40
40

Fig.7

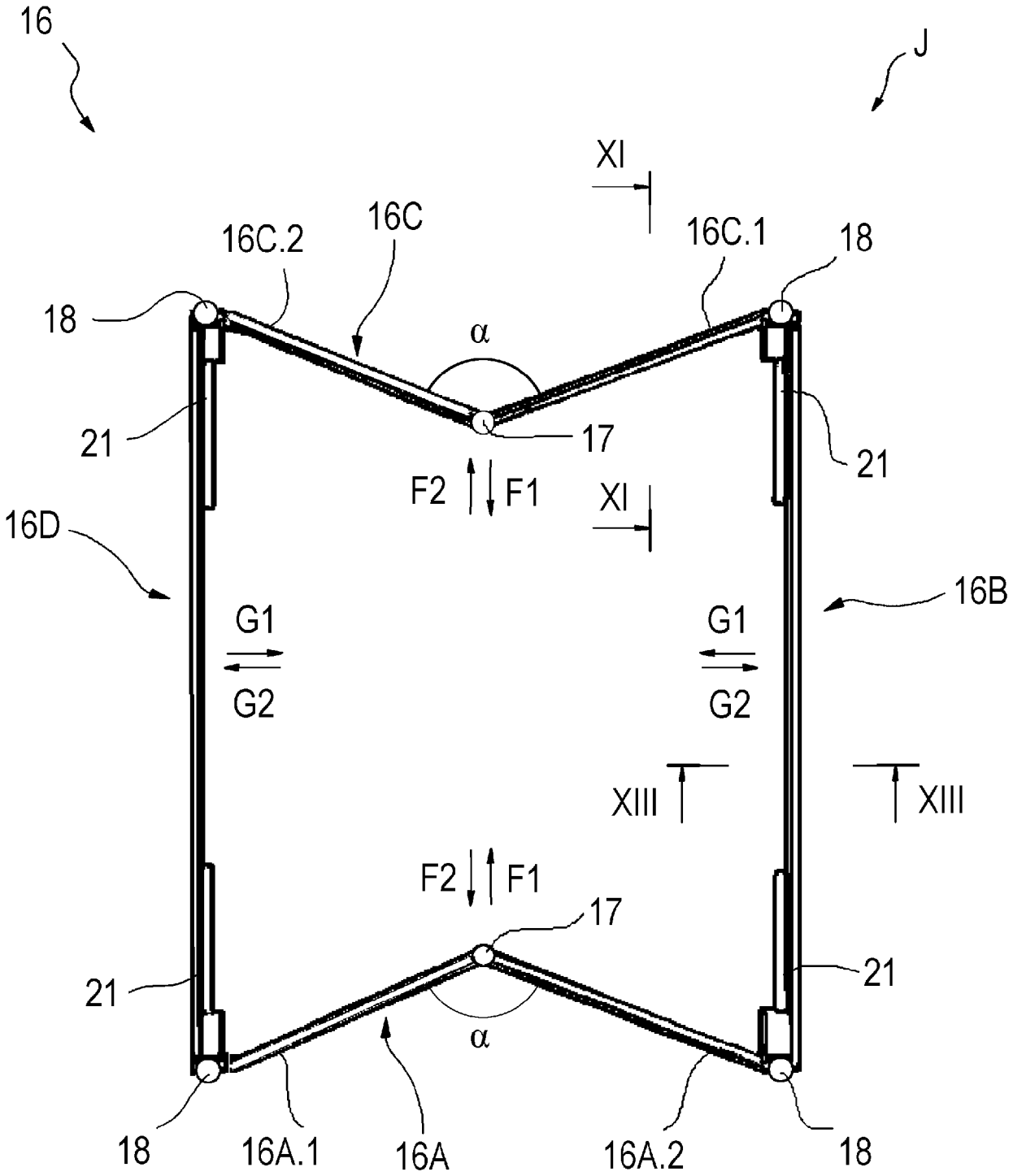
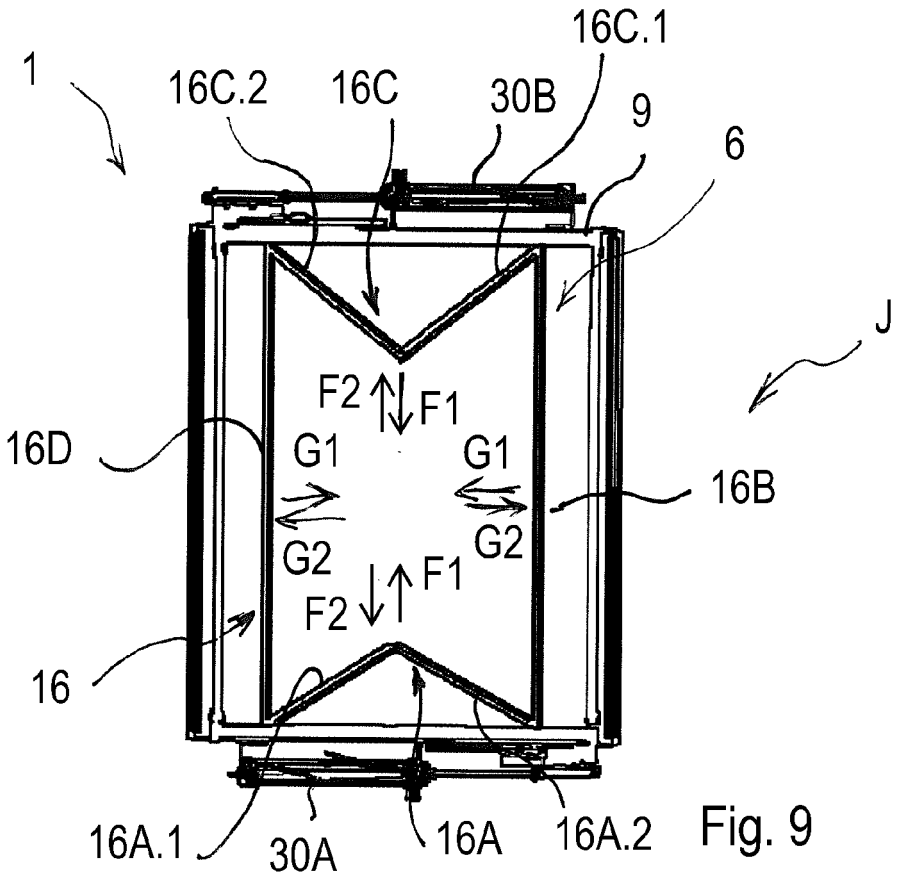

16
J
XI
16C
16C.2
16C.1
18
18
α
21
17
21
F2
F1
XI
16D
16B
G1
G2
G1
G2
XIII
XIII
F2
F1
17
21
21
α
18
16A.1
16A
16A.2
18

Fig.8


1
16C.2
16C
30B
16C.1
9
6
J
F2
F1
16D
G1
G1
16B
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F1
F2
16
16A.1
30A
16A
16A.2

Fig. 9

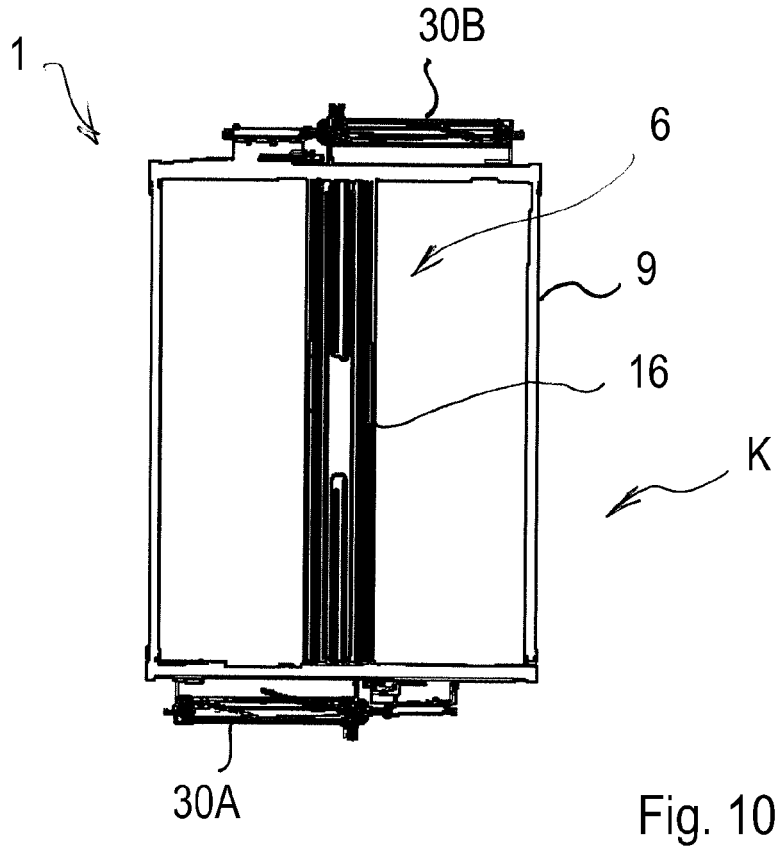
1
30B
6
9
16
K
30A

Fig. 10

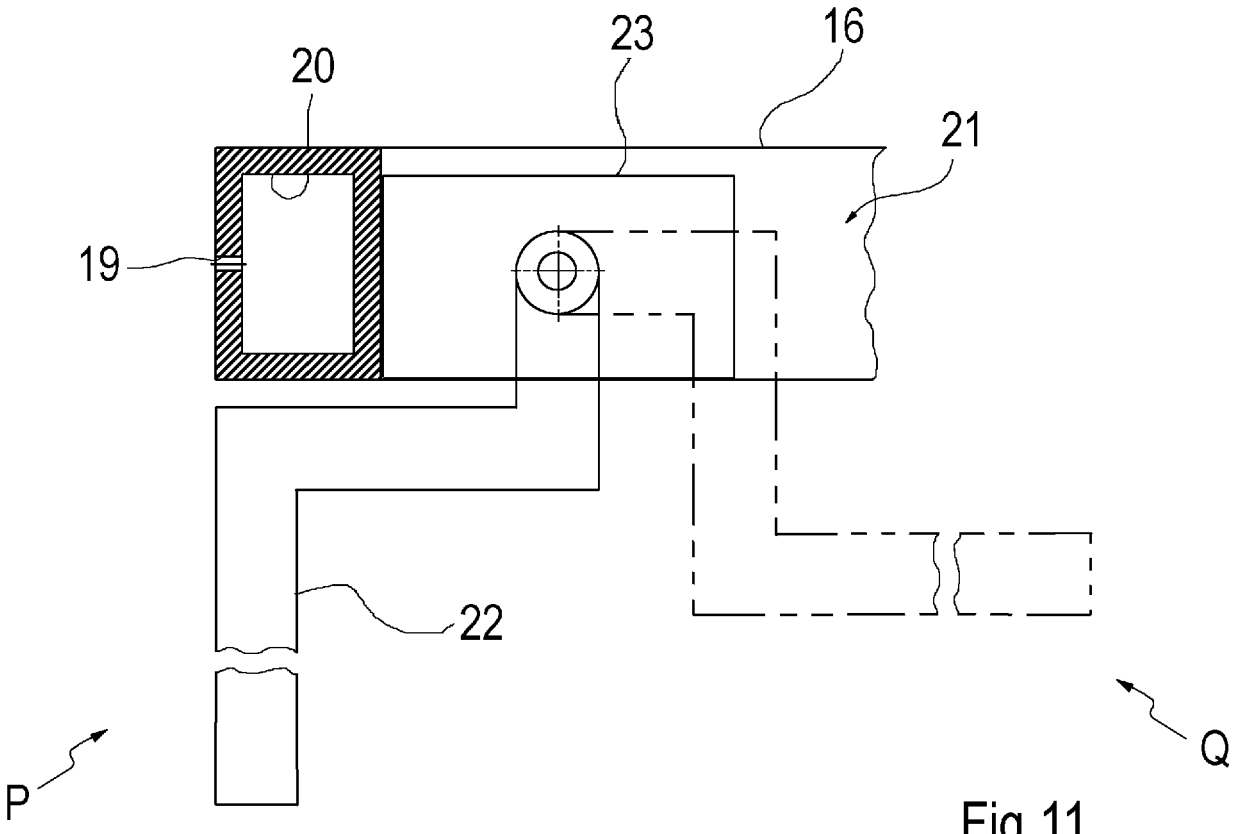

Fig.11

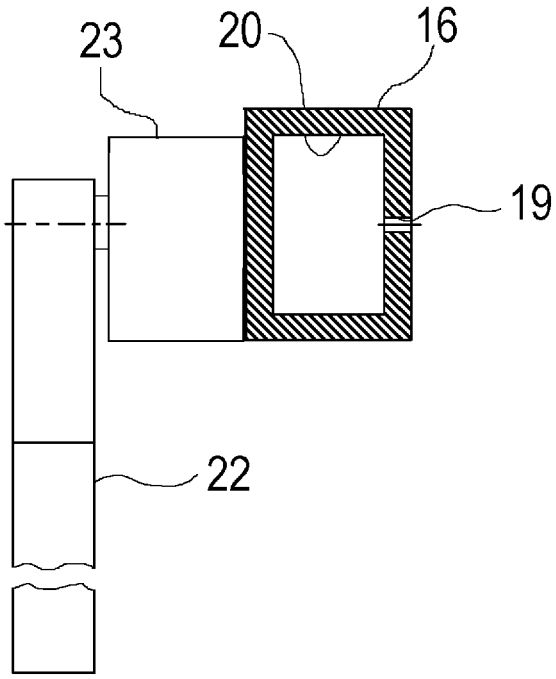

Fig.12

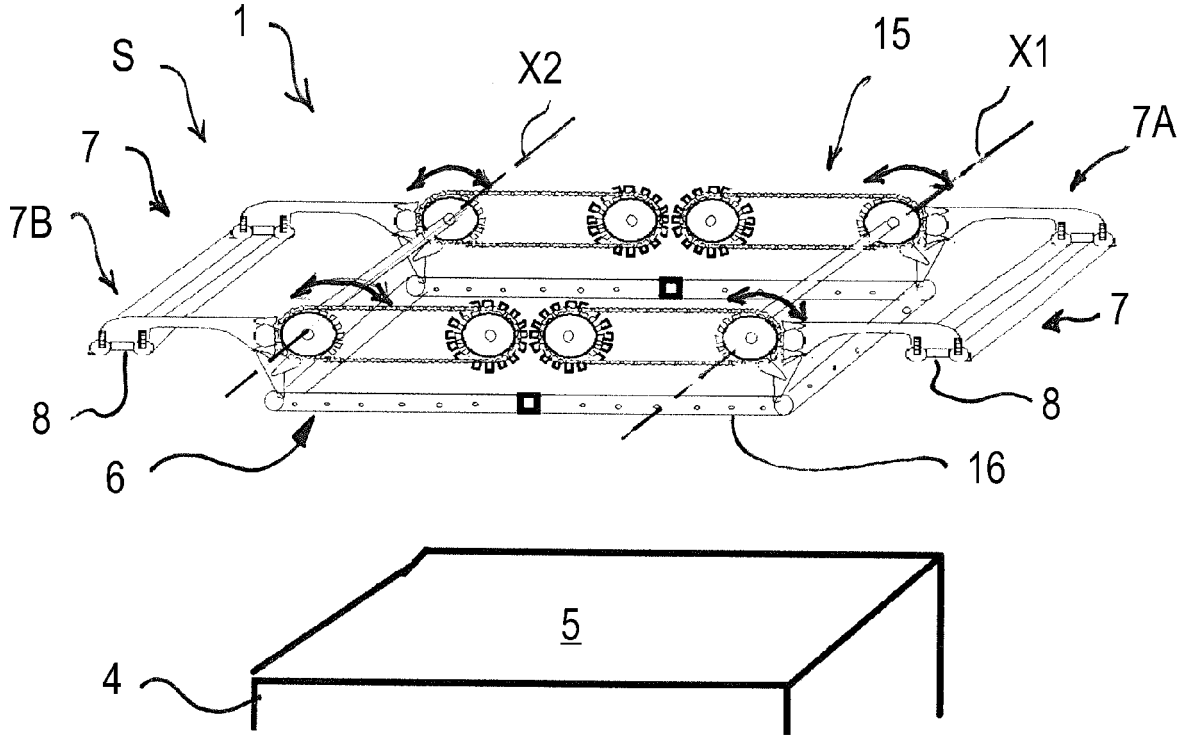

Fig. 13

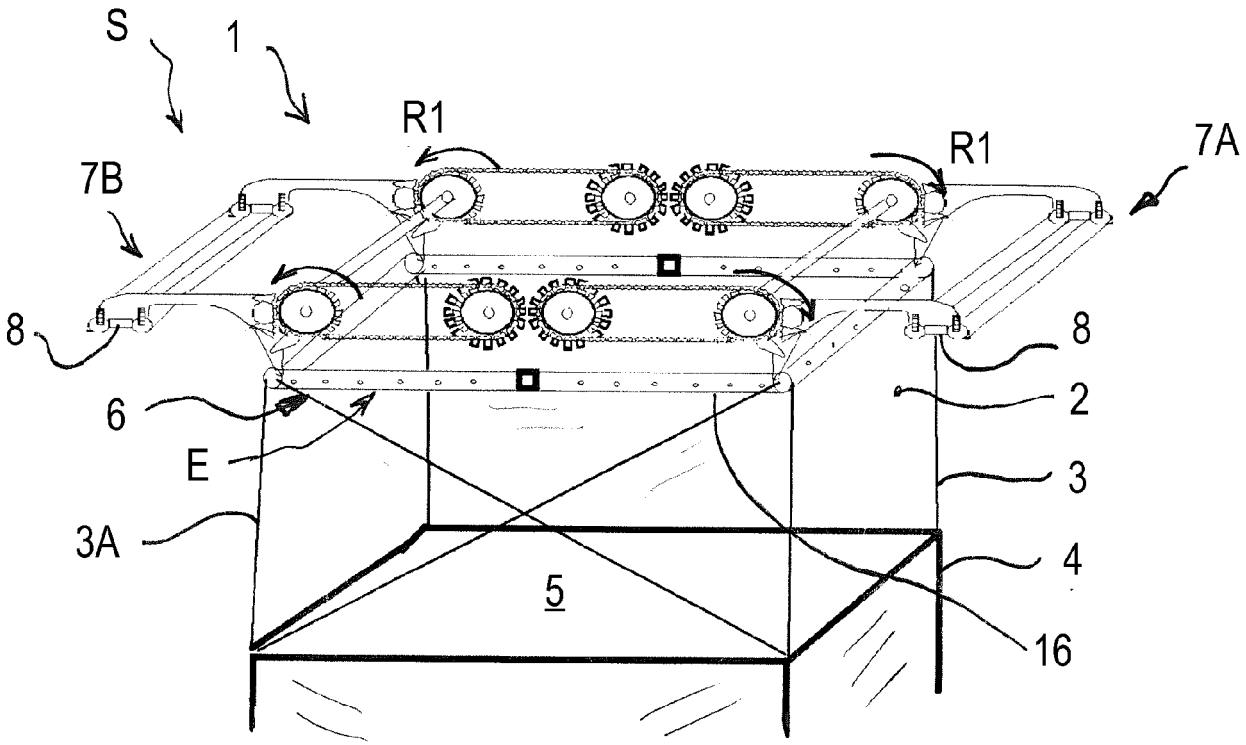

Fig. 14

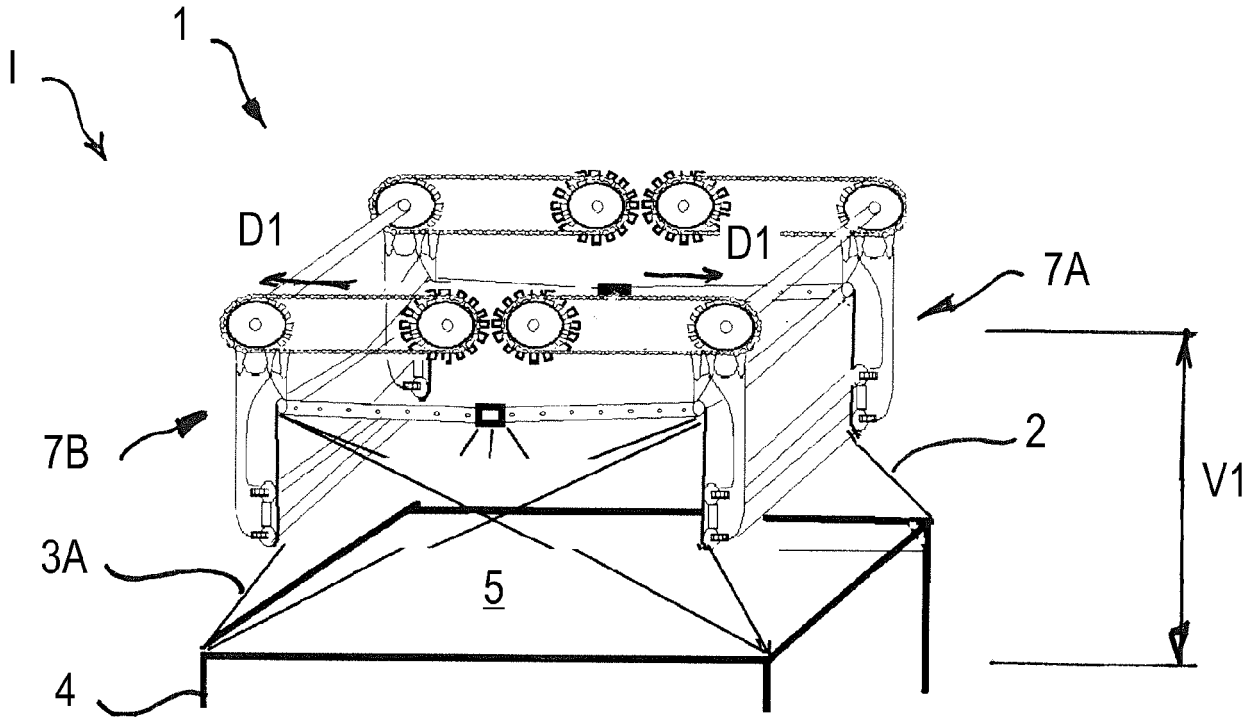

Fig. 15

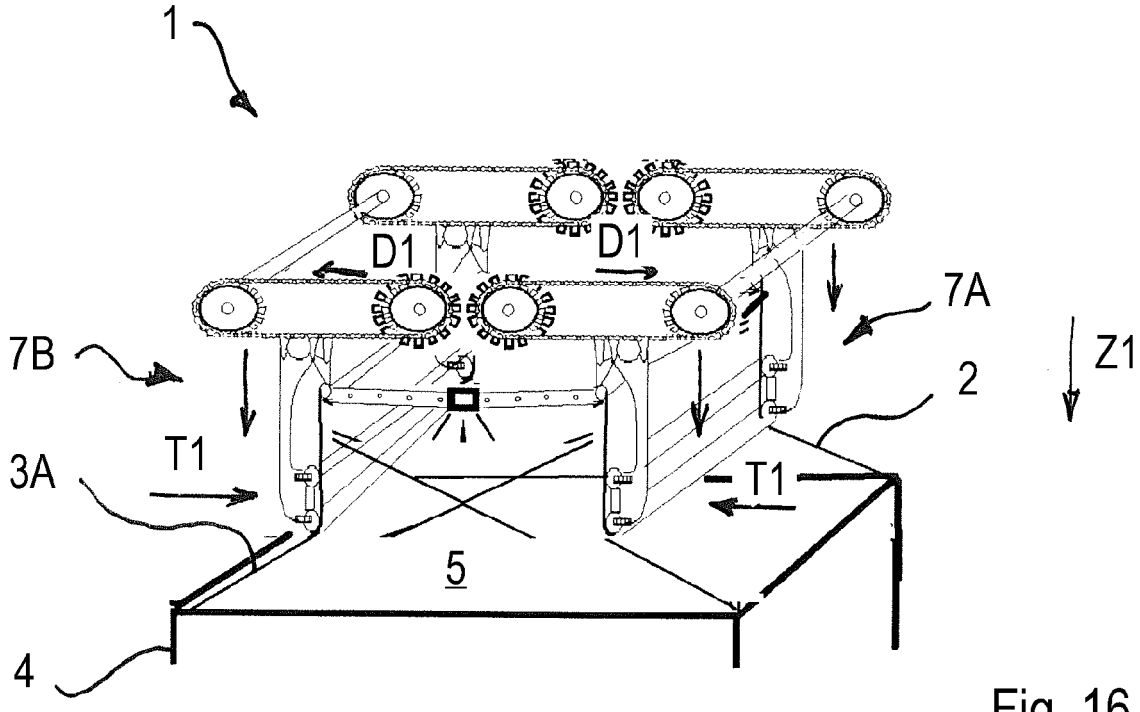

Fig. 16

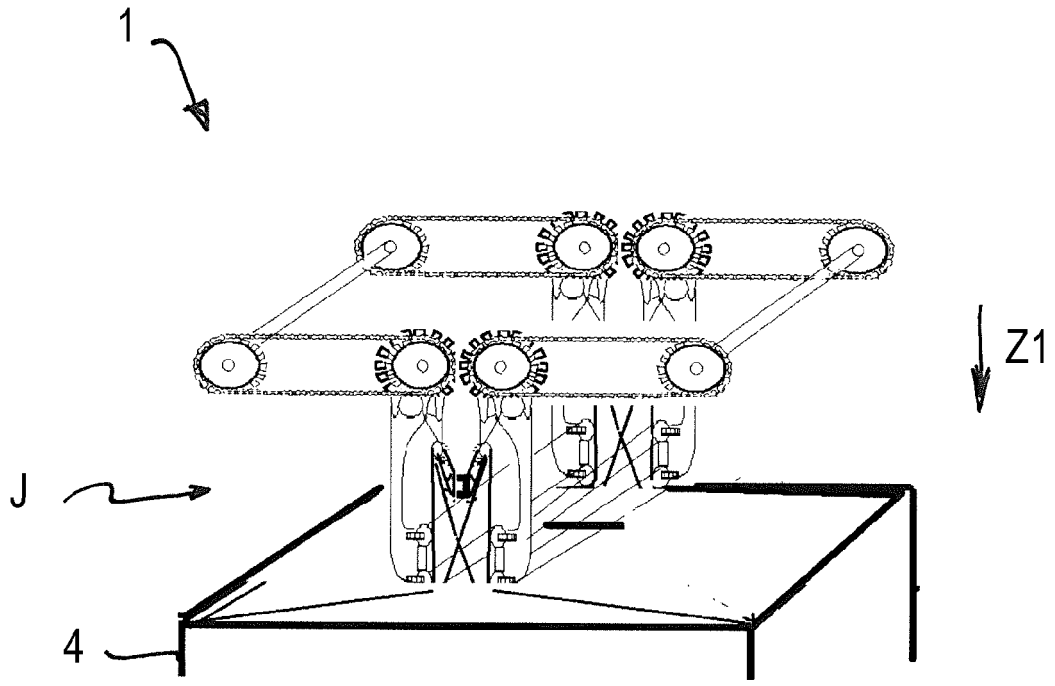

Fig. 17

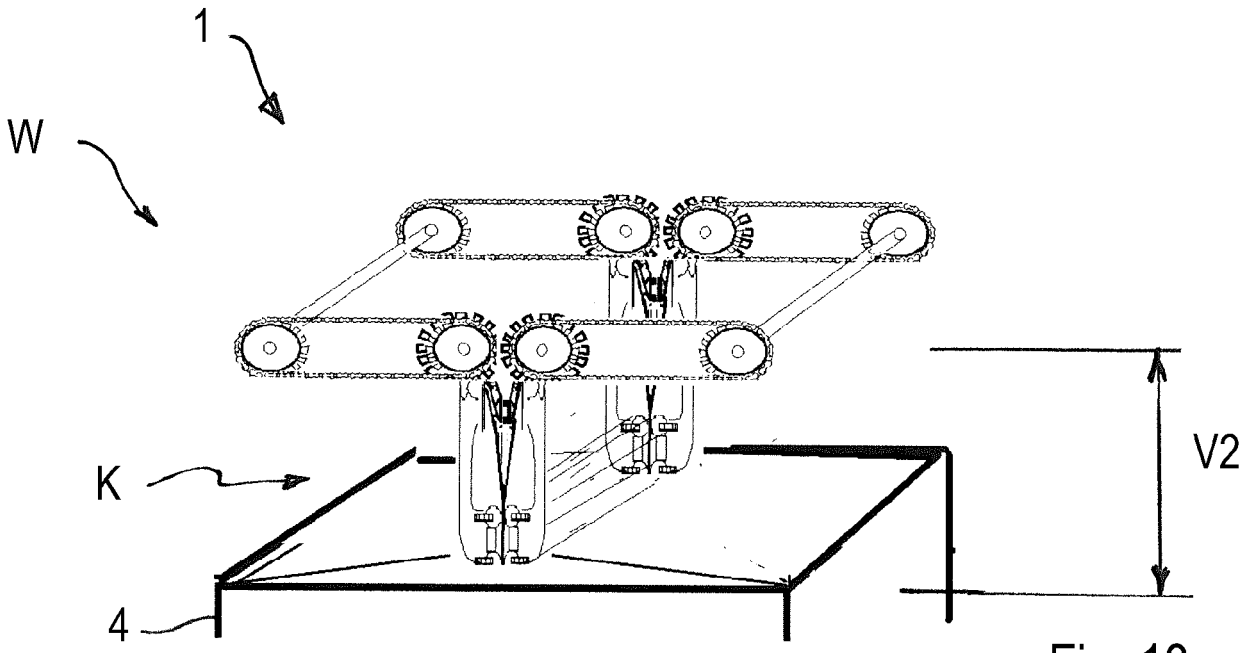

Fig. 18

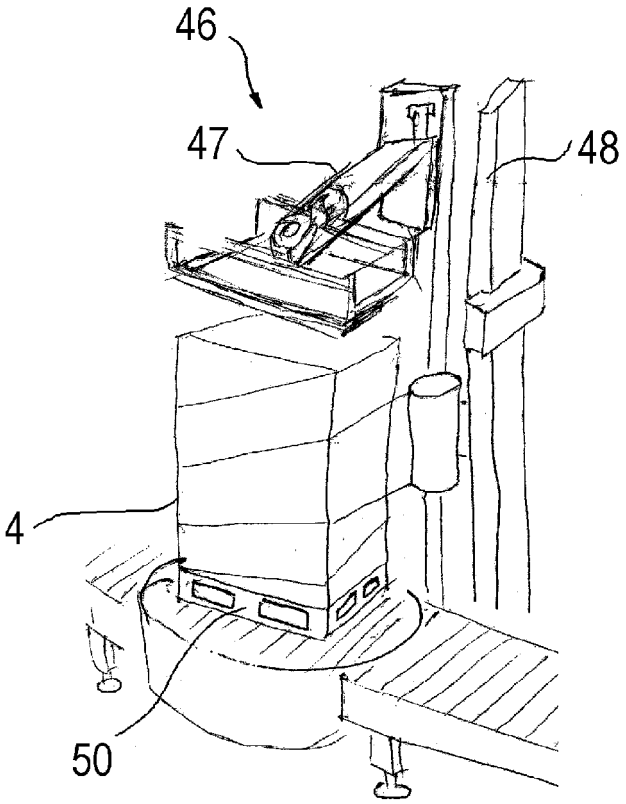

Fig.19

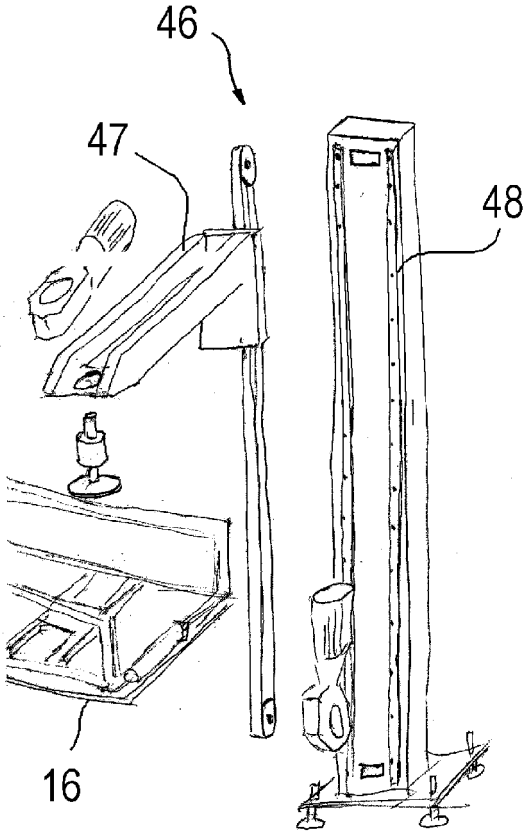

Fig.20

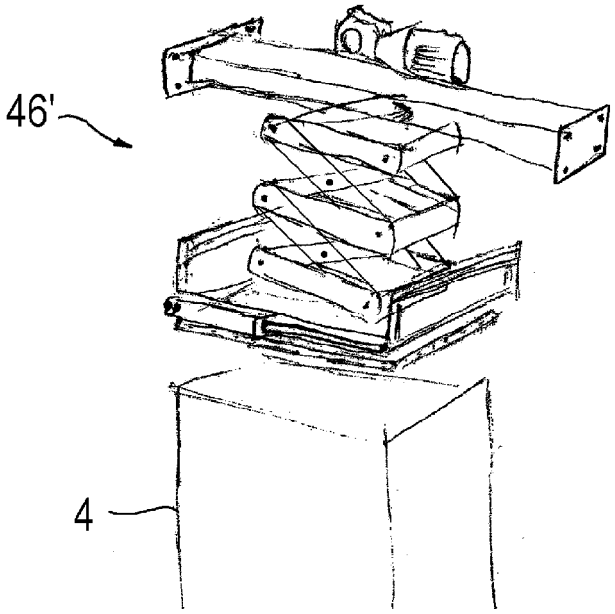

Fig.21

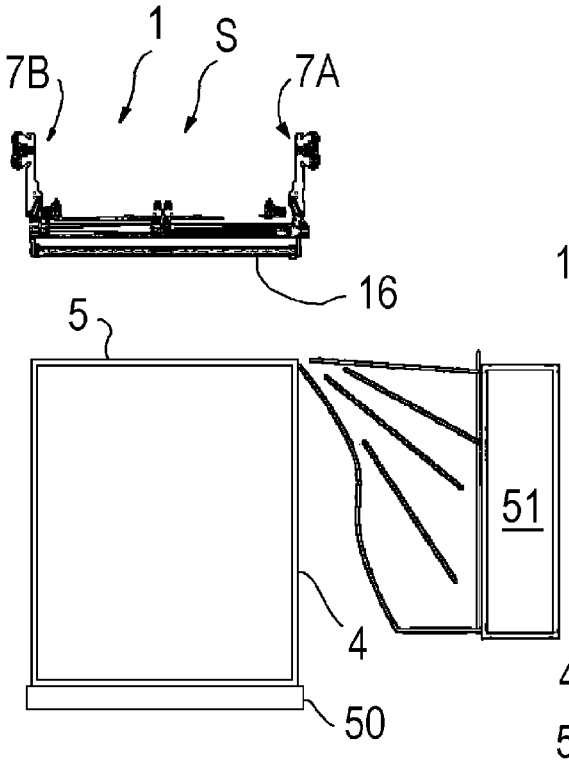

Fig.22

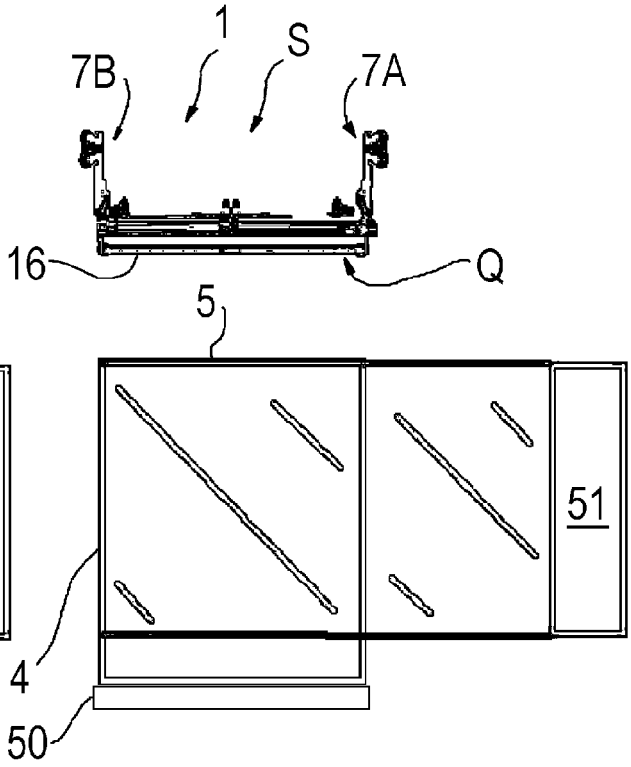

Fig.23

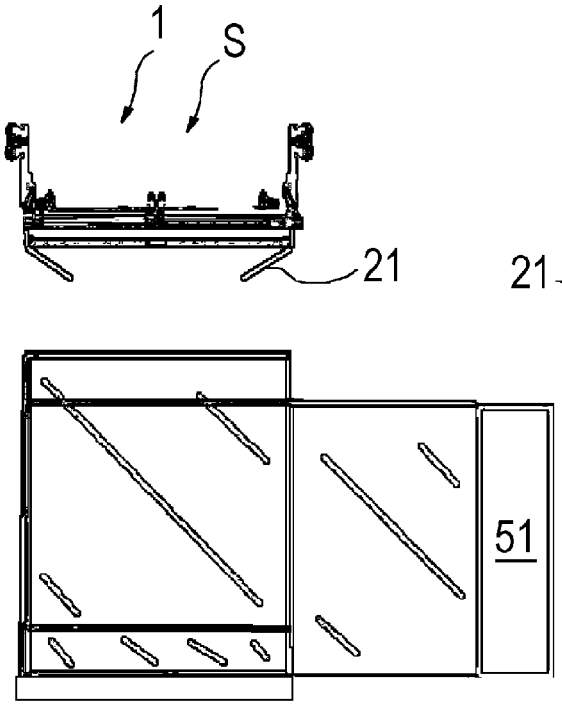

Fig.24

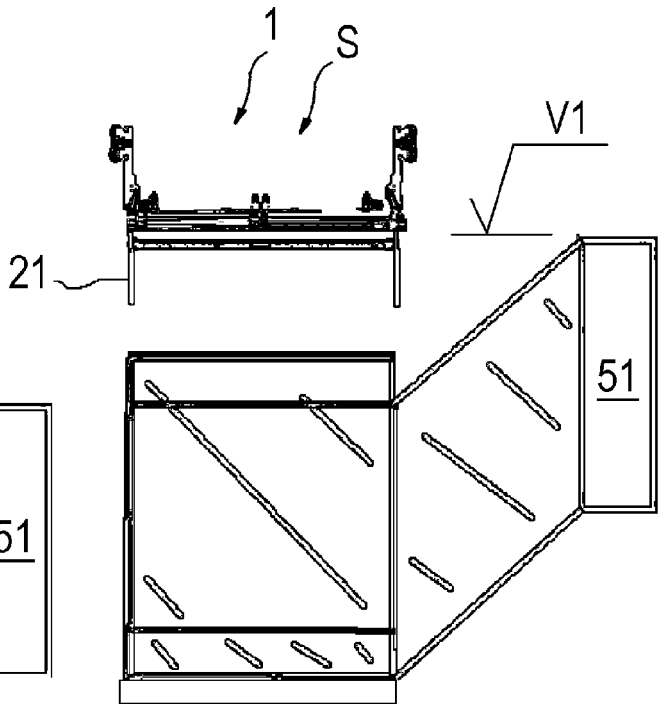

Fig.25

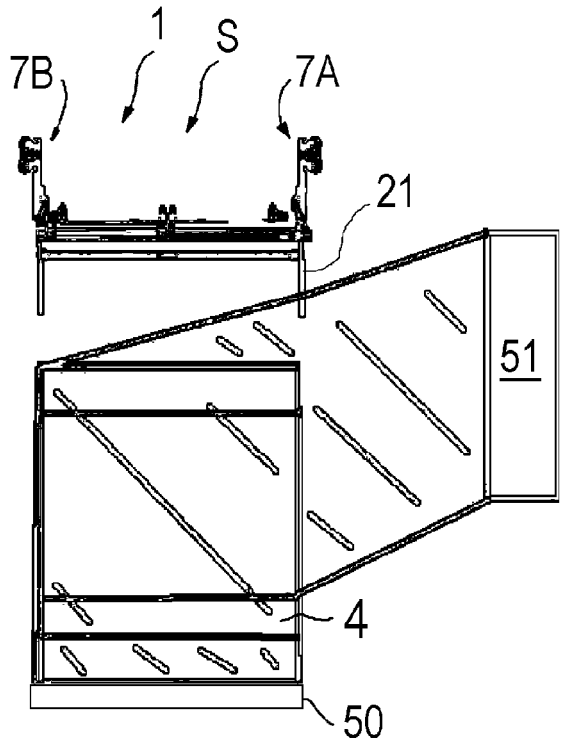

Fig.26

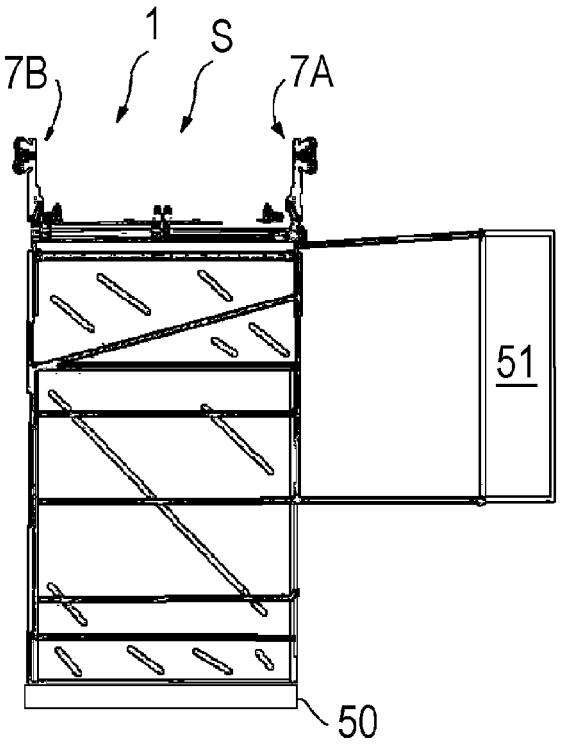

Fig.27

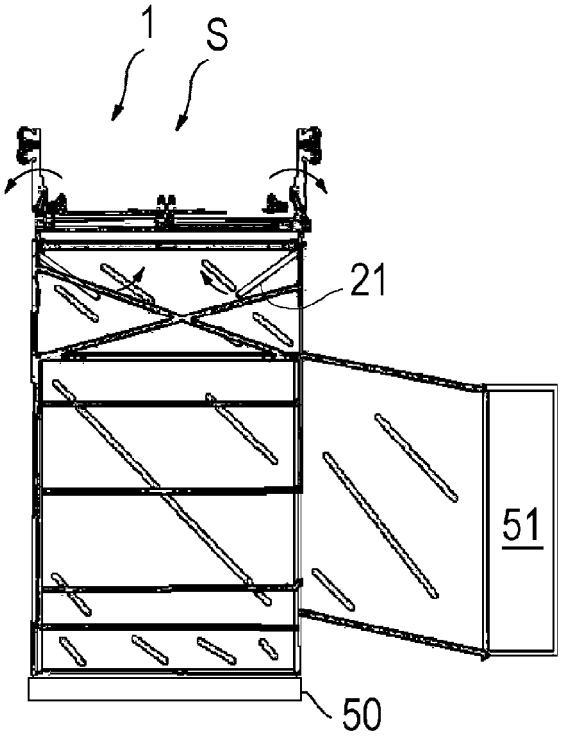

Fig.28

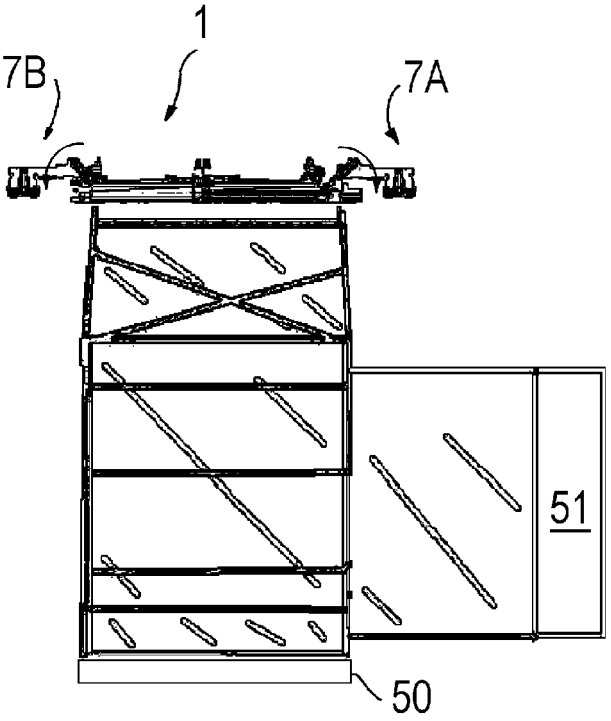

Fig.29

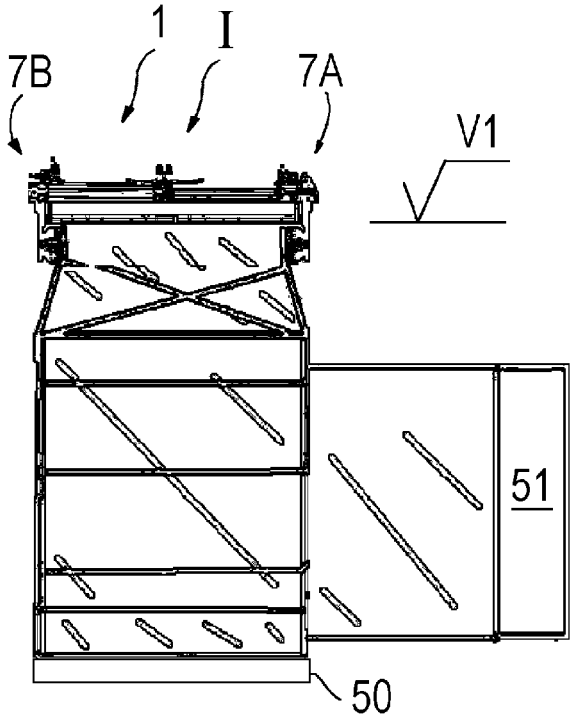

Fig.30

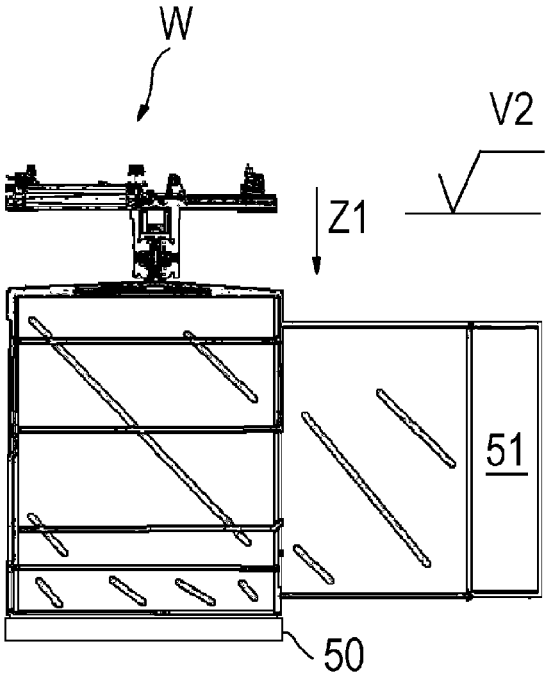

Fig.31

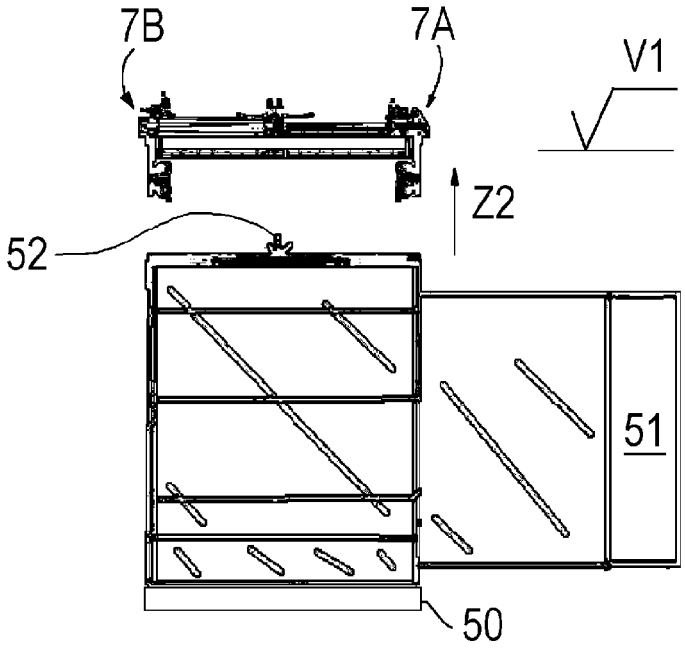

Fig.32

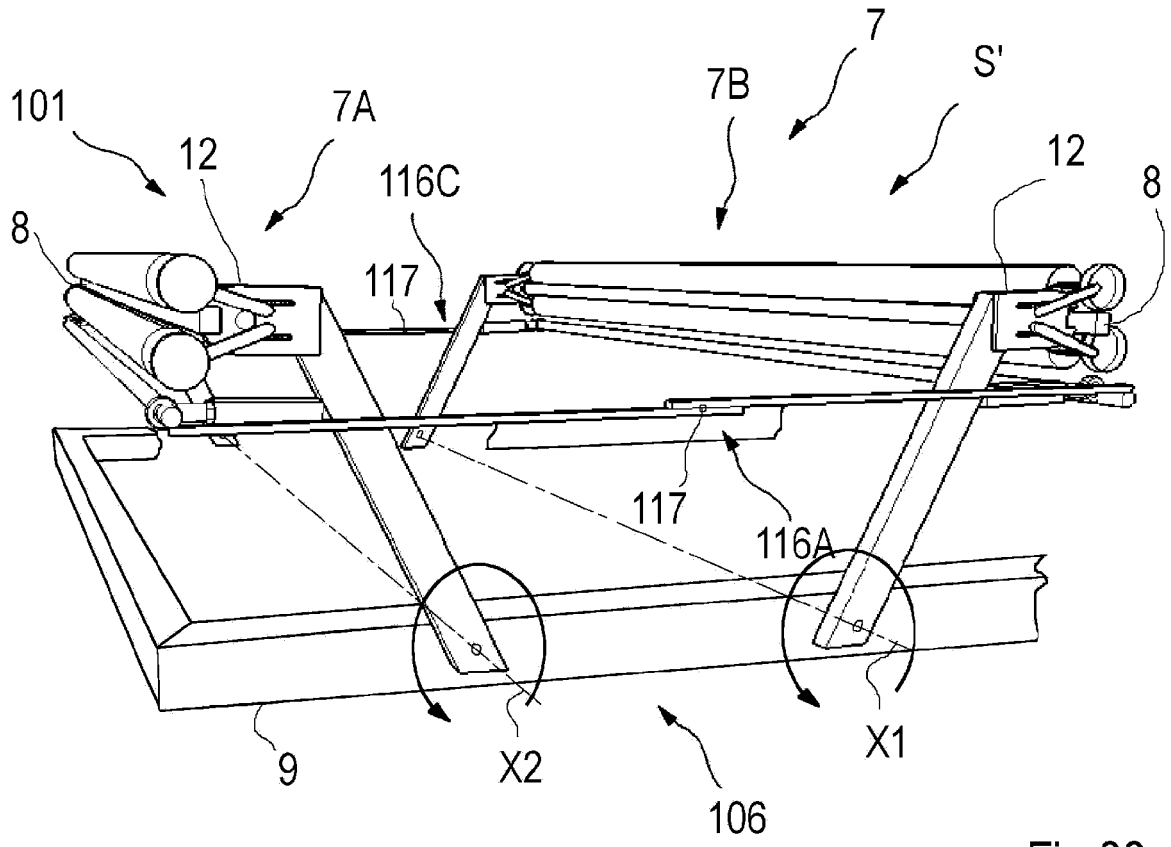
101
12
7A
116C
117
8
7
7B
S'
12
8
117
116A
9
X2
X1
106

Fig.33

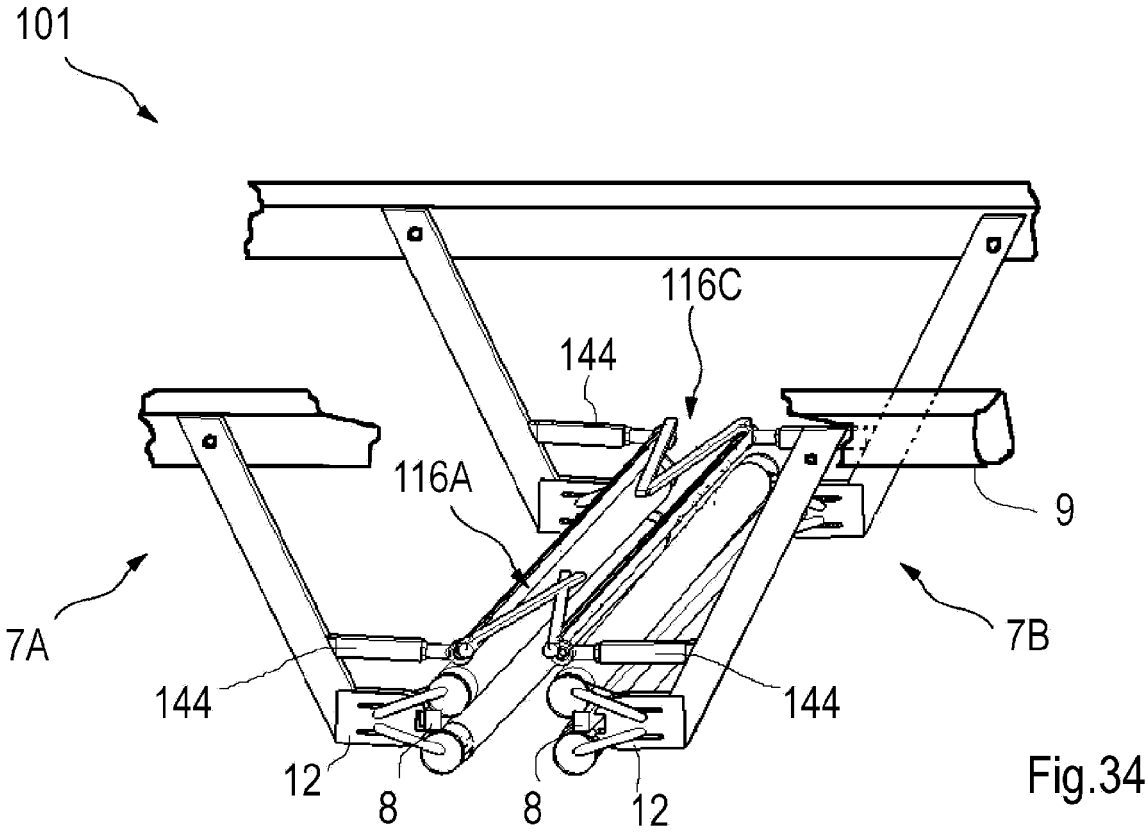
101
116C
144
116A
9
7A
7B
144
144
12
8
8
12

Fig.34

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 2422000 **[0007]**