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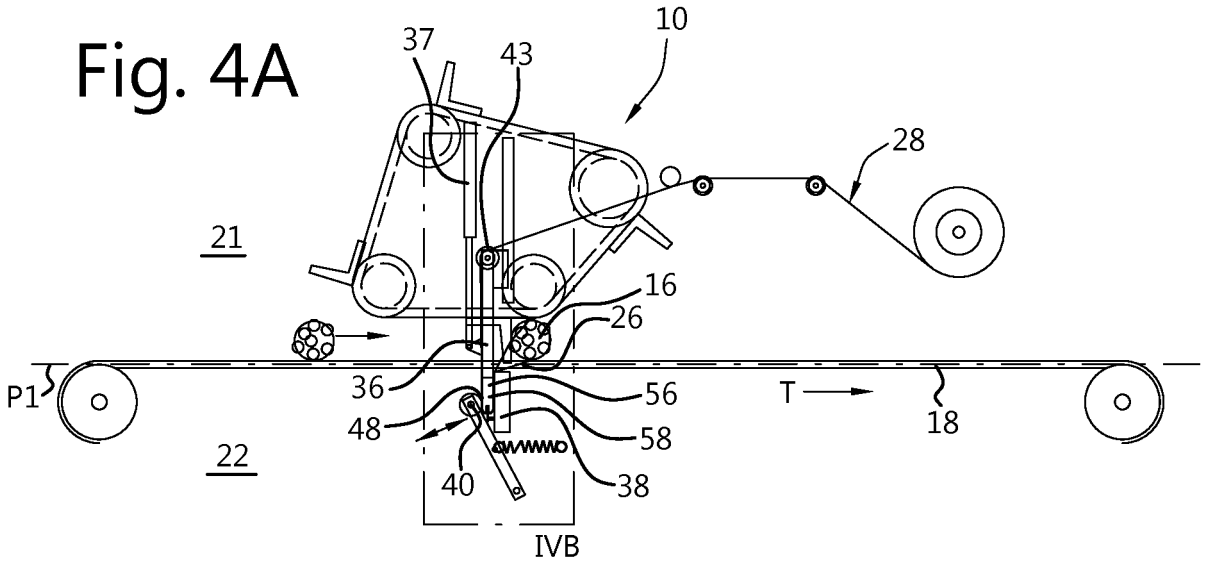
Remarks:
Claims 16 to19 and 21 to 23 are deemed to be abandoned due to non-payment of the claims fee (Rule 45(3) EPC).

(54) TAPE SEALER FOR WINDING ADHESIVE TAPE AROUND AN OBJECT

(57) A method and tape sealer (10) for winding adhesive tape around an object (16) such that two adhesive portions of the tape contact each other. The tape sealer comprises: a housing (12) with a passage (14) for passing the object there through in a transport direction parallel to a plane having a first side (21) and an opposite second side (22); a tape supply (43) at the first side of the plane and adapted for supplying tape (26) with its adhesive side (28) facing the transport direction; a support (38) and a clamping element (40) at the second side of the plane and adapted for clamping therebetween a first portion of the tape supplied by the tape supply, wherein the clamping element is moveable towards and away from the support; and a push element (36) with a contact surface (48), moveable between a first position in which the contact surface is located on the first side and a second position in which the contact surface is located on the second side, wherein in the second position the contact surface protrudes between the clamping element and the support for pressing the adhesive side of the first portion of the tape against an adhesive side of a second portion of the tape.

Fig. 4A



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Description

Field of the invention

[0001] The present invention relates to a tape sealer for winding adhesive tape around an object such that two adhesive portions of the tape contact each other, in particular comprising a passage having an entrance and a separate exit for entry and exit of the object respectively, during transport of the object along the tape sealer in a single direction of transport. The present invention further relates to a method for sealing tape around an object. The object preferably comprises a bouquet of flowers that has been loosely placed in a bag from a sheet like material such as plastic and/or paper, wherein the tape sealer is adapted for winding adhesive tape around the bag in such a manner that the bag is more tightly arranged around the bouquet of flowers, and such that the bouquet can be picked up by only holding a sheet portion of the bag.

Background art

[0002] From EP 0 128 687 A1 a machine for closing filled bags with an adhesive tape is known, comprising a pair of endless belts which come together to form a nip and act as guide to receive an open end part of a filled bag as it is moved through the machine, a follow-up member which is movable adjacent the guide following a bag to gather together the open end of the bag, and means for supplying a length of pressure sensitive adhesive tape and holding it across the path of the gathered together end of the bag. The pressure sensitive adhesive tape is provided by a tape supply reel.

[0003] After a length of adhesive tape has been cut and tied around a bag, a free end of the tape from the tape supply reel is caught by a reciprocating gripper which places the tape from the reel in a position for closing a subsequent bag. However, when bags are closed at high speeds, e.g. 3600 bags per hour or more, the free end is likely to move unpredictably relative to the gripper and the machine, causing the gripper to miss the free end, and consequently failure of the machine to tie tape around subsequent bags.

[0004] The present invention seeks to provide a tape sealer capable of winding adhesive tape around an object at a high speeds.

[0005] It is a further object of the present invention to provide a tape sealer adapted for winding adhesive tape around objects having irregular outer diameters.

Summary of the invention

[0006] To this end, according to a first aspect, the present invention provides a tape sealer for winding adhesive tape around an object such that two adhesive portions of the tape contact each other, comprising: a housing with a passage for passing the object there through in a transport direction, wherein the passage defines a plane parallel to the transport direction, the plane having a first side and an opposite second side; a tape supply, arranged at the first side of the plane and adapted for supplying tape with an adhesive side thereof facing the transport direction; a support and a clamping element arranged at the second side of the plane and adapted for clamping therebetween a first portion of the tape supplied by the tape supply, wherein the clamping element is moveable towards and away from the support; and a push element with a contact surface, adapted for moving between a first position in which the contact surface is located on the first side of the plane and a second position in which the contact surface is located on the second side of the plane and arranged for pressing the adhesive side of the first portion of the tape against an adhesive side of a second portion of the tape. As an object is moved through the passage with the push element in the first position, the object is moved against an adhesive side of the tape while an end portion of the tape is held between the clamping element and the support. The object is then moved further past the push element in the direction of transport and the push element is moved to the second position, pushing the first adhesive portion of the tape against the second adhesive portion in this manner closing the loop of tape around the object and also substantially preventing the end portion of the tape from moving out of between the support and the push element. As the push element is moved from the second position back to the first position, the end of the tape is thus held on the second side of the plane. In particular, when the portion of tape that has been looped around the object is still attached to the tape supply, another portion of the tape may thus be held against the contacting surface on the second side of the plane. Once the portion of tape looped around the object has been cut so that it no longer is connected to the tape supply, the end of the tape which runs from the tape supply may be held on the second side between the clamping element and the support. The invention thus ensures that a portion of tape running from the tape supply is always held substantially in place on the second side of the passage. This enables winding of tape around objects at high rates as movement of the tape at the second side remains substantially defined during use of the tape sealer. The direction of transport of the object through the passage, and the plane defined by the passage are preferably substantially horizontal. The object may thus enter the passage at an entrance of the passage, and pass along the tape sealer in the horizontal direction of transport before leaving the passage at an exit of the passage while continuing being transported in the same horizontal direction of transport.

[0007] During movement of the object along the direction of transport and against the adhesive side of the tape, additional tape is supplied from the tape supply to form a loop around the object. The total amount of tape that is wound around the object thus depends on the size of the object, so that the method is particularly suitable

for winding tape around objects of which the exact outer dimensions are not known in advance. Examples of such objects are bouquets of flowers.

[0008] Once the push element is in the second position, the first and second portions of the tape are pressed against each other, and the loop around the object is closed. In general, the tape used in the tape sealer has an adhesive side and an opposite non-adhesive side.

[0009] In an embodiment, the push element is adapted for moving between the first position and the second position such that in the second position, the contact surface protrudes between the clamping element and the support for pressing the adhesive side of the first portion of the tape against an adhesive side of a second portion of the tape. Thus, when the push element is in the first position, the tape is clamped between the clamping element and the support, and when the push element is in the second position with its contact surface protruding between the clamping element and the support, the tape is clamped between the clamping means and the contact surface of the push element, with the adhesive side of the tape contacting the clamping element and the contact surface arranged at a non-adhesive side of the tape. During movement of the push element from the second position back to the first position, the adhesive side of the tape adheres to the clamping element while the clamping element is moved back towards the support to clamp the tape.

[0010] In an embodiment, the clamping element is adapted for clamping a portion of the tape against the support when the push element is in the first position. The end portion of the tape may thus be held in place on the second side of the plane, while the contact surface of the push element is completely arranged on the first side of the plane.

[0011] In an embodiment the push element is arranged for moving between said first and second position in a direction substantially normal to the transport direction. This the length of the first and second portions of tape that are pressed against each other can thus be minimized. For instance, when the transport direction is horizontal, the push element is preferably arranged for moving in a vertical direction between its first and second position.

[0012] In an embodiment the support is arranged substantially coaxially with the direction of movement of the push element. The end portion of the tape can thus be clamped particularly stably between the push element and the support when the push element is in the second position.

[0013] In an embodiment, the support and the contact surface of the push element are adapted for, when the push element is in the second position, substantially clamping a portion of the tape therebetween at at least two spaced apart portions, with a gap extending between said two spaced apart portions, and wherein, when the push element is in the second position, the clamping element is moveable between a clamping position in which it at least partially extends into the gap for pressing the portion of tape against the support element, and a non-clamping position in which it is spaced apart from the tape. Rollers may be provided at the two spaced apart portions for guiding movement of the tape. Preferably the contact surface and the support are adapted for substantially axially clamping the end portion of tape there between along the direction of movement of the push element from the first position to the second position. The end portion of the tape can thus be clamped against the support by the clamping element and the push element at the same time. This allows the push element to clamp the tape against the support when pushing the adhesive sides of the first and second tape portion against each other when the clamping element is spaced apart from the tape, so that the clamping element does not become stuck between the two adhesive sides. Once the adhesive sides are pressed against each other, the clamping element can be moved to the clamping position in which it extends into the gap and clamps the pressed together portions of tape against the support. When the end portion of the tape held in place in the manner, the push element can be moved from the second position back to the first position.

[0014] Preferably, the contact surface is provided with two spaced apart abutment portions for abutting the tape, wherein the gap is adjacent to and between said abutment portions such that the tape is spanned between the abutment portions across the gap during movement of the push element from the first position to the second position. Alternatively, the contact surface may be provided with a first protruding surface and the support with a second protruding surface offset from the first protruding surface, in such a manner that when the push element is in the second position, the protruding surfaces are spaced apart from each other and define the gap therebetween.

[0015] In an embodiment, the support comprises a moveable block for contacting the tape, wherein the block is arranged coaxially with the direction of movement of the push element from the first to the second position. The moveable block is preferably biased in a direction opposite to said direction of movement, and may be a spring mounted block, e.g. comprising an air spring, and/or be provided with an actuator for urging movement of the block towards the push element.

[0016] In an embodiment the tape sealer further comprises a biasing element for biasing the clamping element against the support. Though such a biasing element may be a wire spring, the biasing element preferably comprises a gas cylinder which can be actuated for moving the clamping element towards the support, until a predetermined clamping force is achieved. The force exerted by the biasing element is small enough to be overcome by the push element when the contact surface is moved from the first to the second position.

[0017] In an embodiment the tape sealer further comprises a cutting device arranged for cutting the tape at a location on the second side of the plane, preferably for

cutting the second portion of the tape, more preferably for cutting the first and second portion of the tape at a location where the adhesive sides thereof contact each other. The cutting device may comprise a cutting edge that is moveable with respect to the support for cutting the tape. For instance, the cutting device may be arranged on the second side, or may be provided on the push element.

[0018] In an embodiment the cutting device comprises a cutting edge, wherein the contact surface is provided with two spaced apart abutment portions for abutting the tape and a recess adjacent to and between said abutment portions such that the tape is spanned between the abutment portions across the recess during movement of the push element from the first position to the second position, and wherein the cutting edge is arranged for cutting the tape at said recess when the push element is in the second position.

[0019] In a preferred embodiment the cutting device is arranged at a fixed position relative the support, preferably in-line with a direction of movement of the push element. Thus, when the push element is moved to the second position, the portions of tape are stretched over the groove, and eventually are cut when the groove is moved to partially accommodate the cutting edge. Movement of the cutting edge relative to the support, which is typically fixed to the housing is thus avoided, allowing particularly safe operation of the tape sealer.

[0020] In an embodiment the tape sealer further comprises an actuator for driving movement of the push element between the first and the second position. The actuator, e.g. a pneumatically or electrically actuated piston, is adapted for driving movement of the push element from the first position to the second position and/or vice versa.

[0021] In an embodiment the tape sealer further comprises an urging element for urging the object against the adhesive side of the tape in the transport direction. The urging element thus prevents the object being blocked by the tape from being moved along the transport direction. The urging element preferably is adapted for urging the object beyond a line which extends from the periphery of the tape supply at the first side of the plane to between the support and the clamping element. It is thus ensured that the object is out of the way of the push element when the push element is moved from the first to the second position. In general, two spaced apart urging elements will be provided which are moveable in conjunction and along the direction of transport from a position upstream of the support and push element to a position downstream of the support and push element.

[0022] In an embodiment the urging element is adapted to be stationary with respect to the passage during movement of the push element from the first position to the second position to press the adhesive side of the first portion against the adhesive side of the second portion. The two portions that are thus prevented from being moved by the urging element relative to each other and/or to the support when the adhesive sides of the portions are being pressed together.

[0023] In an embodiment the urging element is adapted to move the object further along the transport direction after the first and second portions of tape have been pressed against each other with their adhesive sides. The further movement of urging element helps to prevent that the object stays in the passage after the adhesive sides have been pressed together, e.g. due to an adhesive portion of the tape that has been wound around the object sticking to the support.

[0024] In an embodiment the tape sealer further comprises an actuator for driving movement of the urging element. Preferably, the urging element is motorized and the tape sealer is provided with a controller connected thereto and adapted for controlling movement of the urging element. For instance, the urging element may be provided on an endless chain that is driven an actuator in the form of an electromotor.

[0025] In an embodiment the tape sealer is provided with a conveyor arranged for sequentially transporting a plurality of objects through the passage in the direction of transport. In general the objects will be sequentially transported through the passage by the conveyor, such as an endless belt conveyor, which supports the objects during their travel through the passage from an upstream end thereof to a downstream end of the passage along the direction of transport. During this transport, each of the objects comes into contact with the facing adhesive side of a portion of tape which extends along a line from the tape supply at the first side of the plane to between the support and the clamping element. The object is then moved further along the transport direction and beyond the line, so that a portion of the loop of tape around the object is formed. Next, in order to close the loop, the push element is moved from the first position in which its contact surface is located on the first side, to the second position in which its contact surface protrudes between the clamping element and the support at the second side and presses two adhesive portions of the tape against each other to close the loop.

[0026] In an embodiment the tape sealer further comprises: a detector adapted for generating a detection signal when an object is being conveyed by the conveyor at a predetermined distance with respect to the passage; and a controller adapted for controlling the actuators to drive movement of the urging element and the push element dependent on said detection signal, preferably also dependent on the transport velocity the conveyor. Preferably the detector is arranged upstream of the urging element along the direction of transport. It is especially advantageous if the controller drives movement of the urging element such that the urging element urges the object against the adhesive tape at a velocity higher than a transport velocity of the conveyor, and such that while the push element is moved from the first to the second position to push the first and second adhesive tape portions against each other, the urging element re-

mains substantially stationary relative to the passage. Once the push element no longer pushes the first and second adhesive portions against each other, the urging element is again controlled to move in the direction of transport than the conveyor, preferably at a higher velocity than the conveyor, to ensure that the object and any adhesive tape attached to the object exits the passage.

[0027] In an embodiment the tape sealer further comprises a tape feeding device arranged for feeding the adhesive tape to the tape supply, the tape feeding device comprising: an arm provided with a first tape reel holder rotatable around a first axis of rotation and adapted for holding a first reel of tape, wherein the arm further comprises a second tape reel holder rotatable around a second axis of rotation and adapted for holding a second reel of tape, wherein the arm is rotatable relative to the housing around a third axis of rotation that is parallel to the first and second axis of rotation; an attachment device provided with an attachment portion for holding a free end of the second reel of tape such that the non-adhesive side of said free end faces the adhesive side of tape from the first reel of tape that is fed to the tape supply, wherein said attachment portion is moveable between a first position in which the first and second tapes are spaced apart, and a second position in which it pushes the non-adhesive side of the second tape against the facing adhesive side of the first tape; and a tape cutter arranged between the first tape reel holder and the attachment portion of the attachment device, for cutting the first tape. When a tape sealer, such as a tape sealer according to the present invention, is used to wind tape around large numbers of objects per hour (3600 objects per hour or more), it is highly desirable the tape sealer operates continuously without having to be paused when a reel of tape runs out. The tape feeding device allows continuous operation of the tape sealer when the first reel runs out, by attaching the free end of the second reel of tape to the first reel of tape while tape from the first reel is still being fed to the tape supply. Once the tape from the second reel is being fed to the tape supply, the tape from the first reel is cut, and the first tape reel is replaced by a full tape reel. Next, the arm can be rotated such that the second tape reel takes the former position of the first tape reel and the full tape reel takes the former position of the second tape reel. The free end of the full tape reel may then be attached with its adhesive side to the attachment portion of the attachment device, so that it is ready to be attached to the second tape when the second tape reel reaches its end.

[0028] In an embodiment the tape sealer further comprises: an encoder arranged for providing a signal indicative of an amount of tape that has been fed from the first tape reel to the tape supply; and a controller adapted for, upon receipt of said signal from the encoder, determining whether a predetermined portion of the first reel of tape has been fed to the tape supply and if this predetermined portion has been fed to the tape supply, controlling the attachment device to move the attachment portion to the second position and controlling the tape cutter to subsequently cut the first tape. Based on the signal from the encoder and a predetermined length of the first reel of tape when it was first installed on the first tape reel holder, the controller determines whether the predetermined portion of the first reel of tape, e.g. 95%, 97%, 98% or more, but less than the complete length of the first reel of tape, has been fed to the tape supply. If this is the case, the controller controls the attachment device to attach the free end of the second tape to the first tape and controls the tape cutter to subsequently cut the first tape.

[0029] According to a third aspect the present invention provides a method for winding adhesive tape around an object such that two adhesive portions of the tape contact each other, during which the object is moved along a transport direction through a passage which defines a first plane parallel to the transport direction, the first plane having a first side and an opposite second side, and the tape having an adhesive side and an opposite non-adhesive side, the method comprising the steps of:

- supplying tape from a tape supply that is arranged at the first side of the first plane to the second side of the first plane, with the adhesive side of the tape facing the transport direction;
- on said second side, clamping a first portion of the tape between a support and a clamping element such that a middle portion of the tape, which extends between from tape supply to the support and the clamping element, is held taut within a second plane and such that the adhesive side of the first portion of the tape faces the clamping element;
- moving the object along the transport direction from a side upstream of the second plane to a side downstream of the second plane, such that the object is pressed against the adhesive side of the tape;
- when the object is on the side downstream of the second plane, moving a push element, which is provided with a contact surface arranged for contacting the non-adhesive side of the tape, from a first position in which the contact surface is located on the first side of the first plane and a second position in which the contact surface is located on the second side of the first plane, the contact surface in the second position pressing the adhesive side of the first portion of the tape against an adhesive side of a second portion of the tape. The direction of transport of the object towards the middle portion of the tape is preferably substantially horizontal, while the second plane is preferably substantially vertical. The push element preferably moves downwards from the first position to the second position and parallel to the second plane. The method is preferably carried out

using a tape sealer according to the present invention.

[0030] In an embodiment, when in the second position, the contact surface protrudes between the clamping element and the support for pressing the adhesive side of the first portion of the tape against an adhesive side of a second portion of the tape.

[0031] In an embodiment the support and the contact surface of the push element are adapted for substantially axially clamping a portion of the tape therebetween at least two spaced apart portions when the push element is in the second position, wherein a gap extends between said two spaced apart portions, and wherein, and wherein, when the push element is in the second position and presses the first and second tape portions against the support, the clamping element is moved from a non-clamping position in which it spaced apart from the tape, to a clamping position in which it at least partially extends into the gap and presses the portion of tape against the support element, and subsequently the push element is moved from the second position to the first position.

[0032] Preferably, when the object is on the side downstream of the second plane, during movement of the push element from the first position to the second position, initially the clamping element is in the clamping positon for holding the tape against the support, and just before the contact surface actually presses the tape against the support, the clamping element is moved to the non-clamping position, to avoid the clamping element being stuck between the adhesive sides of the first and second tape portions. The push element may subsequently press the two adhesive sides against each other, after which the clamping element can be moved to the clamping position and the push element can be moved back to the first position. In an embodiment the object is arranged on a conveyor for moving the object in the transport direction with a first velocity, and wherein an urging element is provided for urging the object against the adhesive side of the tape; the method further comprising:

- when the object is within a predetermined range from the second plane, moving the urging element at a second velocity greater than the first velocity thus urging the object along the transport direction from the side upstream from the second plane to the side downstream of the second plane, wherein the urging element is held stationary with respect to the passage during movement of the push element from the first position to the second position. When the urging element moves faster than the conveyor, it urges the object against the adhesive side of the middle portion of the tape, beyond the second plane. In order to prevent excessive stress on the tape during movement of the push element, movement of the urging element is stopped while the push element is moved from the first to the second position. The averages of the first velocity and the second velocity during travel of an object through the passage, i.e. the average conveyor velocity and average velocity of the urging element, including the time the urging element does not move, are preferably equal.

Short description of drawings

[0033] The present invention will be discussed in more detail below, with reference to the attached drawings, in which

Figs. 1A and 1B schematically show a perspective view of a tape sealer according to the invention, and a top view of a portion thereof;
Fig. 2 schematically shows a side view of the tape sealer of Fig. 1A;
Figs. 3A-3B schematically show the tape sealer of Fig. 2, with the push element in the first position;
Figs. 4A-4B schematically show the tape sealer of Fig. 2, with the push element in the second position;
Figs. 5A-5B schematically show the tape sealer of Fig. 2, while withdrawing the push element from the second position to the first position;
Figs. 6A-6D each show schematically a side view of a tape sealer according to the invention, provided with a tape feeding device for replacing tape reels during continuous operation of the tape sealer;
Fig. 7 schematically shows a side view of a tape sealer according to the invention, provided with an actuator for driving movement of the clamping element of the tape sealer;
Figs. 8A-8F schematically show a detail of a tape sealer according to a further embodiment;
Figs. 9A-9F schematically show side views of the tape sealer of Figs. 8A-8F along respective planes IX-A - IX-F.

Description of embodiments

[0034] Figs. 1A and 1B respectively show a schematic perspective view of tape sealer 10 according to the present invention, and a top view of a portion thereof viewed along plane IB-IB. The tape sealer 10, here shown arranged along an endless conveyor 18, comprises a housing 12 with a passage 14 which extends along direction of transport T of the conveyor 18. Bouquets of flowers 16, each surrounded by a bag 13, are transported by the conveyor 18 such that ends of the bouquets and bags pass through the passage 14 of the tape sealer 10. People may be present in the vicinity of the tape sealer, e.g. for picking up bouquets around which tape has been wound, from the conveyor 18. The housing protects people from moving parts and pinch points of the tape sealer, in particular from those parts of the tape sealer which are powered by actuators, such as urging elements and push elements which will be described below in more detail. Besides the main conveying surface 17, the conveyor 18 comprises a conveyor cable 19 which is spaced apart

from the main conveying surface 17 and arranged for supporting the ends of the bouquets 16. The conveyor cable 19 moves with a same velocity as the conveyor surface 17 in the direction of transport T. Together the conveyor surface 17 and conveyor cable 19 move the bag 13 in which the bouquet of flowers 19 is placed in the direction of transport T towards an adhesive side of a portion of tape 26, see Fig. 1B.

[0035] Fig. 1B schematically shows a top view of a part of a tape sealer 10 along plane IB-IB of Fig. 1A. The tape sealer is provided with a push element 36, see also Fig. 2, which in Fig. 1B is shown in a position in which it contacts the non-adhesive side of the tape 26 and pushes two portions of the tape with their adhesive sides against each other between the push element 36 and a stationary support 38. The manner in which the two portions are pressed together will be described in greater detail below. The tape 26 extends such that it is intersected by a substantially vertical plane P2, with the adhesive side of the tape directed towards the object 16. On either side of the plane P2 and the tape 26, urging elements 46 are arranged, for moving the along the transport direction T to urge the object against the adhesive side of tape 26. The urging elements 46 ensure that movement of the object along the transport direction is not blocked by the tape.

[0036] Fig. 2 schematically shows a cross-sectional side view of the tape sealer 10 of Figs. 1A and 1B. The passage 14 defines a first plane P1, extending in the transport direction T and in the lateral direction Y. The first plane P1, which substantially coincides with the support surface of the conveyor 18, defines a first side 21, here an upper side, and a second side 22, here a lower side. At the first, upper, side 21, a tape supply 43 is provided for supplying the tape 26. The tape supply 43, here in the form of a roller attached to the push element 36, is arranged for receiving tape from a reel of tape 71 that is held on tape reel holder 32. Rollers 34 guide transport of the tape from the reel of tape 71 to the tape supply 43. The tape 26 runs from the tape supply 43 along the push element 36 to a contact surface 48 of the push element, with its adhesive side facing away from the push element 36. The tape extends from the tape supply 43 at the first side 21 of the plane P1 to the second side 22 of plane P1 where a first portion 56 the tape is held clamped between the support 38 and clamping element 40. The support 38 is stationary with respect to the housing and the passage, while the clamping element is biased against the support by a spring 42 which is attached at on end to the clamping element and is fixed at its other end to the housing 12.

[0037] An actuator 37, here in the form of hydraulic cylinder 37 which is connected to the push element and to the housing 12, is provided for moving the push element 36 along vertical direction Z. The actuator is thus arranged for driving movement of the contact surface 48 of the push element from the first side 21 to the second side 22 of the plane P2 and to a position between the clamping element 40 and the support 38. As the push element is moved from the first position to the second position, it contacts a portion of the tape 26, guiding said portion along with it through the first plane P1 to be clamped between the support 38 and the clamping element 40.

[0038] In order to prevent the transport of the bouquet 16 along the transport direction T from being blocked by middle tape portion 57 which traverses the passage 14, an urging device 44 is provided to apply a force in the transport direction T on the bouquets 16 lying on the conveyor 18. The urging device 44 is powered by electromotor 45 and comprises an endless chain to which the urging elements 46 are attached. The chain and the support surface of the conveyor 18 are spaced sufficiently apart to prevent contact between the objects and the chain.

[0039] A detector 80 is provided along the conveyor upstream from the passage 14 for detecting a bouquet of flowers 16 during its transport to the passage 14. Such detectors are known in the art and may comprise a mechanical switch that is actuated by a bouquet, an optical sensors, and the like. When the detector 80 detects a bouquet at a predetermined distance from the passage 14, it sends a signal to a controller 82. Based on this signal, the controller 82 determines when actuator 45 of the urging device 44 should be activated to press the detected bouquet 16 against middle portion 57 of the tape 26. Based on this signal, the controller 82 also controls actuator 37 for moving the push element, so that the tape sealer is only activated when

[0040] Fig. 3A schematically shows the tape sealer 10, with the push element 36 in a first position in which its contact surface is arranged on the first side 21 of plane P1. The push element is arranged for closing a loop of adhesive tape around a bouquet flowers 16 which has been pressed against the adhesive side 28 of the tape 26 by urging elements 46. The urging elements 46 have urged the object just beyond the push element 36, i.e. just past plane P2, so that the push element can be moved downward without passing through the object 16.

[0041] Fig. 3B shows a detail of section IIIB of Fig. 2A, but without the urging device for reasons of clarity. As the bouquet of flowers 16 has been pressed against the adhesive side 28 of the middle portion 56 of the tape, the tape 26 on the first side 21 partially follows the curvature of the contact surface 48 of the push element 36, with the non-adhesive side 30 of the tape 26 contacting the push element. On the second, lower, side 22 of the plane P1 portion 56 of the tape 26 is held clamped between the support 38 and the clamping element 40. The clamping element 40 comprises a cylinder 50 which contacts the adhesive side of a first portion 56 of the tape. In order to prevent the tape 26 from winding itself around the cylinder 50, the latter is fixed with respect to the clamping element 40.

[0042] A cutting device 52 having a cutting edge 54 is mounted on the support 38 at side of the support which contacts the tape 26. The cutting edge 54 is directed the

contact surface 48 of the push element 36. When the push element is moved to the second position, the cutting edge thus cuts the tape that is spanned between two abutment portions in the contact surface 48 across groove 60.

[0043] Fig. 4A schematically shows the tape sealer 10, with the push element 36 moved to a second position in which its contact surface is arranged on the second side 22 of the plane P1. In the second position the contact surface of the push element 36 pushes the support 38 and the clamping element 40 apart. At the same time adhesive sides of tape portions 56, 58 of the tape 26 are pressed against each other between the contact surface 48 and the support 38.

[0044] Fig. 4B shows a detail of section IVB, for reasons of clarity again without the urging device. The push element 36 presses the adhesive side of the first portion 56 against the adhesive side of the second portion 58, which lies along the support 38. Thus the adhesive side of portions 56 and 58 stick together and close off a loop of tape around the object 16. When the push element is moved further down, the groove 60 across which the tape is spanned moves towards the cutting edge 54, so that the cutting edge 54 extends partially into the groove and cuts the tape spanning the groove.

[0045] Figs. 5A and 5B schematically show the tape sealer 10 after the tape has been cut, and a detail of section VB of Fig. 5A. The figures show the push element 36 partially moved back towards the first position. The cut-off portion of tape 27 forms a closed loop around the object 16. The free end 25 of the tape 26 that is still attached to the reel of tape, is left in between the support 38 and the clamping element 40. During movement of the push element back 36 to the first position, the free end 25 is held in place, first between the contact surface 48 and the cylinder 50 of the clamping element 40, and subsequently between the support 38 and the cylinder 50.

[0046] Figs. 6A-6D schematically illustrate a tape sealer 10 according to the invention, further provided with a tape feeder 170 which allows continuous operation of the tape sealer, even when a roll of tape runs out. Though the tape feeder 170 is here shown in combination with the tape sealer of the invention, it will be appreciated that the tape feeder can be used separate from the tape sealer and/or with other kinds of tape sealers instead. In the figures, like reference numerals refer to like structures.

[0047] Fig. 6A shows the tape sealer 10 provided with a tape feeding device 170 which feeds adhesive tape 126 from a first reel of tape 171 to the tape supply 43. The first reel of tape 171 is held on a first tape reel holder 131 that is arranged at the end of an arm 173 which is rotatable relative to the housing 12 around an axis a3. On an opposite end of the arm 173 a second tape reel holder 132 is arranged which holds a second reel of tape 172 that is to be used when the first reel of tape 171 has been used up. The first tape reel holder 131 and second tape reel holder 132 are rotatable around respective first axis of rotation a1 and second axis of rotation a2. The arm 173 is rotatable around the third axis of rotation a3 which extends parallel to the first and second axes a1, a2 and is arranged therebetween. Though tape 126 from the first reel of tape 171 and/or tape 126' the second reel of tape 172 may be fed to the tape supply 43 such that the non-adhesive side of the tape is in contact with the roller of the tape supply 43, in Fig. 6A only tape 126 from the first reel of tape is fed to the tape supply, i.e. only the first reel of tape is connected to the tape supply 43.

[0048] An encoder 180 is arranged for measuring an amount of tape that has been fed to the tape supply 43 from the tape that presently connected to the tape supply. The encoder 180 sends a signal to a controller 182, which controller determines whether the reel of tape 174 that is currently connected to the tape supply is almost finished based upon the signal and predetermined information on the length of tape on the tape reel when no tape has yet been rolled off. The controller 182 further controls movement of an attachment device 176 and a tape cutter 178. The attachment device 176 is pivotably attached to the housing at point 179 and is provided with a roller 177 to which the adhesive side of the free end the second tape 126' from the second reel of tape 172 is attached. The device 176 is adapted to be rotated relative to the housing in such a manner that, upon receipt of a control signal from the controller 182, the roller is moved in direction A to attach the free end of the second tape 126' the adhesive side 128 of the tape 126 of the first reel of tape 171. The rotation may be driven in any manner known in the art, e.g. by an electrically or pneumatically powered actuator and/or by a biasing element, such as a spring, arranged for biasing the roller in the direction A.

[0049] Upon rotation of the device 176, the non-adhesive side of the second tape 126' is thus pressed against the adhesive side of the first tape 126. The roller 177 is further moveable along longitudinal direction a direction B in which the tape is fed to the tape supply along the attachment device, so that the tape 126'can be attached to tape 126 without having to pause supply of tape to the tape supply. When the controller has determined that the tape on roll 171 has almost run out, it controls the attachment device to attach the tape 126' to tape 126 during continued operation of the tape sealer.

[0050] Fig. 6B schematically shows the tape sealer 10 of Fig. 6A, but without the housing. Here, portion 177 of the attachment device pressing the second tape 126' onto the tape 126. After the free end of the second tape 126' coming from the second reel of tape 175 is stuck to the adhesive side 128 of the tape 126 of the first reel of tape 174, the end 177 of the attachment device 176 moves along in direction B with both tapes 126, 126' while pressing the tapes together.

[0051] Fig. 6C schematically shows the tape sealer 10 of Figs. 6A-6B, after moving the portion 177 has moved along direction B with the tapes 126, 126' and the tapes have been firmly pressed against each other. Next, a tape cutter 178, which is arranged between the attach-

ment device 176 and the position where the first reel holder 132 is located, is activated by the controller 182 to move in direction C in order to cut the tape 126 from the first reel 171.

[0052] Fig. 6D schematically shows the tape sealer 10 of Figs. 6A-6C, after cutting the tape 126 by the cutter 178. The arm 173 has been rotated around its axis of rotation a3 in direction D, so that the first and second tape reels have interchanged their positions with respect to their respective positions in Fig. 6C. The direction of rotation D is such that the reel of tape 175 which is connected to the tape supply 43 moves initially in a direction towards the tape supply 124, and such that the empty, first reel of tape 174 does not interfere with the tape 126' that extends from the second reel of tape 175 to the tape supply 124. The attachment device 176 and the cutter 178 have been moved back to their initial positions shown in Fig. 6A.

[0053] The first reel of tape which is not connected to the tape supply 43 and now has a free end 126 can be replaced with a new reel of tape, with the free end of the new reel attached with its adhesive side to portion 177 of the attachment device 176. All of this can be done while the tape sealer 10 remains in operation, enabling continuous operation of the tape sealer during tape replacement.

[0054] Fig. 7 schematically shows a tape sealer 10, similar to the one depicted in Fig. 2, in which like reference numbers refer to like components. However, instead of a spring for biasing the clamping element 40 towards the support 38, a pneumatic cylinder is provided that is connected to a pressurized air supply. When the cylinder is provided with pressurized air it pushes the clamping element 40 towards the support 38. Release of pressurized air from the cylinder can be regulated by means of an adjustable valve, preferably an adjustable throttle valve. By adjusting the adjustable valve, the duration of time and/or force for biasing the clamping element against the support can easily be set. The use of a pneumatic cylinder thus offers the advantage that the force that must be overcome in order to move the clamping element away from the support when the cylinder is not being actuated, is easily adjustable.

[0055] The pneumatic cylinder 84 is connected to the controller 82 which controls it to move the clamping element towards the support when the push element 36 is moved from the second position back to the first position. In this way, when the push element is in the first position, stable clamping of tape between the clamping element and the support is ensured.

[0056] Figs. 8A - 8F show schematical views of a portion of another embodiment of a tape sealer according to the invention, illustrating steps of wrapping adhesive tape around object 16 as the object is transported through the passage in the transport direction T. The elements of the tape sealer 800 above the plane P1 are substantially the same as in the tape sealer of Fig. 2, with same reference numerals referring to like structures. Figs. 9A - 9F show schematical side views in the direction of respective planes IX-A - IX-F.

[0057] Figs. 8A and 9A show an object 16 as it approaches an adhesive side of a portion of tape 26, with the portion of tape held on first side 21 of plane P1 on push element 836, and clamped on the second side of plane P1 between an arm portion 843 of a clamping element 840 and a support 838, with an adhesive side of the tape contacting spring loaded block 839 that is part of the support 383, and with an opposite side of the tape contacting the arm portion 843. Plane IX-A intersects both the push element 836 and the spring loaded block 839, the latter being arranged in the longitudinal direction of movement of the push element. The tape is thus held taut between contact surface 860 of the push element, and the clamping element and support, with the contact surface being arranged on the first side 21 of the plane P1. Fig. 9A shows more clearly that the arm portion 843 of clamping element 840 of Fig. 8A is in a clamping position, in which it presses a portion of the tape 26 between the spring loaded block 839 and the arm portion 843. An actuator 883, e.g. a pneumatically or electronically driven actuator, is provided for driving movement of the clamping element 840 around pivot axis 841 between the clamping position, as shown, and a non-clamping position, shown e.g. in Fig. 9C, in which the clamping element is spaced apart from the tape.

[0058] Figs. 8B and 9B show the object 16 as it has moved against the adhesive side of the tape 26 and past plane IX-B, such that the object 16 and a portion of tape that is in contact with the object 16 is moved from upstream of plane IX-B to downstream of plane IX-B along the transport direction T. The push element 836 is in the same position as in Fig. 8A, with the contact surface 860 on the first side of the plane P1. A portion of the tape 26 on the first side 21 of plane P1 is held against the contact surface 860 of the push element that is still in the first position, while on the second side 22 of plane P1 a portion of the tape is pulled against pushed a further support surface 870. The further support surface 870 extends parallel to the direction of movement of the push element 860 in such a manner that when the push element is in the second position, it is spaced apart by a small distance of 1 cm or less, preferably 0,5 cm or less from the further support surface 870. This allows two facing adhesive portions of the tape 26 to lie between the contact surface and further support surface.

[0059] In Figs. 8C and 9C the push element is shown during movement thereof from the first position to a second position in which the contact surface 860 is arranged on the second side 22 of plane P1. During the movement, a portion of the tape is spanned over a gap 863 that extends between spaced apart rollers 861,862 of the contact surface 860. Adhesive sides of two portions of the tape are pressed against each other between the further support surface 870 and a facing downstream portion of the contact surface 860. The further support surface 870 extends parallel to the direction of movement of the push

element in such a manner that the adhesive sides of the two portions of tape are pressed against each other at as the push element is moved further to the second position. In this manner the pressed-together portions of tape are confined within the space between the further support surface 870 and contacting surface 860. As the portion of tape that is looped around the object is still attached to the tape supply, it is substantially ensured that the tape is held taut between an upstream and downstream portion of the contact surface. The clamping element 840 is moved from the clamping position to the non-clamping position, as shown in Fig. 9C, in which the clamping element is spaced apart from the tape 26. This causes the spring loaded block 839 to move slightly towards the contact surface 860. By moving the clamping element to the non-clamping position while the pressed-together portions of the tape are confined between the further support surface 870 and the downstream end of the contacting surface 860, it is prevented that the becomes stuck between the tape and the block 839 when the push element is moved completely to the second position.

[0060] In Figs. 8D and 9D the push element has moved completely to its second position, pressing a portion of tape 26 against spring loaded block 839 which is also somewhat pushed down by the push element 836. The downward movement of the contacting surface causes a portion of the tape 26 to be held taut between rollers 861,862 of the push element such that is spans across a gap 863 between the rollers. A portion of tape is thus held in place between roller 861 and spring loaded block 839, and the first and second portions of tape that have been pressed against each other with their adhesive sides span the gap 863 between the rollers. A cutting device 852 is arranged such that a cutting edge 854 thereof extends into the gap when the push element has moved completely to the second position, thus cutting the pressed-together portions of tape that span the gap 863. Once these portions have been cut, a free end of the tape 26 that is still connected to the tape supply is held clamped between the push element and block 389 of the support 838, and the object around which a portion of tape has been looped moves on in the transport direction T

[0061] Next, as shown in Fig. 8E and 9E, the clamping element is moved back to a position in which its arm portion extends into the gap 863, during which the arm portion remains spaced apart from the tape that is held against the block 839 by the push element 836.

[0062] During subsequent movement of the push element is back to the first position, the spring mounted block 839 moves upward so that a portion of the tape 26 is held clamped between the arm portion 843 and the block 839. Once the tape is held between the arm portion of the clamping element, the push element is moved further towards the first position in which it no longer presses down on the block 839. This results in the situation shown in Figs. 8F and 9F, in which the adhesive tape has been wound around the object 16, and the tape sealer is ready to wrap another piece of tape around another object.The present invention has been described above with reference to a number of exemplary embodiments as shown in the drawings. Modifications and alternative implementations of some parts or elements are possible, and are included in the scope of protection as defined in the appended claims.

Claims

1. Tape sealer (10) for winding adhesive tape around an object (16) such that two adhesive portions of the tape contact each other, comprising:

   a housing (12) with a passage (14) for passing the object there through in a transport direction (T), wherein the passage defines a plane (P1) parallel to the transport direction(T), the plane having a first side (21) and an opposite second side (22);
   a tape supply (24), arranged at the first side (21) of the plane (P1) and adapted for supplying tape (26) with an adhesive side (28) thereof facing the transport direction (T);
   a support (38; 838,839) and a clamping element (40; 840) arranged at the second side (22) of the plane (P1) and adapted for clamping therebetween a first portion (56) of the tape supplied by the tape supply, wherein the clamping element (40; 840) is moveable towards and away from the support (38; 838,839); and
   a push element (36; 836) with a contact surface (48; 860), adapted for moving between a first position in which the contact surface (48; 860) is located on the first side (21) of the plane (P1) and a second position in which the contact surface (48; 860) is located on the second side (22) of the plane (P1) and is arranged for pressing the adhesive side of the first portion of the tape against an adhesive side of a second portion (58) of the tape.

2. Tape sealer according to claim 1, wherein the push element is adapted for moving between the first position and the second position such that in the second position the contact surface (60) protrudes between the clamping element (40) and the support (38) for pressing the adhesive side of the first portion of the tape against an adhesive side of a second portion (58) of the tape.

3. Tape sealer according to claim 1 or 2, wherein the clamping element (40; 840) is adapted for clamping a portion of the tape against the support (38; 838,839) when the push element (36; 836is in the first position.

4. Tape sealer according to claim 1, 2 or 3, wherein the push element (36; 836) is arranged for moving between said first and second position in a direction substantially normal to the transport direction (T).

5. Tape sealer according to any one of the preceding claims, wherein the support (838,839is arranged substantially coaxially with the direction of movement of the push element (836).

6. Tape sealer according to any one of the preceding claims, wherein the support (839,839) and the contact surface of the push element are adapted for, when the push element (836) is in the second position, substantially clamping a portion of the tape therebetween at at least two spaced apart portions (861,862), with a gap extending (863) between said two spaced apart portions, and wherein, when the push element is in the second position, the clamping element is moveable between a clamping position in which it at least partially extends into the gap for pressing the portion of tape against the support element, and a non-clamping position in which it is spaced apart from the tape.

7. Tape sealer according to claim 6, wherein the contact surface (48) is provided with two spaced apart abutment portions (861,862) for abutting the tape, wherein the gap is adjacent (863) to and between said abutment portions such that the tape is spanned between the abutment portions across the gap during movement of the push element from the first position to the second position.

8. Tape sealer according to any one of the preceding claims, further comprising a cutting device (52) arranged for cutting the tape at a location on the second side (22) of the plane (P1), preferably for cutting the second portion of the tape, more preferably for cutting the first and second portion of the tape at a location where the adhesive sides thereof contact each other.

9. Tape sealer according to claim 8, wherein the cutting device (52) comprises a cutting edge (54), wherein the contact surface (48) is provided with two spaced apart abutment portions for abutting the tape and a recess (60) adjacent to and between said abutment portions such that the tape is spanned between the abutment portions across the recess during movement of the push element from the first position to the second position, and wherein the cutting edge is arranged for cutting the tape at said recess when the push element is in the second position.

10. Tape sealer according to claim 8 or 9, wherein the cutting edge is arranged at a fixed position relative to the support.

11. Tape sealer according to any one of the preceding claims, further comprising an actuator (37) for driving movement of the push element (36) between the first and second position.

12. Tape sealer according to any one of the preceding claims, further comprising an urging element (46) for urging the object against the adhesive side of the tape in the transport direction.

13. Tape sealer according to claim 12, wherein the urging element (46) is adapted to be stationary with respect to the passage (14) during movement of the push element (36) from the first position to the second position to press the adhesive side of the first portion against the adhesive side of the second portion.

14. Tape sealer according to claim 12 or 13, wherein the urging element (46) is adapted to move the object further along the transport direction (T) after the first and second portions of tape have been pressed against each other with their adhesive sides.

15. Tape sealer according to claim 12, 13 or 14, further comprising an actuator (45) for driving movement of the urging element (46).

16. Tape sealer according to any one of the preceding claims, provided with a conveyor (18) arranged for sequentially transporting a plurality of objects through the passage (14) in the transport direction (T).

17. Tape sealer according to claim 16 when dependent on claims 11 and 15, further comprising:

a detector (80) adapted for generating a detection signal when an object is being conveyed by the conveyor (18) at a predetermined with respect to the passage; and
a controller (82) adapted for controlling the actuators (45, 37) to drive movement of the urging element and the push element dependent on said detection signal.

18. Tape sealer according to any one of the preceding claims, further comprising a tape feeding device (170) arranged for feeding the adhesive tape to the tape supply (24; 124), the tape feeding device comprising:

an arm (173) provided with a first tape reel holder (131) rotatable around a first axis of rotation (a1) and adapted for holding a first reel of tape (171), wherein the arm further comprises a second tape reel holder (172) rotatable around a second axis of rotation (a2) and adapted for holding a

second reel of tape (172), wherein the arm (173) is rotatable relative to the housing around a third axis of rotation (a3) that is parallel to the first and second axis of rotation;
an attachment device (176) provided with an attachment portion (177) for holding a free end of the second reel of tape (172) such that the non-adhesive side of said free end faces the adhesive side of tape from the first reel of tape (171) that is fed to the tape supply (43), wherein said attachment portion (177) is moveable between a first position in which the first and second tapes are spaced apart, and a second position in which it pushes the non-adhesive side of the second tape (126') against the facing adhesive side of the first tape (126);
a tape cutter (178) arranged between the first tape reel holder (171) and the attachment portion (177) of the attachment device, for cutting the first tape.

19. Tape sealer according to claim 18, further comprising:

an encoder (180) arranged for providing a signal indicative of an amount of tape that has been fed from the first reel of tape (171) to the tape supply (43); and
a controller (182) adapted for, upon receipt of said signal from the encoder, determining whether a predetermined portion of the first reel of tape (171) has been fed to the tape supply (43) and if this predetermined portion has been fed to the tape supply, controlling the attachment device (176) to move the attachment portion (177) to the second position and controlling the tape cutter (178) to subsequently cut the first tape.

20. A method for winding adhesive tape around an object (16) such that two adhesive portions of the tape contact each other, during which the object is moved along a transport direction (T) through a passage which defines a first plane (P1) parallel to the transport direction (T), the first plane having a first side (21) and an opposite second side (22), and the tape having an adhesive side and an opposite non-adhesive side, the method comprising the steps of:

- supplying tape from a tape supply that is arranged at the first side of the first plane (P1) to the second side of the first plane (P1), with the adhesive side of the tape facing the transport direction (T);
- on said second side, clamping a first portion (56) of the tape between a support (38) and a clamping element (40) such that a middle portion (57) of the tape, which extends between from tape supply (43) to the support and the clamping element, is held taut within a second plane (P2) and such that the adhesive side of the first portion (56) of the tape faces the clamping element (40);
- moving the object along the transport direction (T) from a side upstream of the second plane (P2) to a side downstream of the second plane (P2), such that the object (16) is pressed against the adhesive side of the tape;
- when the object (16) is on the side downstream of the second plane (P2), moving a push element (36), which is provided with a contact surface (48) arranged for contacting the non-adhesive side of the tape, from a first position in which the contact surface (48) is located on the first side (21) of the first plane (P1) and a second position in which the contact surface (48) is located on the second side (22) of the first plane (P1), the contact surface (48) in the second position pressing the adhesive side of the first portion (56) of the tape against an adhesive side of a second portion (58) of the tape.

21. The method according to claim 20, wherein in the second position the contact surface protrudes between the clamping element (40) and the support (38) for pressing the adhesive side of the first portion (56) of the tape against an adhesive side of a second portion (58) of the tape.

22. The method according to claim 20, wherein the support and the contact surface of the push element are adapted for substantially axially clamping a portion of the tape therebetween at at least two spaced apart portions when the push element is in the second position, wherein a gap extends between said two spaced apart portions, and wherein, when the push element is in the second position and presses the first and second tape portions against the support, the clamping element is moved from a non-clamping position in which it spaced apart from the tape, to a clamping position in which it at least partially extends into the gap (863) and presses the portion of tape against the support element, and subsequently the push element is moved from the second position to the first position.

23. The method according to claim 19, 20 or 21, wherein the object is arranged on a conveyor for moving the object in the transport direction with a first velocity, and wherein an urging element (46) is provided for urging the object against the adhesive side of the tape; the method comprising:

- when the object is within a predetermined range from the second plane (P2), moving the urging element (46) at a second velocity greater

than the first velocity thus urging the object along the transport direction (T) from the side upstream from the second plane (P2)to the side downstream of the second plane (P2),

wherein the urging element (46) is held stationary with respect to the passage (14) during movement of the push element (36) from the first position to the second position.

Fig. 1A

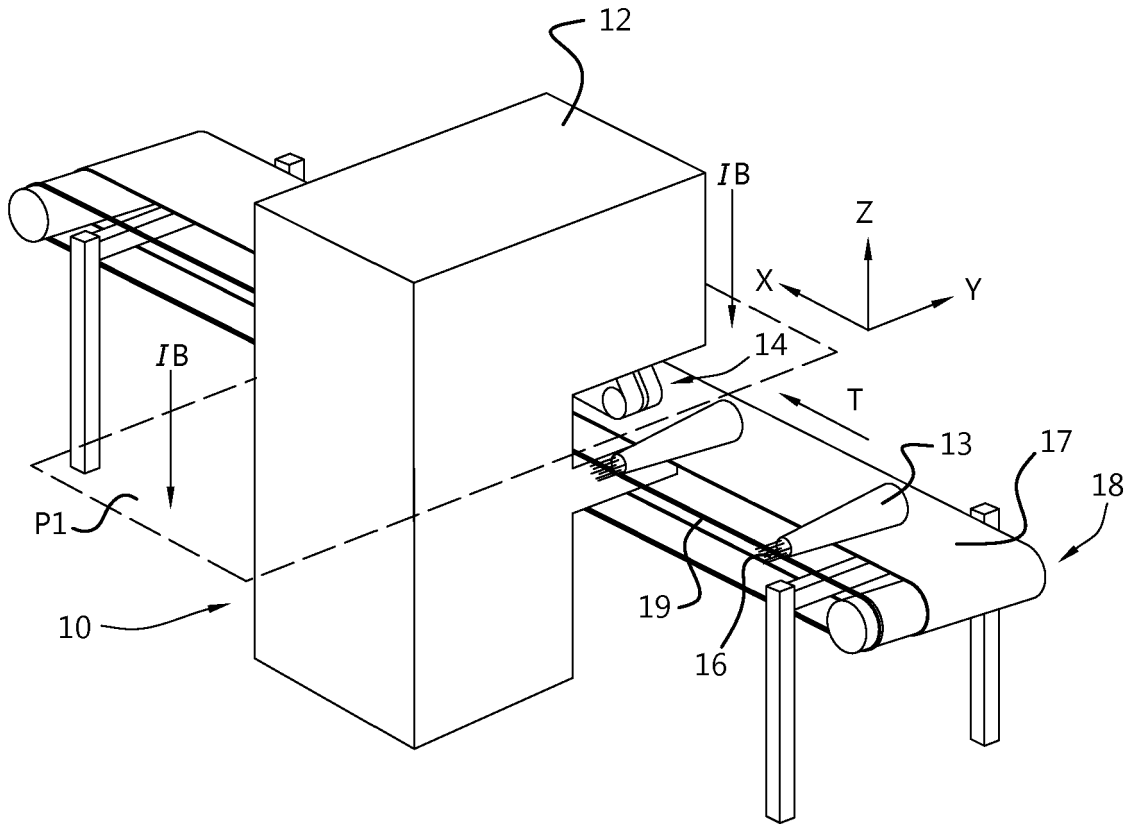

Fig. 1B

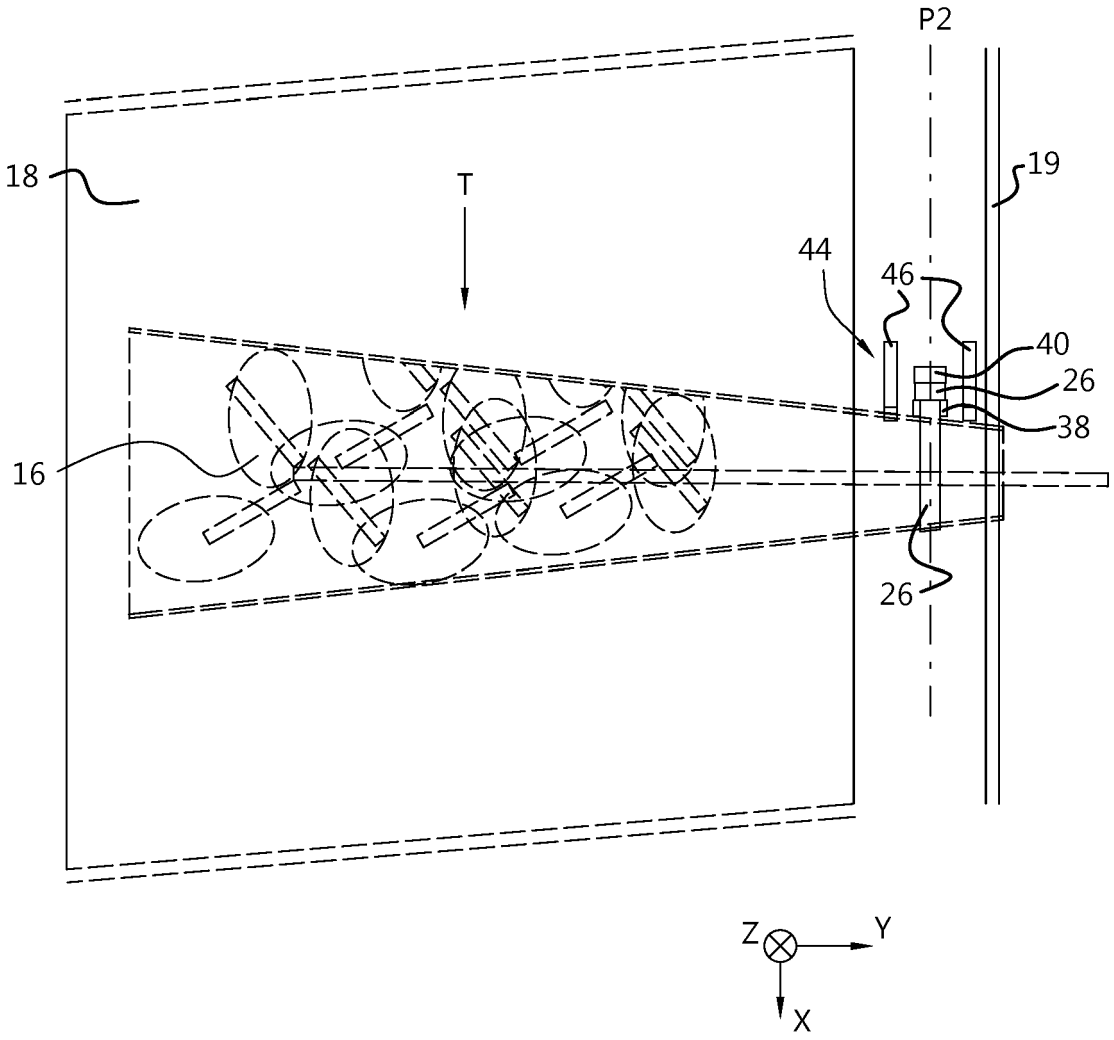

Fig. 2

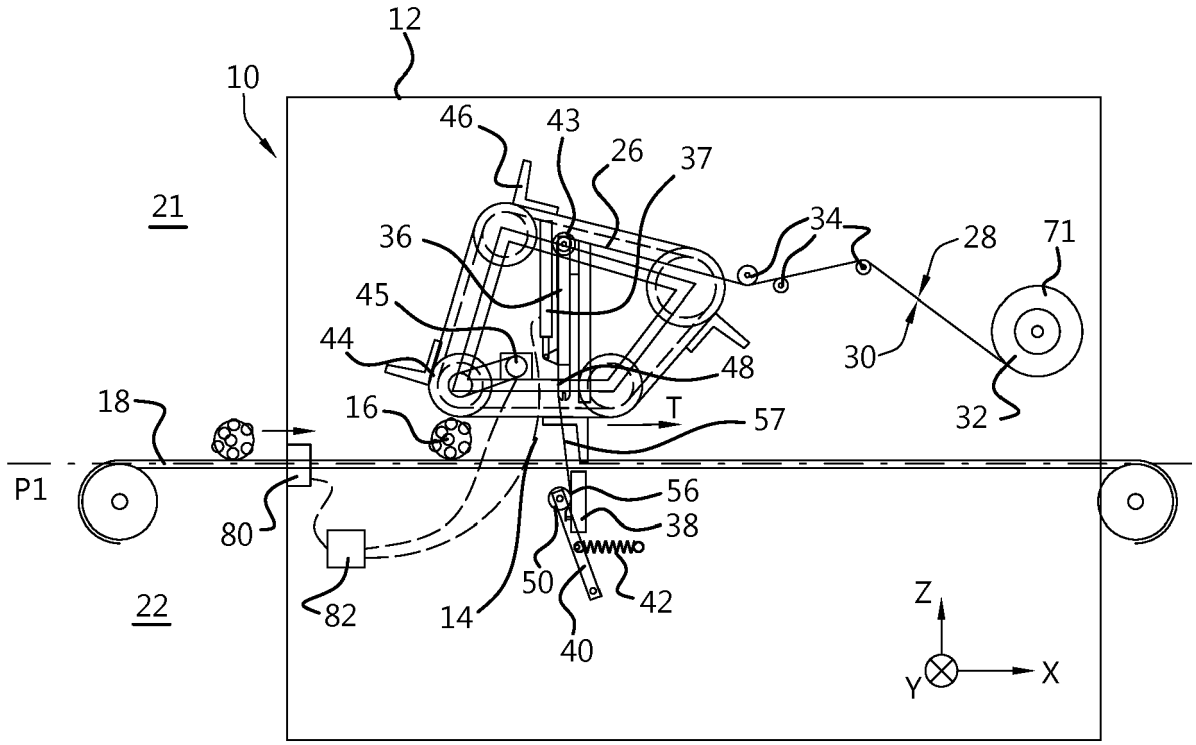
12
10
46
43
26
37
21
36
34
28
71
45
44
48
30
18
16
T
57
32
P1
56
80
38
50
42
22
82
14
40
Z
Y
X

Fig. 3A

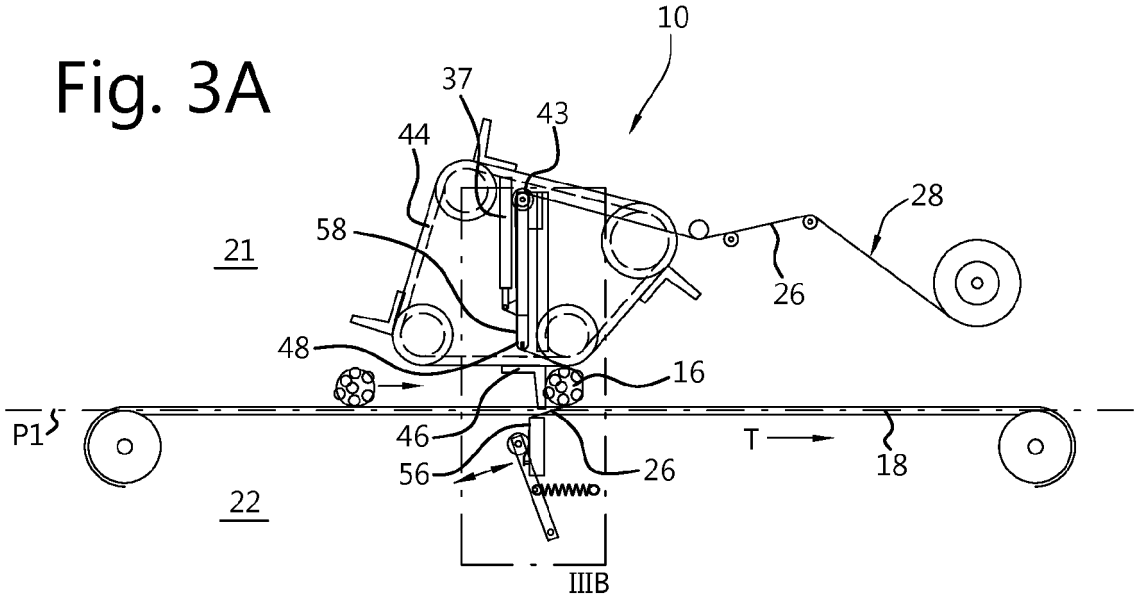

Fig. 4A

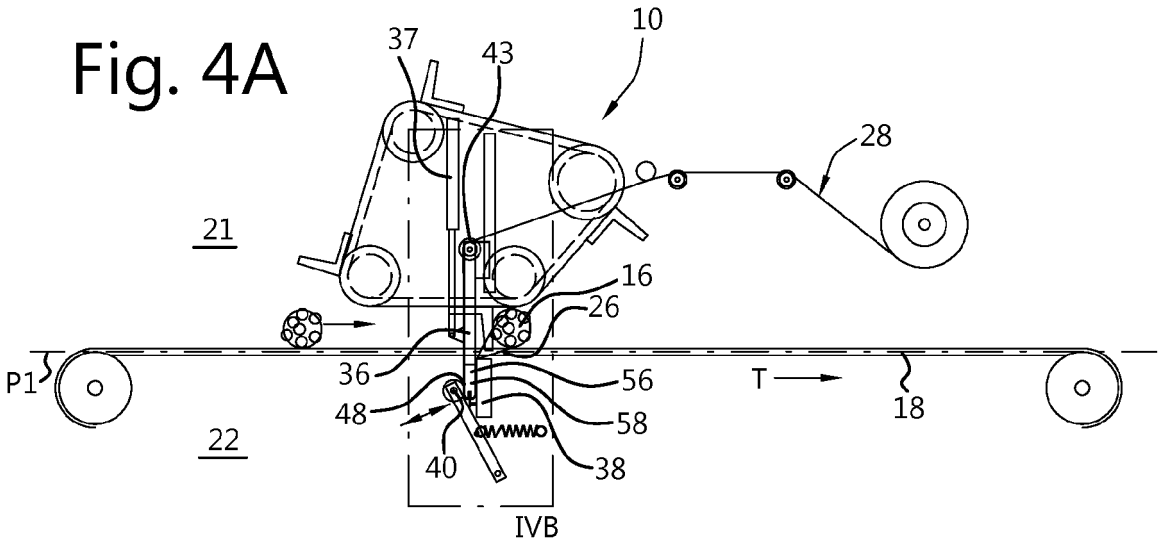

Fig. 5A

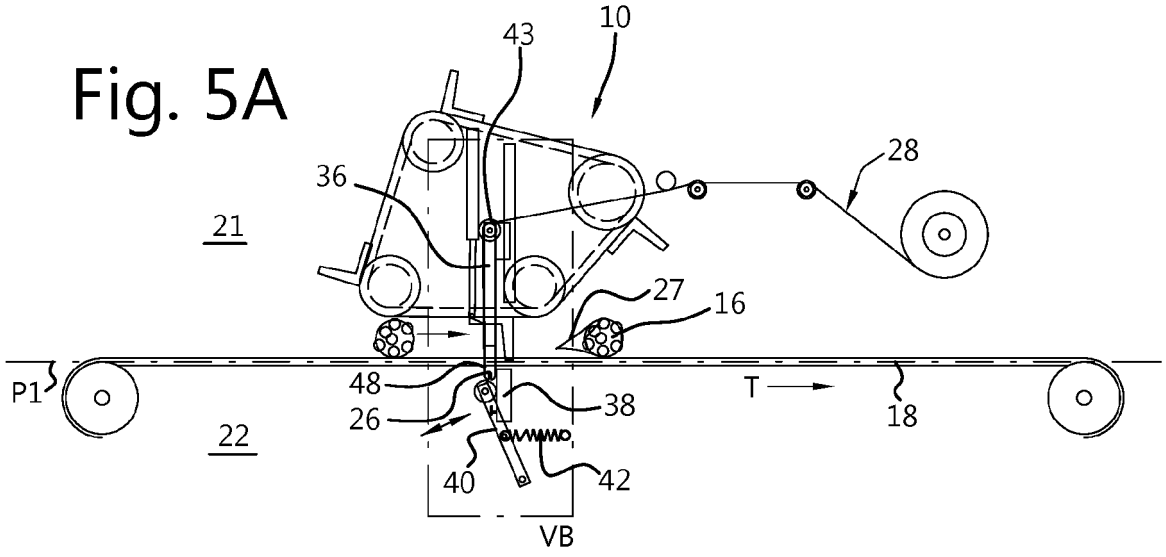

Fig. 5B

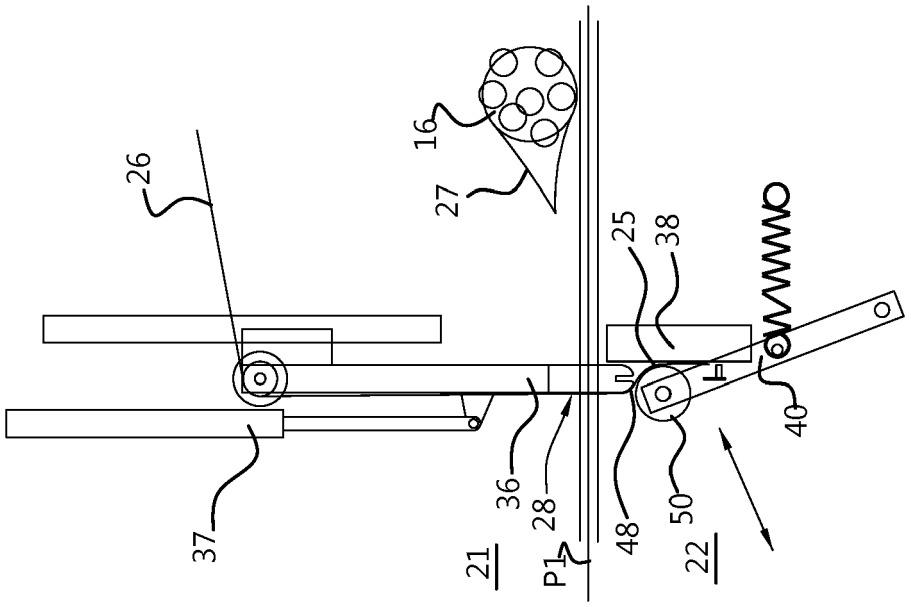

Fig. 4B

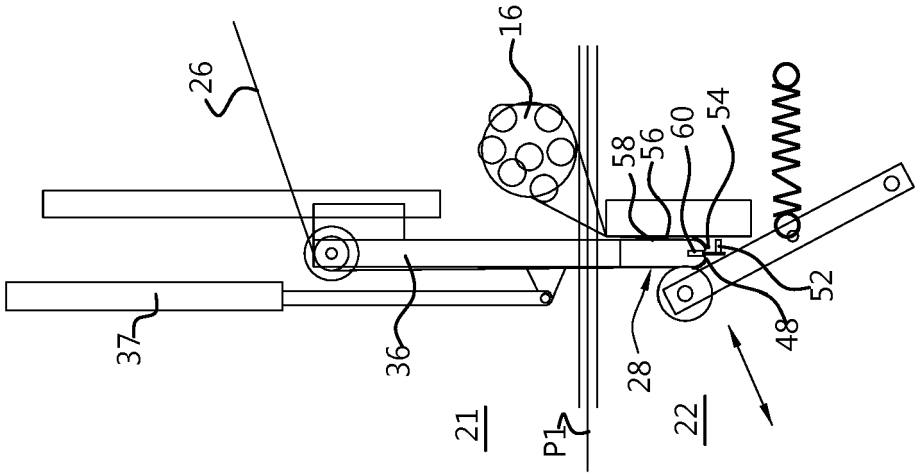

Fig. 3B

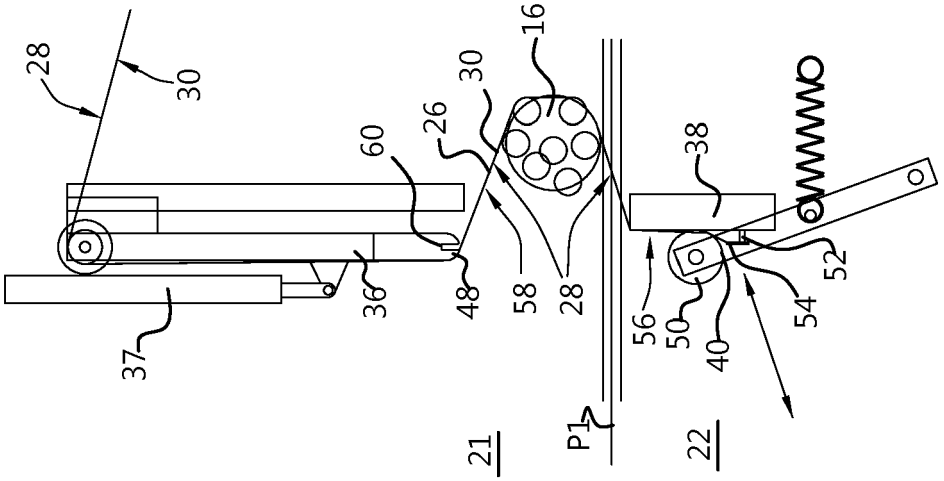

Fig. 6A

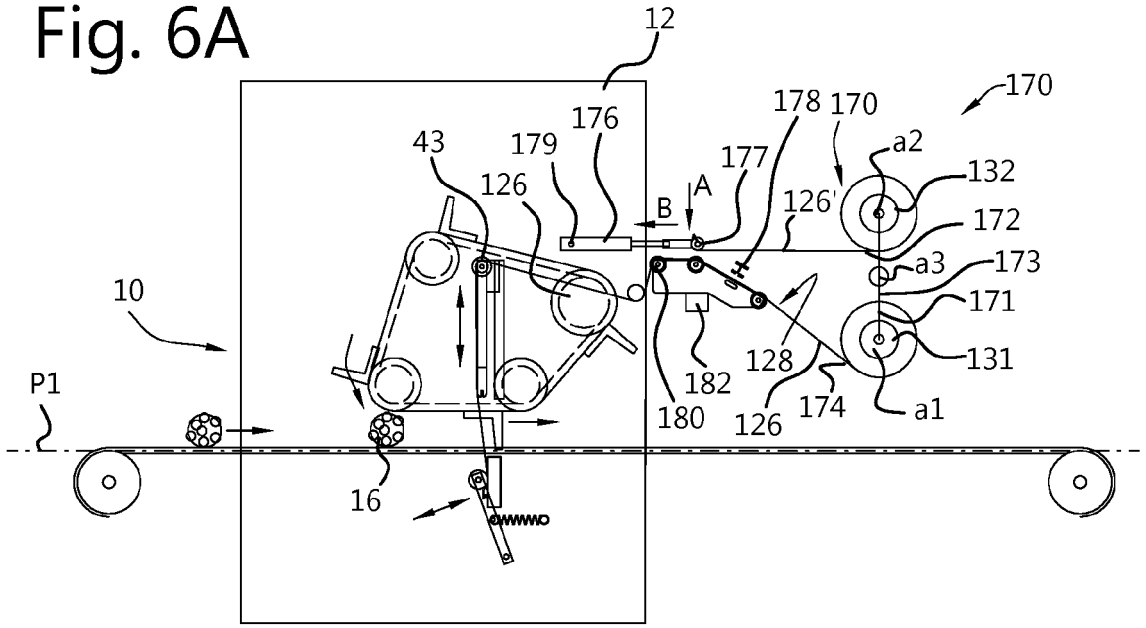

Fig. 6B

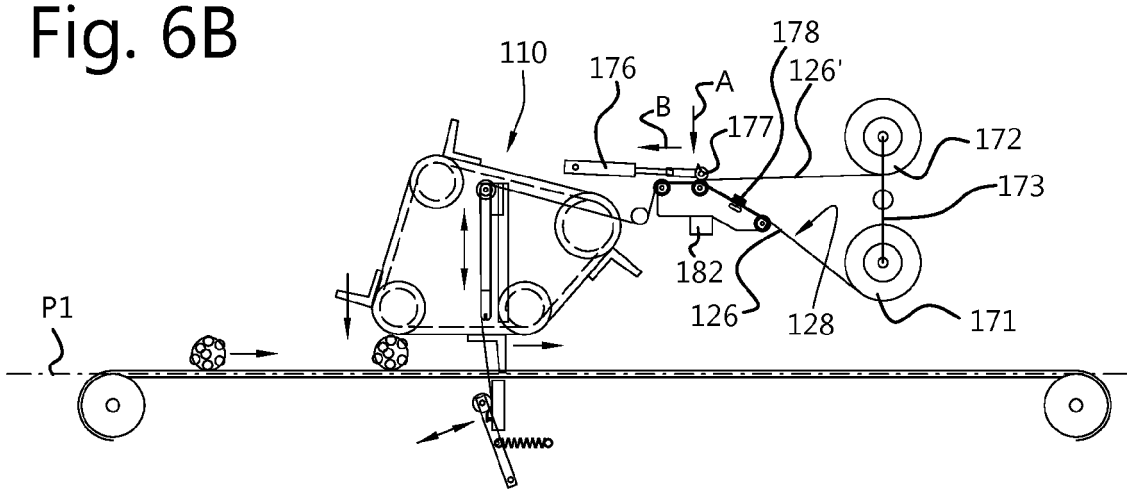

Fig. 6C

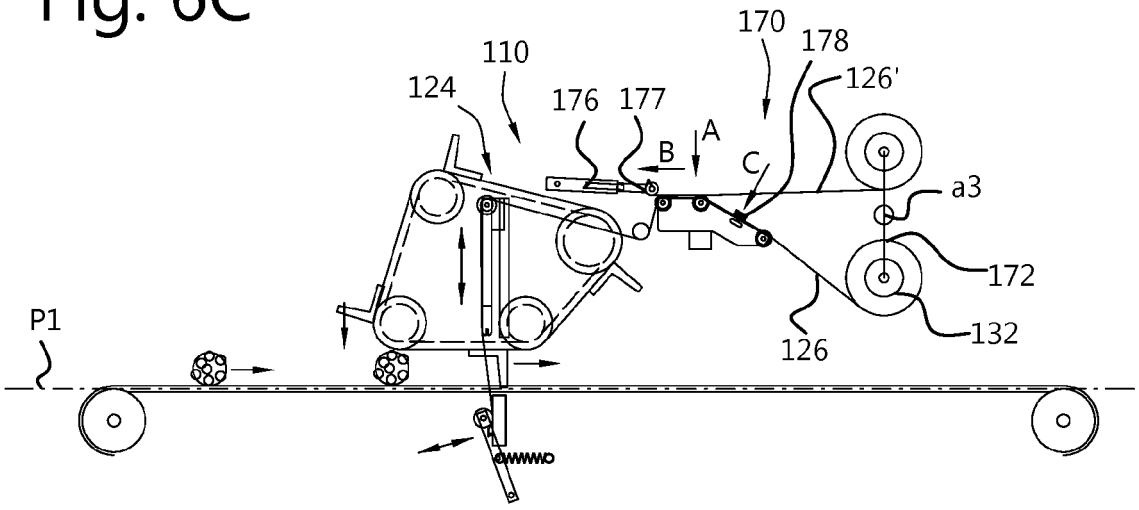

Fig. 6D

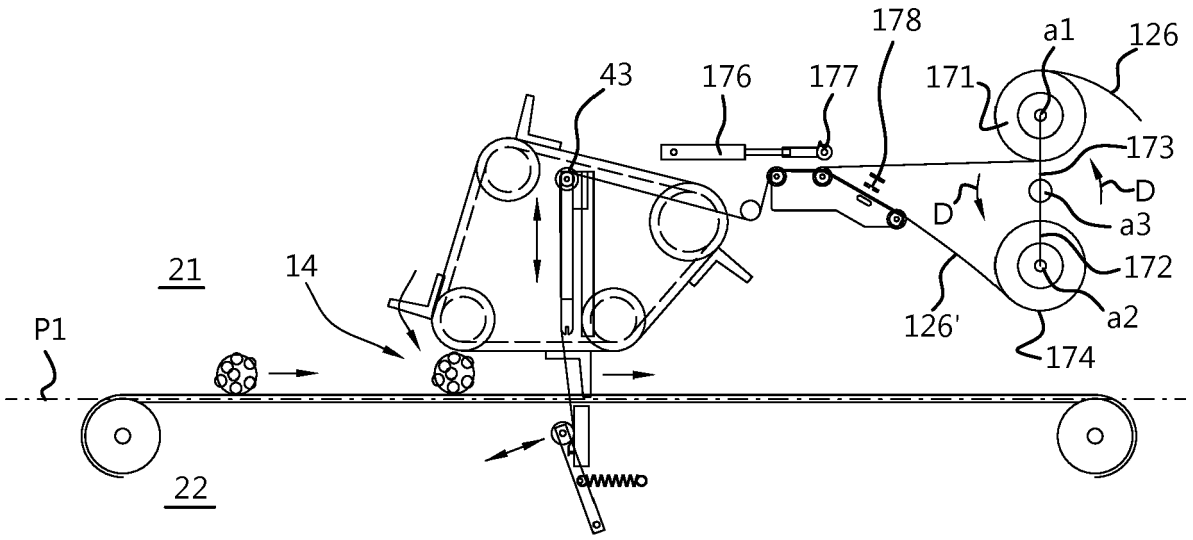
178
a1
126
43
176
177
171
173
D
D
a3
21
14
172
126'
a2
P1
174
22

Fig. 7

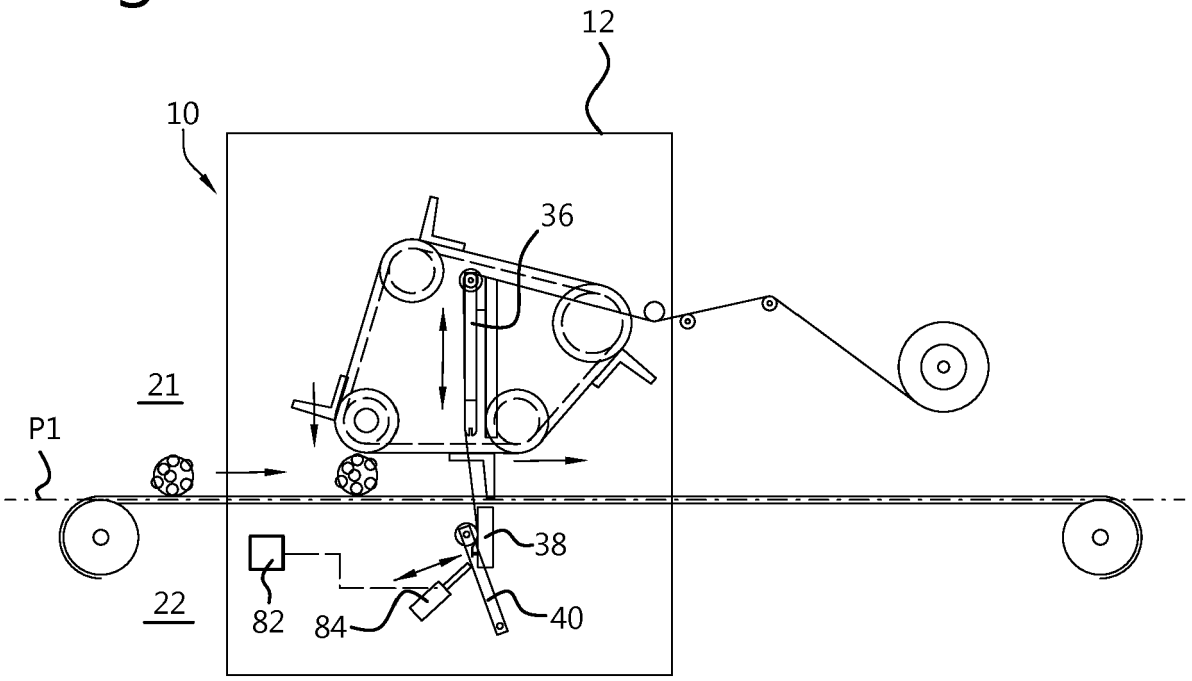
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Fig. 9A

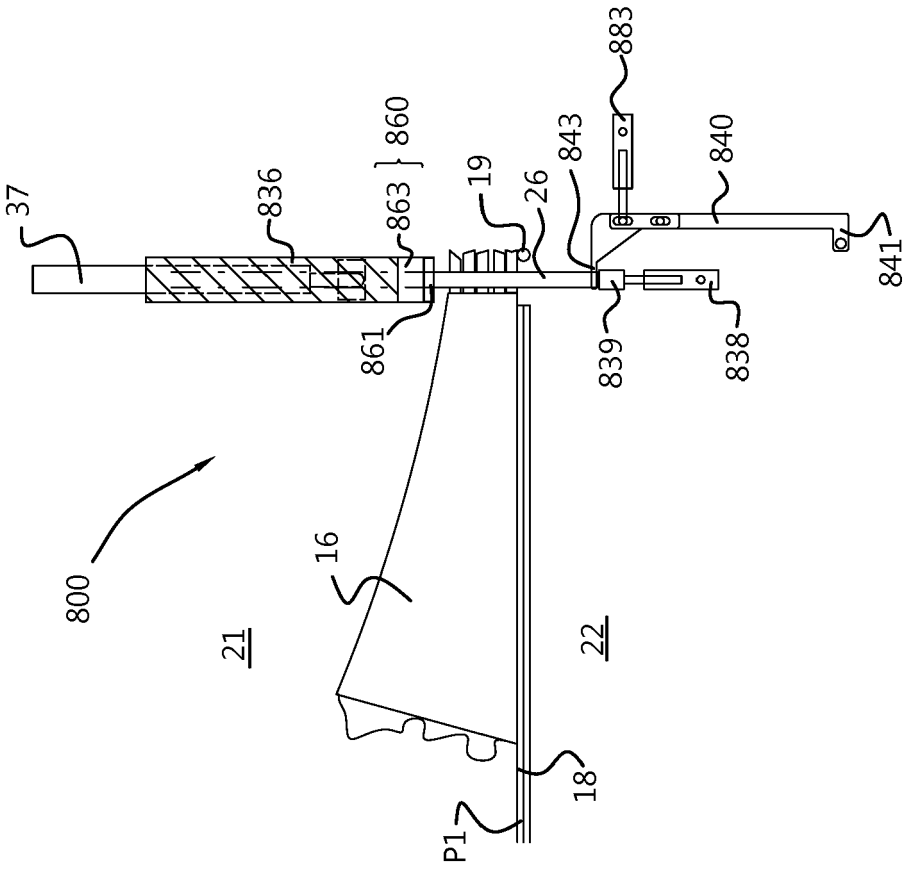
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Fig. 8A

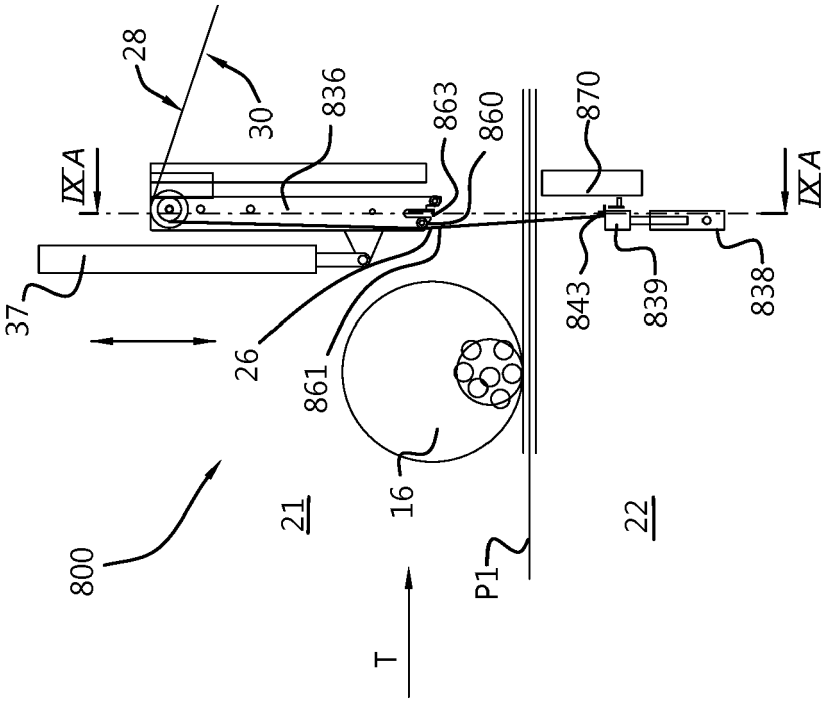
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Fig. 9C

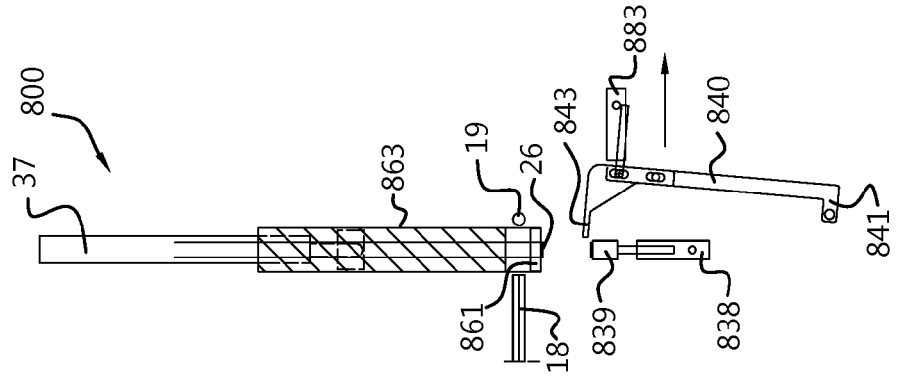


Fig. 8C

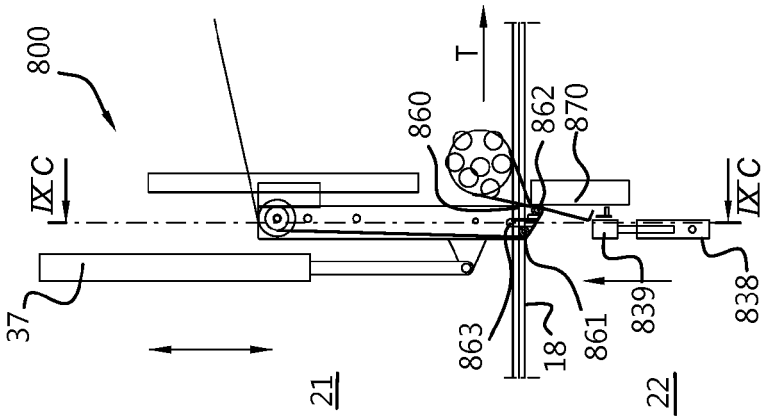


Fig. 9B

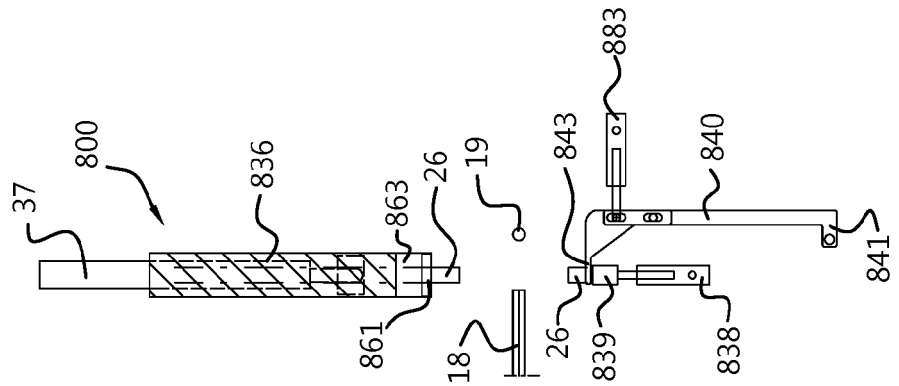


Fig. 8B

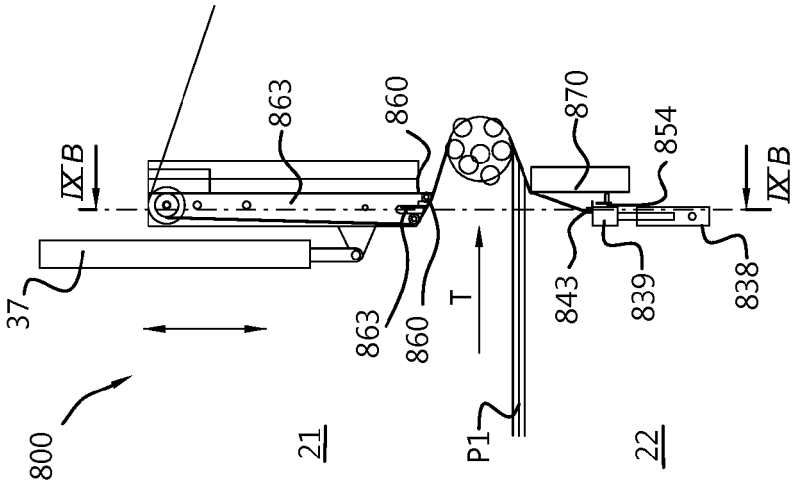


Fig. 9E

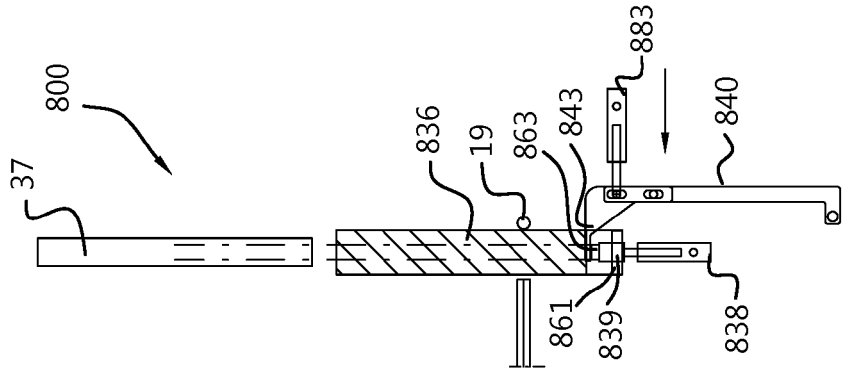


Fig. 8E

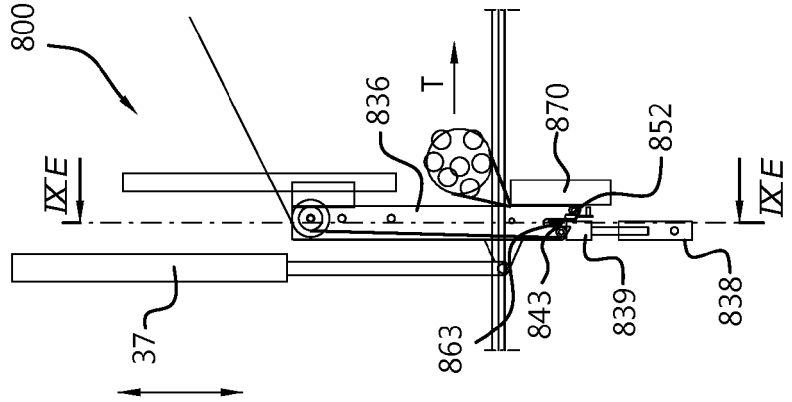


Fig. 9D

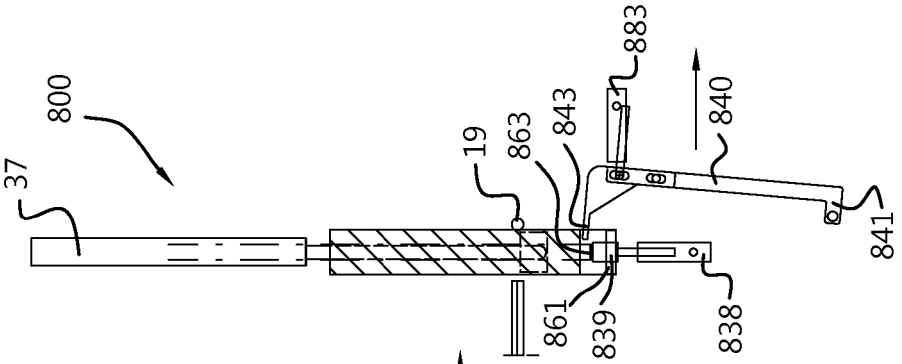
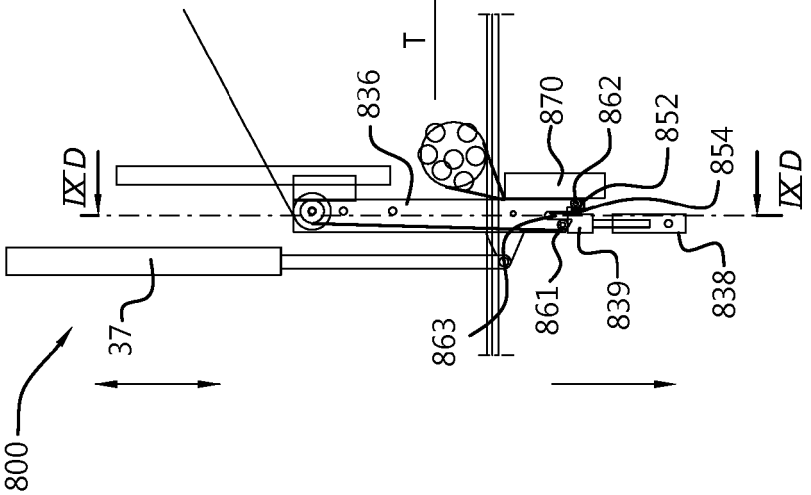


Fig. 8D



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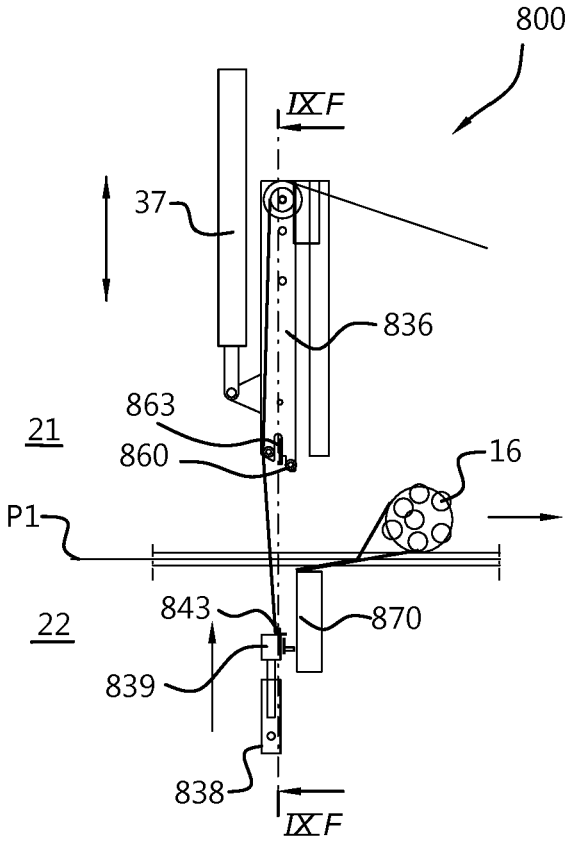
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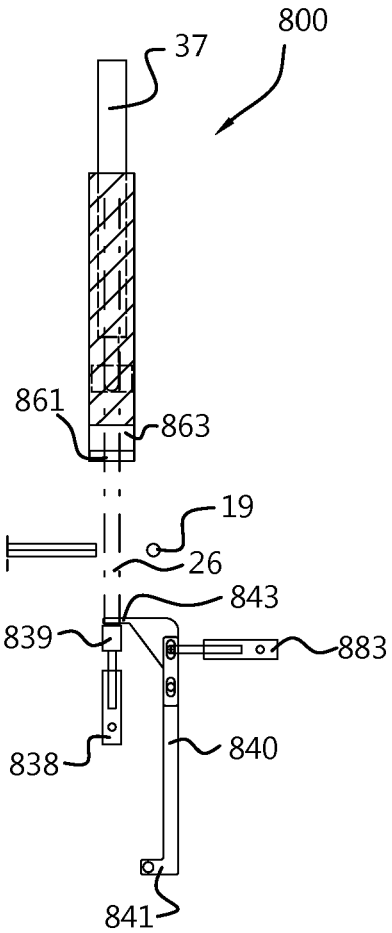
Fig. 9F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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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