(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 923 980 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.09.2015 Bulletin 2015/40

(51) Int Cl.:
B65H 19/30 *(2006.01)*

(21) Application number: **15160658.9**

(22) Date of filing: **24.03.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

(30) Priority: **25.03.2014 IT LU20140004**

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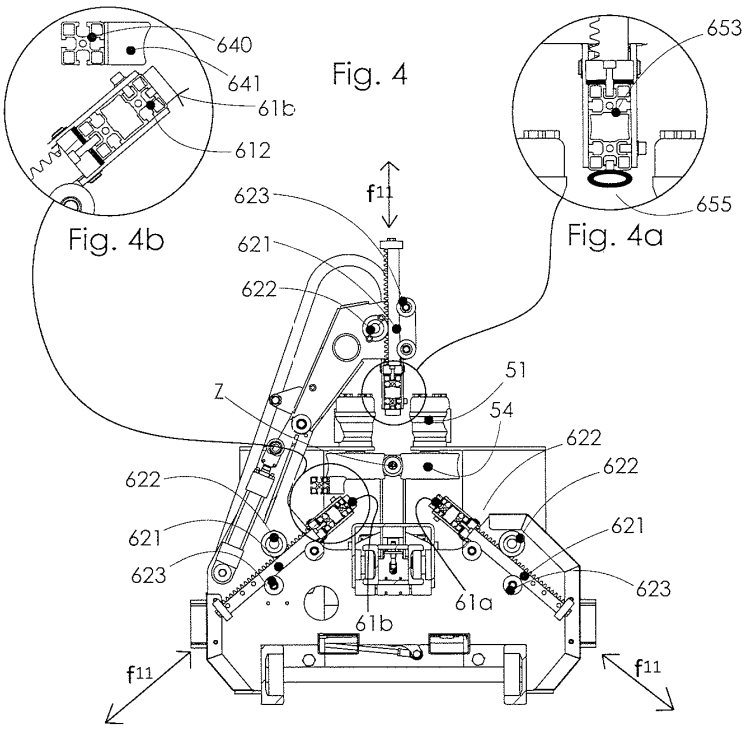
(54) DEVICE AND METHOD TO PREPARE WINDING MANDRELS FOR REREELING MACHINES

(57) Device to prepare winding mandrels (P) on which to form reels, comprising a support structure (6) to which supports (61a, 61b) are associated configured to support, close to or distanced from each other and on their circumference, a plurality of cores (N) keeping them aligned along a pre-determined axis of insertion, and a gripping unit (4) configured to allow the introduction of said mandrel (P) in said cores (N) and along said axis of insertion. The preparation device comprises adjustment members (621) configured to adjust the position of the supports (61 a, 61b) in a radial direction with respect to the axis of insertion and to dispose said axis of insertion of said mandrel (P) always in the same position with respect to the support structure (6) as at least the diameter of said cores (N) varies.



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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a device and method to prepare winding mandrels for re-reeling machines.

[0002] Here and in the following description and claims the terms mandrel and rod are used as synonyms to identify an oblong element, such as a shaft, on which the material to be wound to form reels is wound.

BACKGROUND OF THE INVENTION

[0003] Production processes for tissue paper and non-woven fabric, like those for other ribbon-like products, provide to rewind the product, previously cut into longitudinal strips of different width, onto cylindrical cores made of paper or plastic material, inserted on rods or shafts equipped with pneumatic or mechanical expanders that keep the cores in a predetermined position.

[0004] The position of the cores must be such that the material wound on them corresponds perfectly to the sizes and position of the core on the rod itself. In particular productions like non-woven fabric, the cut strip shrinks during winding, which entails the need to position the cores on the shaft, keeping a certain distance between them, so that at the end of working the core does not protrude from one or both sides of the wound reel.

[0005] At the end of the winding process, the expandable rod, without the cores, must be removed from the formed reel. This is obtained by deflating or releasing the expandable rod both directly in correspondence with the zone where the reel is formed, and also in correspondence with a different point where the reel is made to roll.

[0006] The height at which the rod finds itself at the moment of extraction depends on the diameter of the formed reel, and hence the machine or plant that performs the extraction must be positioned at a variable vertical height, that is, it must make an automatic search for the vertical position of the rod.

[0007] Present-day machines vertically move a gripping device, generally consisting of a fork that couples (engages) with a throat (groove, saddle) provided for the purpose at the end of the rods. The device for deflating the rod is inserted in correspondence with the gripping device. When the deflating operation is terminated, the rod is totally or partly extracted from the reel, exerting a traction force.

[0008] In some machines, the totally extracted rod is kept cantilevered, held at its end so that the operator can position the cores, inserting them manually on the rod. In some machines of this type, the correct positioning of the cores is facilitated by mechanical abutments that approach the expandable rod and that constitute a mechanical abutment for the cores.

[0009] In other machines the rod, partly extracted from the reel, is positioned between two rubberized rollers, motorized electrically or hydraulically, which are pressed laterally on the cylindrical body of the rod and allow it to be totally extracted from the formed reel.

[0010] During this step, the extracted rod is inserted inside the cores, previously positioned either manually or automatically inside the supports; after the rod has been inserted inside the cores the rod is inflated so that the cores are stably integrated with the rod.

[0011] The cores can be previously cut into elements with a suitable length or can be whole and then cut after they have been inserted on the expandable rod.

[0012] One example of a machine of this type is described in WO0061480 (US665529), which consists of three independent stations. The first of these extracts the rod from the reels by using a pair of rubberized rollers and at the same time inserts the rod inside a single core, not cut. The combined rod-core is transferred by rolling to the second station where the core is cut into elements, and at the end of the cutting operations the core is transferred by rolling to the return station which transfers the rod to the re-reeling machine.

[0013] This solution does not allow to distance the cores from each other as required in the field of working non-woven fabric.

[0014] The machine described in WO2007096916 A1 represents an evolution of the previous machine, that is, an evolution of the terminal return station which allows to reposition the cores on the rod so as to allow a distance between the individual elements. The plant for the overall management of the extraction, cutting and insertion operations in any case consists of three separate units.

[0015] The system described in WO2009004659A1 consists of a combination of machines served by an anthropomorphic robot equipped with a particular gripping device able to: i) deflate the expandable rod, ii) extract it from the reel, and iii) insert the rod inside a sequence of cores, previously cut to size by a machine belonging to the same plant.

[0016] The robot is able to suitably distance the cores on the expandable rod before reflating and returning the rod inside the re-reeling machine.

[0017] For all re-reeling machines the rod, complete with cores, can be returned either in correspondence with the zone where the reel is formed, or in correspondence with a "tray", which is in a translated position and at a different height from the position where the rod is first collected.

[0018] For some productions, it is necessary to use expandable rods of different diameters, depending on production requirements. In some machines currently on the market, mechanical parts must be replaced in order to work cores of different diameters, if this is envisaged. In other machines, different housings are provided for the cores and different collection and return positions, and also different deflating and reflating devices of the expandable rod.

[0019] In any case, there are no solutions that contemplate more than two different formats.

[0020] From a general analysis of the state of the art, it is clear that machines currently produced have functional limits, considerable structural complexity, and occupy a great deal of space. Furthermore, they are not able to operate on different core formats.

PURPOSES OF THE INVENTION

[0021] The invention concerns a device and method to prepare mandrels or winding rods on which a reel is formed.

[0022] In particular, some embodiments of the method can provide to extract the expandable rod from the reel, to insert it inside cores that have been previously cut and manually positioned on a suitable seating, to inflate the expandable rod or to mechanically clamp it, which allows the cores to remain integrated with the rod, to expel the rod and return it to the re-reeling machine in a translated position and at a different height from that where it was first collected.

[0023] The purpose of the present invention is also to create a compact device to prepare mandrels that overcomes the limits of current embodiments and, in particular, that allows easy passage from one diameter of the expandable rod to a different diameter.

[0024] Another purpose of the present invention is to obtain a device to prepare mandrels that allows to position the cores compactly, or distanced from each other, which allows to extract the mandrel or expandable rod directly between the forming rollers of the re-reeling machine.

[0025] Another purpose of the present invention is to obtain a device to prepare mandrels that allows to extract the rod from the formed reel even when there is minimum distance between the ends of the rod and the reel itself.

[0026] Another purpose of the present invention is to obtain a device to prepare mandrels that allows to easily remove the rod upward during the cycle, and all these functions integrated in a structural and functional whole.

SUMMARY OF THE INVENTION

[0027] These and other purposes and advantages, which the following text will make clear to those skilled in the art, will be obtained with a device to prepare winding mandrels on which to form reels, comprising a support structure to which supports are associated configured to support, close to or distanced from each other and on their circumference, a plurality of cores, keeping them aligned along a pre-determined axis of insertion, and a gripping unit configured to allow the introduction of the mandrel into the cores and along the axis of insertion.

[0028] According to one feature of the present invention, the device to prepare mandrels comprises adjustment members configured to adjust the position of the supports in a radial direction with respect to the axis of insertion and to dispose the axis of insertion of the mandrel always in the same position with respect to the support structure as at least the diameter of the cores varies.

[0029] Forms of embodiment of the present invention can also concern a method to prepare winding mandrels on which to form reels, which provides to position a plurality of cores on supports of a support structure, disposing them resting with their circumference on the supports, close or distanced, and aligned along a pre-determined axis of insertion, and to subsequently insert a mandrel in the cores and along the axis of insertion.

[0030] According to one aspect of the present invention, the method provides a step of adjusting the position of the supports in a direction radial with respect to the axis of insertion and by means of adjustment members, to dispose the axis of insertion of the mandrel always in the same position with respect to the support structure as at least the diameter of the cores varies.

[0031] According to a possible solution, the device to prepare mandrels consists of a mobile part installed on a pantograph that allows it to ascend and descend; the pantograph can advantageously be mounted on a slider that also allows it to translate.

[0032] According to possible forms of embodiment of the present invention, the device to prepare mandrels comprises, connected to the mobile part: the supports for the cores, a clamping device for the cores, a device or unit for gripping the mobile rod longitudinally, a motorized roller unit, a pneumatic expulsion and inflation device; all these devices are stably connected to each other to form a structural and functional whole.

[0033] To understand better the functional aspects, there will now follow a description of the sequence of the possible operating steps in functional order: loading the cores, extraction of rod, expulsion.

[0034] In a first step the operator manually positions the cores, previously cut to size, on the supports provided for this purpose.

[0035] In one form of embodiment the invention allows to pass from one diameter of the rod and cores to a different diameter simply by adjusting the position of the supports on which the cores are positioned, according to a geometry which, keeping the distance between the axis of the rod and the upper mobile part unvaried, allows to use the same extraction and expulsion devices as the diameter of the cores and rod vary.

[0036] Advantageously, this adjustment is made manually, but hydraulic or electric drive is not excluded.

[0037] Moreover, in a possible configuration the invention provides a double method of axial positioning of the cores.

[0038] A first possible implementation of the method provides that the cores are close to each other: the operator therefore disposes the cores in sequence, a pneumatic or hydraulic device compacts the train of cut cores, and a measuring system analyzes the overall length of the train of cores.

[0039] A second possible implementation of the method allows to position the cores manually in a predetermined position inside a sequence of abutments attached

to a mobile bar and easily inter-changeable.

[0040] In this form of embodiment, the operator must position the cores exactly in correspondence with the spaces between the partitions; in this way it is possible to obtain a predetermined distance between the different cores as required by the processing of the non-woven fabric.

[0041] The bar containing the abutments, the reciprocal position of which can be varied by simple interventions on the clamping systems, is easily replaced by others, previously prepared for different combinations of sizes and diameters.

[0042] The machine can advantageously be equipped with components that allow both positioning methods, which can be activated alternately by the control and command system.

[0043] Otherwise, it is possible to provide a form of the invention that implements only one of these two systems or techniques, and therefore can be equipped only with the components needed to achieve the desired positioning method.

[0044] It is also possible to provide a form of the invention without both systems of manual positioning and/or measuring the cores; in this case the machine is served by an automatic system able to locate the cores correctly on the respective housings.

[0045] When the positioning step is terminated, it can be provided that the automatic extraction cycle is started; the first step is characterized by the tilting movement of an upper closing bar that prevents the radial movement of the cores.

[0046] In the inoperative condition, the bar is rotated in a position opposite the position where the operator finds himself during the manual loading operations of the cores. This stand-by position is characterized by the fact that the bar, in this position, does not create any obstacle to the lifting of the rod present on the supports.

[0047] This condition is extremely important during format-change operations, where the automatic cycle of extraction and re-insertion is interrupted in the step where the rod, complete with cores, is on the supports. The upper presser is then opened, the rod is attached by means of suitable lifting devices, and then the rod is removed by a bridge crane and then repositioned for the new format.

[0048] If the machine is used to prepare mandrels with the cores distanced, the cores must be prevented from moving axially during the insertion of the rod. Therefore, constant pressure must be exerted on the cores by the upper clamping bar so that the friction force prevents them from slipping.

[0049] To obtain this, a tubular element made of rubber has been mounted on the lower surface of the upper presser. At the end of the closing of the presser, the tubular element is inflated to a pressure value that is a function of the diameter and thickness of the cores. In this way a force is guaranteed per unit of length of the presser that is absolutely constant and independent of possible structural deformations of the supports.

[0050] When the clamping and measuring of the cores is complete, the extraction step is begun; this includes a first step in which a rectilinear element driven by a hydraulic or electromechanical system ending in a fork protrudes from the front central part of the machine in the direction of the re-reeling machine, until it arrives at a predetermined distance from the reel.

[0051] Then the rising and search step begins, the photocell positioned as a barrier between the two upper ends of the fork detects the presence of the rod and transmits to the control system the relative height detected by the transducer of the pantograph. Since this height depends on the diameter of the formed reel, it varies during the production process and the search assumes a fundamental importance.

[0052] When the search in the vertical direction is terminated, the gripping element is returned until the photocell identifies the axial end of the rod; subsequently, since the rod is totally identified both vertically and axially, the extraction fork is positioned exactly in correspondence with the throat with a rising movement of the pantograph combined with the forward movement of the extraction head.

[0053] The search operation described in the previous points can be excluded if the rod is extracted in a predetermined and always constant position, that is, if the control system of the re-reeling machine transmits to the control system of the machine the exact height at which the rod is collected. In these cases, the fork is positioned in correspondence with the throat of the rod without any search.

[0054] The actual presence of the head of the rod inside the extraction fork is detected by an inductive proximity sensor. Advantageously, but not necessarily, rods of different diameters will in any case have a throat with the same sizes.

[0055] When the presence of the rod has been confirmed, the expandable elements, which keep the rod clamped inside the cores of the formed reel, are de-activated. This de-activation is obtained with known means, comprised in the terminal part of the extraction device.

[0056] When the de-activation of the expanders is terminated, the mobile extraction element returns in the direction of the extractor and draws with it the rod, whose throat remains inserted inside the fork. The expandable rod is removed only partly from the cores of the formed reel and remains cantilevered.

[0057] The mobile part of the machine, integrated with the extraction head, is made to descend so that the cylindrical part of the rod is in correspondence with two electrically or hydraulically motorized rubberized rollers; the rollers will be closed on the rod and kept forced on it by hydraulic or pneumatic actuators; this technique is already known and used.

[0058] In this step the rod is aligned concentrically with the cores. The drive of the motors connected to the rollers causes the rod to advance in the direction of the cores.

[0059] Three mobile plastic elements, pivoted to the front end of the support elements of the cores, constitute a lead-in so that the rod is aligned correctly with the cores.

[0060] A device comprising a pneumatic cylinder and corresponding conical head located on the same axis of the rods, but on the opposite side of the motorized rollers, constitutes the element to decelerate and stop the travel of the rod during pre-insertion.

[0061] The final positioning of the rod inside the cores cannot always be achieved by means of the thrust generated by the motorized rollers; this is due to the uncertain positioning and small distance between the cores and the end of the rod, which does not allow a sufficient gripping surface of the rollers.

[0062] To overcome this disadvantage of current machines, a device is provided, pivoted to the mobile extraction part which, lifted by a pneumatic actuator, engages with the terminal part of the rod protruding from the rollers and provides the final positioning by means of the same actuator and the corresponding measuring device; the latter two allow to move the gripping unit.

[0063] When the final positioning of the rod inside the cores is complete, the expander elements of the rod are clamped using known techniques.

[0064] When the rod has been clamped inside the cores, the machine is taken to the position to return the rod, by acting on the height of the pantograph and/or on the position of the slider so that the rod is returned to its terminal position.

[0065] When the position where the cores are returned has been reached, the mobile elements that had held the cores located in front of the supports are opened, to allow the removal of the rod, and the rear pneumatic actuator thrusts the rod and the corresponding cores until the external cylindrical surface of the cores is positioned in correspondence with the rubberized rollers. The rubberized rollers are thrust and pressurized on the external surface of the rod and will cause the expulsion of the cores as in known techniques.

[0066] At the end of this step, the rod remains cantilevered, only partly inserted in its return point; the upper part of the machine is made to ascend by a sufficient quantity so that the exit of the extraction element allows to thrust the rod to its definitive position without needing to obtain mechanical contrasts for the correct positioning thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0067] The invention will be more clearly understood by following the illustration of the following drawings, which show a non-restrictive forms of embodiment of the invention wherein:

- fig. 1 is a three-dimensional view of the invention;
- fig. 2 is a detailed three-dimensional view of only the upper part of the machine;
- fig. 3 a is a plan view of only the upper part of the machine;
- fig. 3b is a front view of only the upper part of the machine;
- fig. 4 is a cross section from E to E;
- fig. 4a is a detail of the upper presser;
- fig. 5 is a left lateral view;
- fig. 6 is a front section from G to G;
- fig. 7 is a three-dimensional view with hidden details;
- fig. 8 is a guide with dividing partitions;
- figs. 9 a,b,c,d,e,f,g,h,i,j,k,l,m,n,o are schematic illustrations of an operating sequence with distanced cores;
- figs. 10 a,b,c,d,e,f,g,h,i,j,k,l,m,n,o are schematic illustrations of an operating sequence with compact cores.

DETAILED DESCRIPTION OF SOME FORMS OF EMBODIMENT

[0068] In fig. 1 we can see the base of the machine 1, or device, on which a slider 2 is mounted, able to move by means of an electric drive in the direction indicated by f2. A pantograph 3 is rigidly mounted on the slider 2, able to move vertically in the direction indicated by f3. On the upper part of the pantograph 3 a support structure is rigidly connected, which defines the main body 6 of the machine 1 to which are connected: a unit for gripping the rod 4 able to move in f4, two drawing units 5, in this specific case motorized rollers 54 able to move in f5, a reclinable structure or mobile support presser unit 65, a clamping device or upper presser 653 able to rotate as indicated by f6, supports 61a, 61b for the cores, and a rear thruster.

[0069] According to possible forms of embodiment, the drawing units 5 are configured to introduce into the device 1 the rod P along an axis of insertion Z, disposing the rod P substantially parallel to the oblong development of the supports 61a, 61b.

[0070] According to a possible formulation of the present invention, the pantograph lifter 3 is configured to move the support structure 6 vertically and to adjust the relative height of the device.

[0071] According to a possible solution, the clamping device 653 comprises a closing bar, able to be selectively activated in correspondence with a front plane of the device, to prevent the radial movement of the cores.

[0072] In fig. 2 we see in greater detail the main body 6 of the machine 1 in which there are support units 61a and 61b of the cores each consisting in this specific case at least of a base profile 612, a front stop element 614 of the cores, moved by a pneumatic actuator 613, a mobile compacting element 611 that acts on the circumference of the cores, moved by an actuator 610.

[0073] According to a possible form of embodiment, the supports 61a, 61b comprise rectilinear elements, in this specific case the base profiles 612 lying on specular planes with respect to a front plane of the device, and on which the rod is positioned during use.

[0074] According to a possible solution of the invention, in proximity to a first end of the supports 61a, 61b, at least one mobile rear contrasting element is associated with the support structure 6, with the function of a mobile compacting element 611 configured to assume a closed condition that prevents the axial sliding of the cores N and facilitates the introduction of the mandrel P inside the cores N, and an open condition that allows the cores N to slide freely on the supports 61a, 61b.

[0075] In the upper part of the main body 6 we see the presser 653, connected by adjustment elements to the reclining structure or presser unit 65; the presser 653 is equipped with the front stop element of the cores 614, moved by the pneumatic actuator 613, a mobile compacting element 651 that is moved by an actuator 650 and is connected to a position transducer 652.

[0076] In the rear part of the main body 6 we see the thruster unit 60, consisting of a pneumatic cylinder 601 and an inflation device 602 for the expandable rod.

[0077] In the front part of the main body 6 we see the drawing units 5 provided with a structure 50 free to move along guides 52 thanks to a group of wheels 53 and on which hydraulic motors 51 are mounted, equipped with rubberized rollers 54. To allow the correct centering of the rod the symmetric movement of the two drawing units 5 is guaranteed by a synchronization cam 56.

[0078] Again in the front part of the main body 6 we see the gripping unit 4 which in this specific case consists of a structure with U-shaped profiles 41, a terminal fork 42 equipped at the rear with one or more photocells 43 as a barrier or transducer. In particular, we see that the main body 6 comprises a mobile positioning arm 40 able to move in the direction indicated by arrow f5.

[0079] According to a possible solution of the present invention, the gripping unit 4 comprises a horizontally mobile rectilinear element, in this specific case the structure with U-shaped profiles 41 equipped at its end with the fork 42 configured to engage with a throat of the rod or mandrel.

[0080] According to another form of embodiment of the present invention, the horizontally mobile rectilinear element is connected to an arm, in this specific case the mobile positioning arm 40, selectively mobile vertically, configured to assume a first position in which it is suitable to engage with one end of the mandrel P, and a second position of non-interference with the movements of the mandrel P.

[0081] According to a possible solution, the transducer 43 is configured to measure the excursion of the horizontally mobile rectilinear element 41.

[0082] In figs. 3a and 3b we see the same details in a plan view and on the opposite side to the loading side of the machine 1; in particular the hydraulic cylinders 654 can be seen, which perform the tilting movement of the reclinable structure or presser unit 65; the mobile units 63a, 63b can also be seen, of a support element 64 or bar, and partitions as illustrated better hereafter.

[0083] Fig. 4 shows in section E-E (of fig. 3b) a possible method for obtaining the adjustment of the diameter of the cores, keeping the axis of insertion of the rod unvaried; racks 621 supported by idle wheels 623 engage a toothed wheel 622, and the base profiles 612, which define the supports 61a, 61b of the cores, are rigidly mounted on said racks 621.

[0084] According to the form of embodiment shown in figs. 4 and 5, the supports 61 a and 61b are installed mobile linearly and so that the movement trajectories of the supports 61a and 61b, identified in fig. 4 by f11, intersect in correspondence with an axis defining the axis of insertion Z of the rods P in the cores N.

[0085] According to another aspect of the present invention, the supports 61a and 61b are able to move symmetrically with respect to the front plane, to position themselves at a distance from the axis of insertion Z equal to the radius of the cores N that are installed.

[0086] According to possible forms of embodiment of the present invention, the supports 61a and 61b are movable along the trajectories f11 by adjustment members, which in this specific case are defined by racks 621, although it is not excluded that other forms of embodiment can comprise other types of movement mechanisms such as jack screws, worm screw mechanisms or suchlike.

[0087] According to a possible solution, the supports 61a and 61b are angularly distanced from the axis of insertion Z by a determinate angle.

[0088] According to the form of embodiment in fig. 4, the device according to the present invention is equipped with two supports 61a and 61b, angularly distanced from each other by an angle of 120°. According to a possible form of embodiment, shown in the attached drawings, each support 61a and 61b is angularly distanced with respect to the axis of insertion Z from the presser unit 65 when the latter is in its operating condition, by an angle of 120°. In this way it is possible to ensure an optimum holding of the reels when the rod P is extracted from the latter.

[0089] According to a possible solution, the drawing unit 5 is installed on the main body 6 positioned substantially aligned with the axis of insertion Z. In particular, it can be provided that the rubberized rollers 54 of the drawing unit 5 define a gap between them, through which the rod P is positioned during use, and which is located substantially aligned with the axis of insertion Z.

[0090] Fig. 4a shows a pneumatic tubular element 655 attached on the upper presser 653, while fig. 4b shows the relative position between the base profile 612 and a guide 640, or extruded line, of the support element 64 on which spacer partitions 641 or abutments are mounted.

[0091] According to a possible solution, the abutments 641 are attached, in a reciprocally positionable manner, on the support element or bar 64 able to be associated with the support structure 6.

[0092] According to a possible form of embodiment of the present invention, the supports 61a, 61b are associated with adjustment and clamping member 624, 625

and 626 to adjust and clamp the position of the supports 61a, 61b.

[0093] According to a possible solution, the device comprises a command lever 624 associated at least with the rectilinear elements 612 to selectively position the supports 61a, 61b in correspondence with pre-set notches or references.

[0094] Fig. 5 describes a possible method for adjusting and clamping the supports 61a and 61b: stems that connect the front rack 621 and rear rack are keyed onto a command lever 624 equipped with a pawl device 625 that is inserted into the grooves made on a disc 626. The disc 626 is easily interchangeable to configure the position of the supports 61a, 61b according to production needs.

[0095] It should be noted that the same adjustment mechanism can be installed mounted on the upper presser 653 as shown in figs. 4 and 4a.

[0096] Fig. 6 shows a section of the machine on the plane G-G (of fig. 3a), with a possible form of construction in particular of the gripping unit 4, showing: the structure with U-shaped profiles 41, the terminal gripping fork 42 integrated therewith, accompanied by the barrier photocells 43, a unit 44 to deflate the expandable rod, a mobile positioning arm 40 and a corresponding pneumatic lifting cylinder 43a. Inside the main body 6 there is a hydraulic cylinder 46 that commands the movement of the gripping unit 4. Rubberized rollers 54 are also shown, connected to the hydraulic motors 51 and a cylinder 55 for closing the drawing unit 5, complete with transducer. The support element 64 can be seen, with the spacer partitions 641 and the mobile units 63a, 63b to which it is connected.

[0097] Fig. 7 shows the machine in which the part relating to the presser has been deliberately hidden, so as to show the support element 64 with the function of linear positioning of the spacer partitions 641 connected to them. In particular, the mobile units 63a and 63b can consist of a guided linear pneumatic actuator 630, to the mobile part of which a (known) rapid release handle 631 is connected, on which the extruded line 640 is clamped, on which the spacer partitions 641 are positioned. It also shows with f12 the direction of movement that the pneumatic actuator 630 imparts to the extruded line 640, so that during the loading of the cores it moves near to the supports 61 a, 61b whereas during the return of the rod it is distanced from them, in order to allow the expulsion of the rod.

[0098] According to a possible solution, the abutments 641 are selectively positionable in a direction parallel to the axis of insertion Z and configured to determine a precise positioning of the cores N on the supports 61a, 61b.

[0099] Fig. 8 contains more details that allow an exact comprehension of the support element 64 with a function of separating the cores, and shows the spacer partitions 641 and the respective clamping elements 642 provided to constrain the spacer partitions 641 to the support element 64.

[0100] Figs. 9a to 9o describe the functional sequence, step by step, to prepare rods P with distanced cores N, characterized by an obligatory positioning of each of the cores N between two contiguous spacer partitions 641. This type of working is necessary in processes where the ribbon-like product is subjected to a contraction in size during re-winding, such as for example non-woven fabric.

[0101] Fig. 9a shows the manual loading step of the cores N with the presser unit 65 totally open and tilted. The cores N are inserted between contiguous spacer partitions 641 and in front abutment against the front stop elements 614.

[0102] Fig. 9b shows the upper presser unit 65 closed, and the subsequent inflation of the tubular element 655 to clamp the cores in the correct position.

[0103] Fig. 9c shows the step where the terminal fork 42 integrated with the gripping unit 4 is inserted into the throat of the rod P according to a sequence of movements indicated by f3 and f4. During this step, the method to search for the position of the rod P is implemented, indicated in the description and claimed on the basis of the indications supplied by the barrier photocell 43.

[0104] Fig. 9d shows the step where the rod P is partly extracted from a reel B defined by cores N on which the material is wound, making the gripping unit 4 return until it takes the cylindrical body of the rod P in correspondence with the rubberized rollers 54. The drawing units 5 in this step are open.

[0105] Fig. 9e shows the step where the pantograph descends as indicated by f3 so that the cantilevered rod P is positioned exactly between the rubberized rollers 54.

[0106] Fig. 9f shows the step where the rubberized rollers 54 draw near f5 to the cylindrical body of the rod P and the definitive extraction fP and the simultaneous insertion of the rod P inside the cores N are obtained. In this step the gripping unit 4 protrudes with respect to the main body 6, as indicated by f4.

[0107] Fig. 9g shows the step where, the rollers having completed the extraction, the mobile positioning arm 40 is lifted f7 and inserted at the conical end of the rod P while the group of hydraulic motors 51 moves away, freeing the rod P.

[0108] Fig. 9h shows the step where the gripping unit 4, returning in f4, takes the rod P to its definitive position inside the cores N. In this step, the rod P is held clamped by the contribution of contrary force exerted by the antagonist cylinder 601. When the final position has been reached, the rod is clamped using the inflation device.

[0109] Fig. 9i shows the step where the mobile positioning arm 40 is lowered and the gripping unit 4 is made to return, according to the sequence indicated by f7 and f4.

[0110] Fig. 9j shows the step where the presser unit 65 is lifted and rotated, and the front stop elements 614 are opened. In this step the guide 640, connected to the spacer partitions 641, is distanced to allow the rod P to exit freely.

[0111] Fig. 9k shows the step where the rod P, inte-

grated with the cores N, is thrust by the cylinder 601 and corresponding pumping device 602, or conical inflation element, so that the external surface of the first core N finds itself in correspondence with the rubberized rollers 54.

[0112] When this position is reached, the hydraulic motor units 51 are thrust and pressurized against the rod P according to f5.

[0113] Fig. 9l shows the step where the rod P, complete with cores N, is transferred to the return point by the rubberized rollers 54 and corresponding motors. Note that the return point may be in a different position from the gripping position, because during at least one of the previous steps the pantograph will have translated and ascended or descended.

[0114] Fig. 9m shows the step where, having terminated the expulsion step using the rubberized rollers 54, the rod P remains cantilevered, held by the return seating belonging to the re-reeling machine. The pantograph 3 makes the main body ascend as indicated by f3 until the end of the rod P is positioned at the height of the gripper unit 4 or extraction head.

[0115] Fig. 9n shows the terminal step where the rod P is thrust and correctly positioned inside a return device by the exit movement of the extraction head 4 indicated by f4.

[0116] Figs. 10a to 10q describe the functional sequence step by step to prepare rods P with cores N close to each other. This type of working is useful in processes where the ribbon-like product is not subjected to a contraction in size during re-winding, such as for example paper and tissue paper.

[0117] Fig. 10a shows the manual loading step of the cores N with the presser unit 65 totally open and tilted. The cores N are positioned manually on the supports 61 a and 61b according to the cutting sequence provided, and can also be positioned slightly distanced Dn. In this step, the front stop elements 614 are closed, so that the operator can dispose the cores N close to the clamping device.

[0118] Fig. 10b shows the upper presser unit 65 closed, and the subsequent closing of the front stop element 614 belonging to the presser unit 65.

[0119] Fig. 10c shows the step where the mobile compacting elements 611 and 651 acting on the terminal circular crown of the cores N, driven by means of the actuators 610 and 650, or pneumatic cylinders exert a thrust f9 on the train of cores N that, clamped at the front by the front stop element 614, are compacted with respect to each other. In this step the position transducer 652 installed in correspondence with the upper presser unit 65 transmits to the control system the overall length of the group of cores to verify congruity.

[0120] Fig. 10d shows the step where the gripping unit 4 exits in the direction of the formed reel B and the terminal fork 42 is inserted into the throat of the rod P according to a sequence of combined movements indicated by f3 and f4. During this step, the method to search for the position of the rod P is implemented, indicated in the description on the basis of the indications supplied by the barrier photocell 43.

[0121] Fig. 10e shows the step where the rod P is partly extracted from the reel B, making the gripping unit 4 return until it takes the cylindrical body of the rod P in correspondence with the rubberized rollers 54. The motor or drawing units 5 in this step are open.

[0122] Fig. 10f shows the step where the pantograph 3 descends as indicated by f3 so that the cantilevered rod P is exactly positioned in height between the rubberized rollers 54.

[0123] Fig. 10g shows the step where the rubberized rollers 54 draw near f5 to the cylindrical body of the rod P and the definitive extraction fP and the simultaneous insertion of the rod P inside the cores N are obtained. In this step the extraction head 4 is repositioned as indicated by f4.

[0124] Fig. 10h shows the step where, the rollers having competed the extraction, the mobile positioning arm 40 is lifted f7 and inserted at the conical end of the rod P while the motor or drawing unit 5 moves away, freeing the rod P.

[0125] Fig. 10i shows the step where the gripping unit 4, returning in f4, takes the rod P in its definitive position inside the cores N. In this step, the rod P is held clamped by the contribution of contrary force exerted by the pneumatic cylinder 601. When the final position has been reached, the rod P is clamped to the cores N using the pumping device 602.

[0126] Fig. 10j shows the step where the mobile positioning arm 40 is lowered and the gripping unit 4 is made to return, according to the sequence indicated by f7 and f4.

[0127] Fig. 10k shows the step where the presser unit 65 is lifted and rotated, and the front stop elements 614 are opened.

[0128] Fig. 10l shows the step where the rod P, integrated with the cores N, is thrust by the pneumatic cylinder 601 and corresponding conical inflation element, that is, the pumping device 602, so that the external surface of the first core N finds itself in correspondence with the rubberized rollers 54. When this position is reached, the motor units or drawing units 5 are pressurized against the rod P according to f5.

[0129] Fig. 10m shows the step where the rod P, complete with cores N, is transferred to the return point by the rubberized rollers 54, drawing units 5 and corresponding motors. Note that the return point may be in a different position from the gripping position, because during at least one of the previous steps the pantograph 3 will have translated and ascended or descended.

[0130] Fig. 10n shows the step where, having terminated the expulsion step using the rubberized rollers 54, the rod P remains cantilevered, held by the return seating belonging to the re-reeling machine. The pantograph 3 makes the machine ascend as indicated by f3 until the end of the rod P is positioned at the height of the extrac-

tion head 4.

[0131] Fig. 10o shows the terminal step where the rod P is thrust and correctly positioned inside the return device by the exit movement of the extraction head 4 indicated by f4.

[0132] We shall now give a list of possible forms of embodiment, possibly combinable with each other, of a device to prepare mandrels or rods P:

1. Device to prepare winding mandrels on which to form reels, consisting of a single machine able to extract the mandrels P of various diameters from the formed reels B, to insert them inside core N or cores that have been previously cut to size and positioned on supports 61a, 61b, radially adjustable as a function of the diameter of the cores themselves, to perform an accurate axial positioning of the rod with respect to the cores, to clamp the cores on the expandable rod, positioning them close to or distanced from each other, to return the rod, complete with cores, to the re-reeling machine in a translated position and at a different height from where it was collected.

2. Device according to the form of embodiment as per point 1, in which the supports of the cores consist of two rectilinear elements, lying on planes specular with respect to the front plane of the machine, and having one axis in common. Said axis coincides with the axis of the mandrel during the insertion step of the rod inside the cores, irrespective of the diameter of the rod. The supports are mobile and able to move symmetrically and to position themselves at a distance from said axis equal to the radius of the cores used.

3. Device according to the form of embodiment as per point 1 and 2, in which a third rectilinear element with a presser function is moved in correspondence with the front plane of the machine in a vertical direction in opposition to the lower supports. The element is mobile and adjustable vertically so that it can position itself at a distance from the axis equal to the radius of the cores used, so as to prevent any radial movement of the cores.

4. Device according to the forms of embodiment as per points 1, 2 and 3, in which the rectilinear element with a presser function as per point 3, in its inactive condition, is positioned so as not to constitute an impediment or obstacle to the removal of the rod present on the supports, obtained by the vertical lifting of the rod achieved using gantries or cranes, the movement between the inactive position and the operating position occurring by means of hydraulic or pneumatic drive.

5. Device according to the forms of embodiment as per points 2, 3 in which the adjustment of the distance of the support elements as per point 2 and the upper presser as per point 3 is obtained manually by means of a command lever that is clamped in correspondence with preset notches or references corresponding to the diameters required.

6. Device according to the forms of embodiment 2 and 3, in which the movement of the support elements as per point 2 and the upper presser as per point 3 is obtained by means of an electric motor or hydraulic device driven by the control system as a function of the diameter required.

7. Device according to the forms of embodiment 2 and 3, in which the rectilinear support elements of the cores as per point 2 and the upper presser as per point 3 are equipped at their end on the side of the re-reeling machine with a mobile element: in the closed position it prevents the axial sliding of the cores and facilitates the introduction of the rod inside the cores, if open it allows the cores to slide freely on the supports. On the opposite side, the rectilinear support elements of the cores and the upper presser are equipped with axially mobile elements and driven by a pneumatic or hydraulic device that, engaging on the terminal annular surface of the cores, allow to axially displace the cores and to compact them, cancelling the distance between them.

8. Device according to the forms of embodiment as per points 2, 3 and 7, in which the upper presser as per point 3 or one of the lower support elements as per point 2 of the cores is equipped with a measuring device to measure the axial movement of the rear mobile contrast element. The measurement allows to determine the actual length of the whole of the cores present and to allow the control system to position the rod so as to minimize the tolerances due to cutting errors, or generate a signal if said errors exceed a determinate threshold.

9. Device according to the forms of embodiment as per points 2 and 3, in which a support element, equipped with an adequate number of separator partitions, is connected, in an easily removable manner, to the end of two linear actuators integrated with one of the lower supports as per the form of embodiment in point 2.

10. Device according to the forms of embodiment as per points 2, 3 and 9, in which the mobile support element and the partitions connected to it described in point 9 is advantageously moved by a pneumatic drive linear actuator. An electric or hydraulic drive is not excluded. The actuators determine two possible positions of the element equipped with partitions. In a first position the distance between the partitions and the axis of the rod is greater than the radius of the rod but less than the external radius of the cores: this condition allows to load the cores in a predetermined position. In a second position, the distance of the partitions from the axis of the rod is greater than the radius of the cores; in this way the rod, complete with cores, can translate axially without constraints, to be returned to the re-reeling machine.

11. Device according to the forms of embodiment as

per points 2, 3 and 9, in which the support element and the partitions connected to it can be easily removed from the machine and replaced by any other, every time it is necessary to change the production, intended as a modification in the length of the cuts and hence of the respective cores, and also as a change in diameter of the rod and the cores associated with it.

12. Device according to the forms of embodiment as per points 2, 3, 9 and 11, in which the partitions can be displaced axially along the support element described in point 9 and attached to it in any position using a simple tool so as to obtain every possible combination of length of the cores and the distance between them.

13. Device according to the forms of embodiment as per points 2, 3 and 9, in which the upper mobile element having the function as presser described in point 3 is equipped on its contact surface with the cores with a tubular element consisting of material with high friction coefficient, advantageously rubber, that is pneumatically inflated to hold the cores in an axially correct position during the insertion of the rod inside the cores. The pressure with which the tubular element is loaded can be a function of the diameter of the cores.

14. Device according to the forms of embodiment as per points 1, 2 and 3 in which the devices as per the forms of embodiment in points 7, 8, 9 and 13 are simultaneously installed, with the purpose of making a machine able to prepare both compact mandrels of cores and also mandrels with the cores distanced, depending on operating requirements, without needing to make mechanical modifications.

15. Device according to the form of embodiment as per point 1, in which the extraction process of the rod from the formed reel is obtained by means of a horizontally mobile rectilinear element equipped at its end with a fork that engages with a throat present at the end of the expandable rod. The excursion of the element is measured by a suitable transducer and transmitted to the control system. The movement of the mobile element is advantageously driven by a hydraulic device, but an electric drive is not excluded.

16. Device according to the form of embodiment as per points 1 and 15, in which, integrated with the end fork of the gripping element described in point 15, a barrier photocell is installed. By means of a procedure implemented in the control system, the photocell allows to search for the exact position of the rod both vertically and axially, cancelling possible errors deriving from unexpected movements of the rod with respect to the reel and of the reel with respect to the corresponding supports.

17. Device according to the form of embodiment as per points 1 and 15, in which, integrated with the mobile gripping element described in point 15, an arm is connected, moved vertically by a pneumatic actuator. In a high position the arm engages with the end of the rod during the insertion of the rod inside the cores. In a low position the arm does not interact with the rod during the return of the rod to the re-reeling machine.

18. Device according to the form of embodiment as per points 1, 2, 3 and 15, in which the support elements of the cores described in point 2, the presser element described in point 3 and the gripping element described in 15, as well as all the other components intended for the extraction of the rod, are mounted integrated with the upper structure of a pantograph lifter, driven by a hydraulic cylinder. A measuring device connected to the control system determines the relative height of the machine.

19. Device according to the forms of embodiment as per points 1, 2, 3, 15 and 18, in which the pantograph lifter described in point 18 is mounted on an electrically or hydraulically driven slider able to translate the whole machine parallel to the re-reeling machine to allow to return the rod in a different position from where it was collected.

20. Device according to the forms of embodiment as per points 1, 2, 3, 15 and 18, in which the pantograph lifter described in point 18 is rigidly anchored to the floor. In this configuration, the machine allows the return of the rod only on the same vertical plane on which it was collected.

21. Method implemented on the machine described in the form of embodiment as per point 1 et seq., for the final positioning of the rod inside the cores located on the supports as per point 2 and clamped by the presser as per point 3 obtained by means of the device as per the form of embodiment in point 17 in which the rod is thrust to its final position by a mechanical device connected to the mobile extraction device and detected by using a suitable transducer and not by the pair of motorized rollers that perform the extraction.

22. Method implemented on the machine described in the form of embodiment as per point 1 et seq., to determine the exact position of the rod on the formed reel obtained by means of the coordinated movement of the mobile devices and electric signals arriving from the photoelectric barrier located in correspondence with the extraction fork and by the position sensors of the extraction head and the height of the pantograph. The method consists in identifying the lower edge of the rod by means of the photocell during the ascent of the extraction head, the subsequent horizontal movement of the fork until the end of the rod has been identified. Based on the corresponding data and the data relating to the geometry of the rod such as diameter and distance of the throat from the edge, it is possible to identify exactly the relative position of the throat.

Claims

1. Device to prepare winding mandrels (P) on which to form reels, comprising a support structure (6) to which supports (61a, 61b) are associated configured to support, close to or distanced from each other and on their circumference, a plurality of cores (N) keeping them aligned along a pre-determined axis of insertion, and a gripping unit (4) configured to allow the introduction of said mandrel (P) in said cores (N) and along said axis of insertion, **characterized in that** it comprises adjustment members (621) configured to adjust the position of the supports (61a, 61b) in a radial direction with respect to the axis of insertion and to dispose said axis of insertion of said mandrel (P) always in the same position with respect to the support structure (6) as at least the diameter of said cores (N) varies.

2. Device as in claim 1, **characterized in that** said supports (61a, 61b) are mobile and able to move symmetrically to position themselves at a distance from said axis of insertion equal to the radius of said cores (N).

3. Device as in claim 2, **characterized in that** adjustment and clamping members (624, 625, 626) are associated to said supports (61a, 61b) to adjust and clamp the position of said supports (61a, 61b).

4. Device as in claim 1, **characterized in that** said supports (61a, 61b) comprise rectilinear elements (612) lying on planes specular with respect to a front plane of said device.

5. Device as in claim 4, **characterized in that** it comprises a command lever associated at least to said rectilinear elements (612) to selectively position said supports (61a, 61b) in correspondence to pre-set notches or references.

6. Device as in any claim hereinbefore, **characterized in that** it comprises a clamping device (653) configured to clamp said cores (N) at least in a radial direction and against said supports (61a, 61b).

7. Device as in claim 6, **characterized in that** said clamping device comprises a closing bar (653) able to be selectively activated in correspondence to a front plane of said device, to prevent the radial movement of said cores (N).

8. Device as in claim 7, **characterized in that** a tubular element (655) made of rubberized which can be selectively inflated to constrain the position of said cores (N) on said supports (61a, 61b) is associated to said closing bar (653).

9. Device as in any claim hereinbefore, **characterized in that** at least one rear mobile contrast element (611), configured to assume a closed condition which prevents the axial sliding of said cores (N) and facilitates the introduction of the mandrel (P) inside the cores (N), and an open position that allows the cores (N) to slide freely on the supports (61a, 61b), is associated to said support structure (6) and in proximity to a first end of said supports (61a, 61b).

10. Device as in claim 9, **characterized in that** it comprises a measuring device to measure the axial movement of the rear mobile contrast element (611), configured to determine the actual length of the whole of the cores (N) located on said supports (61a, 61b) and to allow the positioning of the mandrel (P).

11. Device as in any claim hereinbefore, **characterized in that** at least a front stop element (614) which can be selectively driven to engage on the annular end surface of the cores (N) and to move said cores (N) axially along said axis of insertion and compress them, cancelling the distance between them, is associated to said support structure (6) and in proximity to a second end of said supports (61a, 61b).

12. Device as in any claim hereinbefore, **characterized in that** it comprises a plurality of abutments (641) which can be selectively positioned in a direction parallel to said axis of insertion and configured to determine a precise positioning of said cores (N) on said supports (61a, 61b).

13. Device as in claim 12, **characterized in that** said abutments (641) are attached, in a reciprocally positionable manner, on a bar (64) associable to said support structure (6).

14. Device as in any claim hereinbefore, **characterized in that** said gripping unit (4) comprises a horizontally mobile rectilinear element (41) equipped at its end with a fork (42) configured to engage with a groove of said mandrel (P).

15. Device as in claim 14, **characterized in that** it comprises a transducer (43) configured to measure the travel of said horizontally mobile rectilinear element (41).

16. Device as in claim 14 or 15, **characterized in that** an arm (40), selectively mobile vertically and configured to assume a first position in which it is suitable to engage with one end of said mandrel (P), and a second position of non-interference with the movement operations of said mandrel (P), is connected to said horizontally mobile rectilinear element (41).

17. Device as in any claim hereinbefore, **characterized**

in that it comprises a pantograph lifter (3) configured to move said support structure (6) vertically and to adjust the relative height of the device.

18. Device as in claim 17, **characterized in that** it comprises a slider (2) on which said pantograph lifter (3) is installed, said slider (2) being configured to translate said support structure (6).

19. Method to prepare winding mandrels (P) on which to form reels, that provides to position a plurality of cores (N) on supports (61a, 61b) of a support structure (6), disposing them resting with their circumference on said support (61a, 61b), close or distanced, and aligned along a pre-determined axis of insertion, and to subsequently insert a mandrel (P) in said cores and along said axis of insertion, **characterized in that** it provides a step of adjusting the position of said supports (61a, 61b) in a direction radial with respect to the axis of insertion and by means of adjustment members (621), to dispose said axis of insertion of said mandrel (P) always in the same position with respect to the support structure (6) as at least the diameter of said cores (N) varies.

20. Method as in claim 19, **characterized in that** said supports (61a, 61b) are moved symmetrically to position them at a distance from said axis of insertion equal to the radius of said cores (N).

21. Method as in claim 19 or 20, **characterized in that** during said positioning it is provided to clamp said cores (N) by means of a clamping device (653) at least in a radial direction and against said supports (61a, 61b).

22. Method as in claim 19, 20 or 21, **characterized in that** it comprises at least an optical acquisition step to acquire the position of said mandrel (P), to allow the subsequent positioning of said supports (61a, 61b).

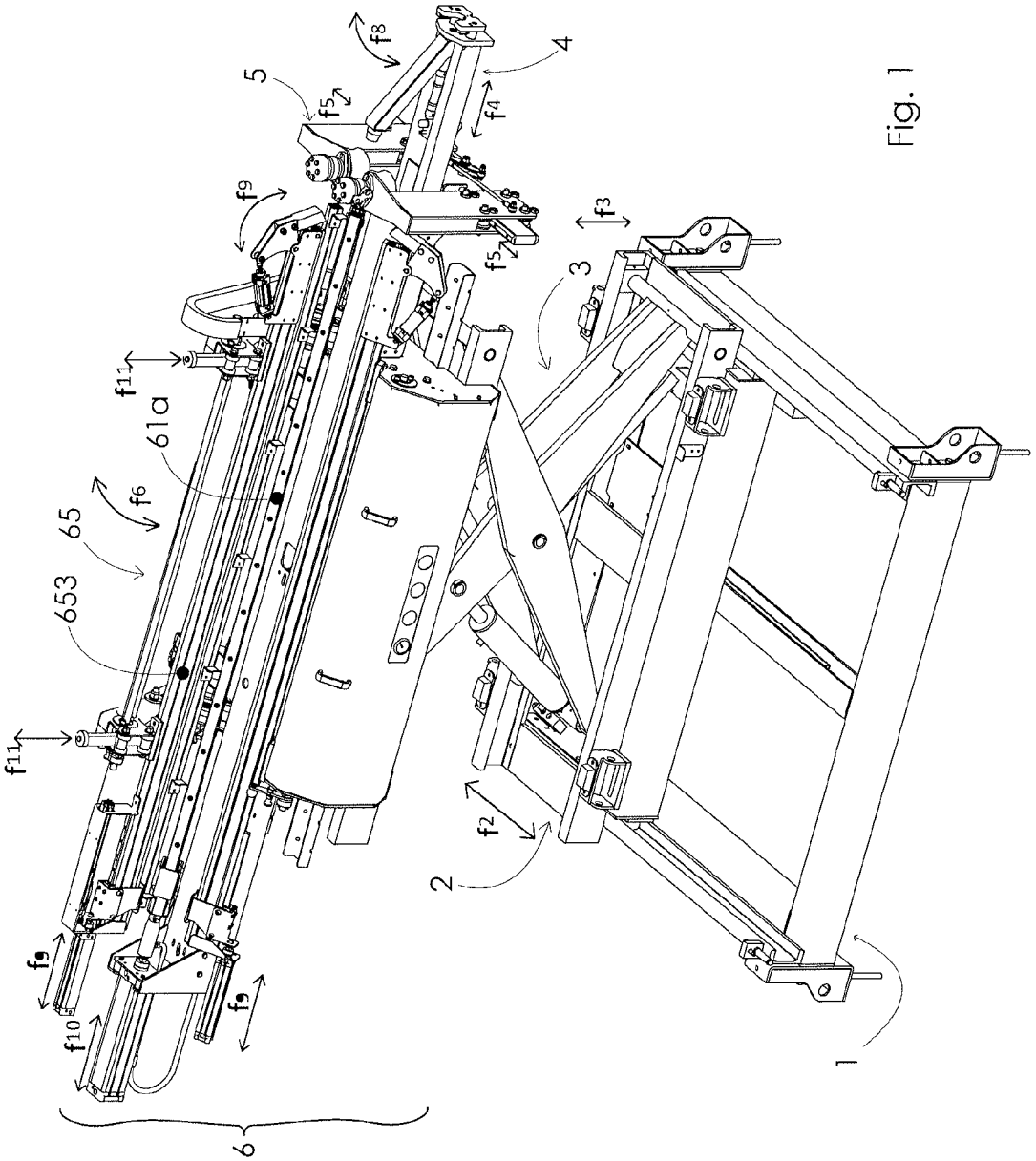
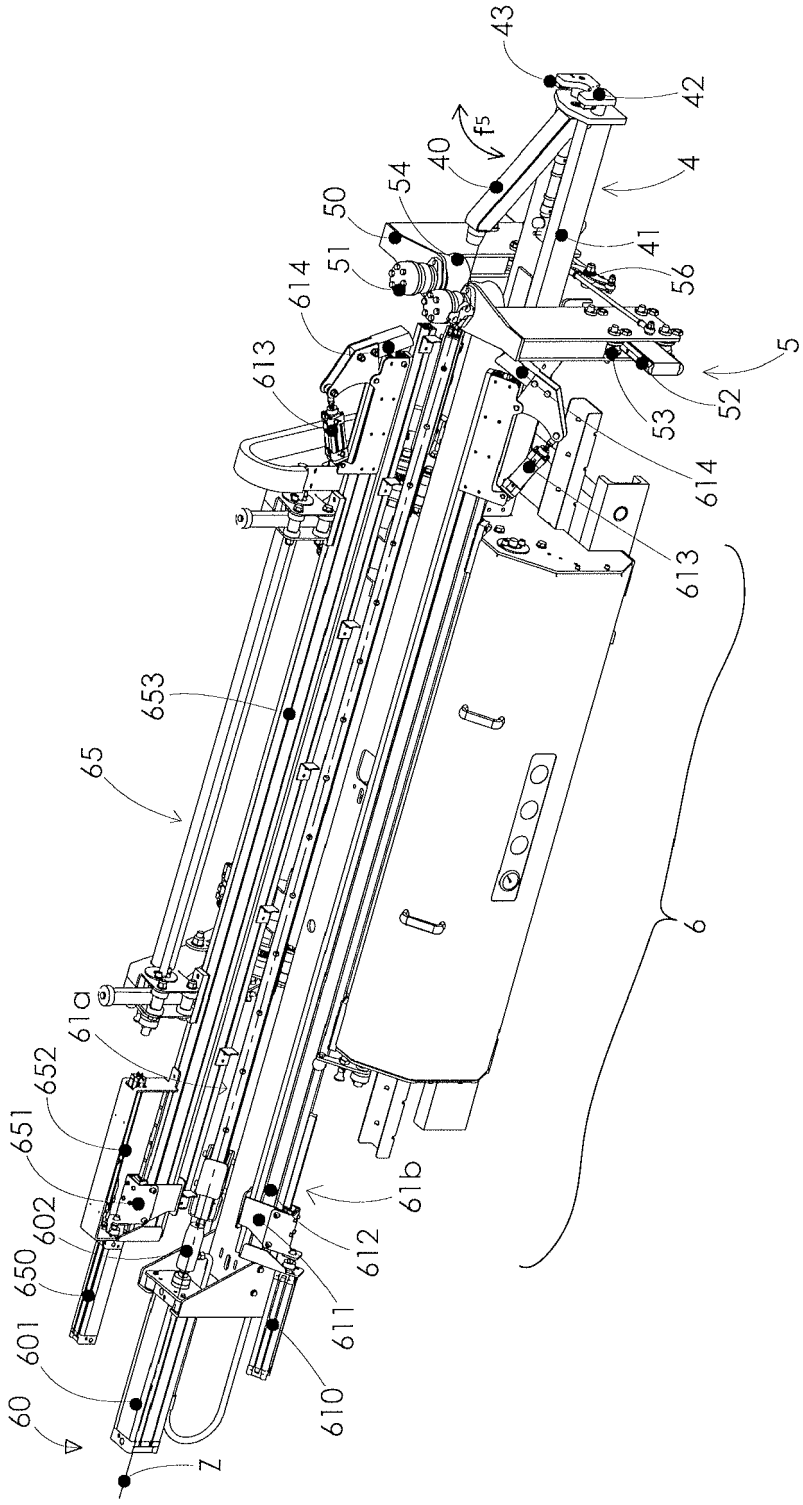


Fig. 1


43
42
F5
40
4
54
50
41
51
56
614
5
613
52
53
614
613
653
65
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61a
652
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61b
602
612
650
611
601
610
60
Z

Fig. 2

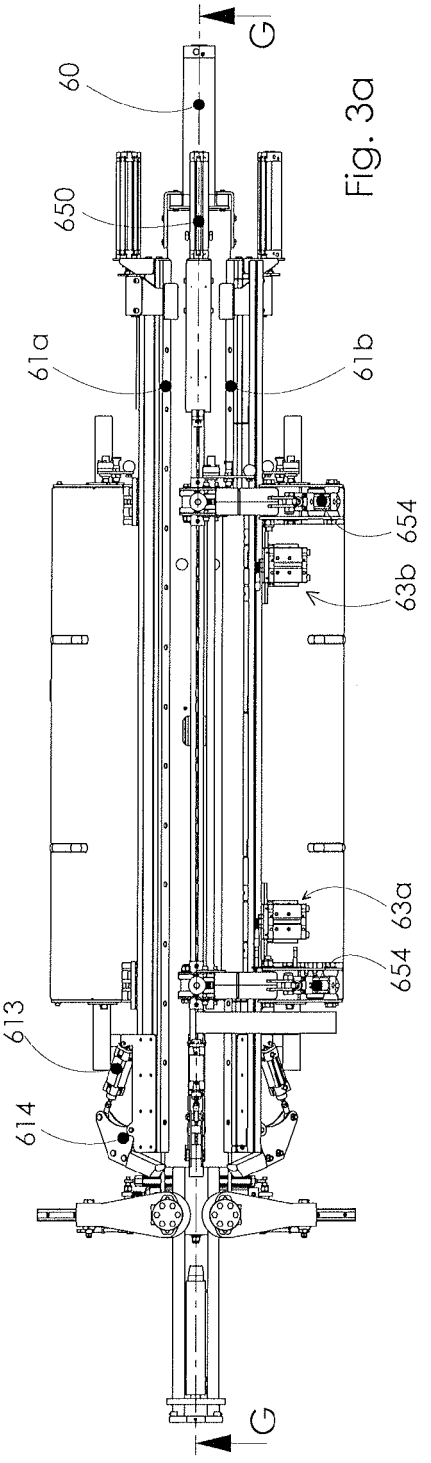

G
60
650
61a
61b
654
63b
63a
654
613
614
G

Fig. 3a

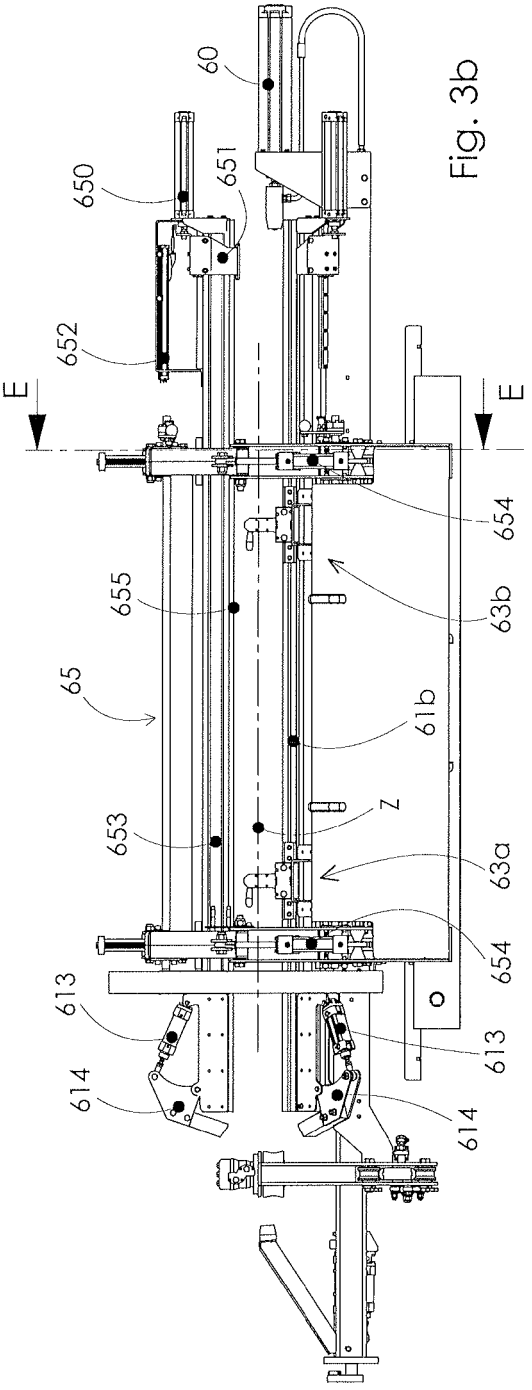

60
650
651
652
E
E
654
655
63b
65
61b
653
Z
63a
654
613
613
614
614

Fig. 3b

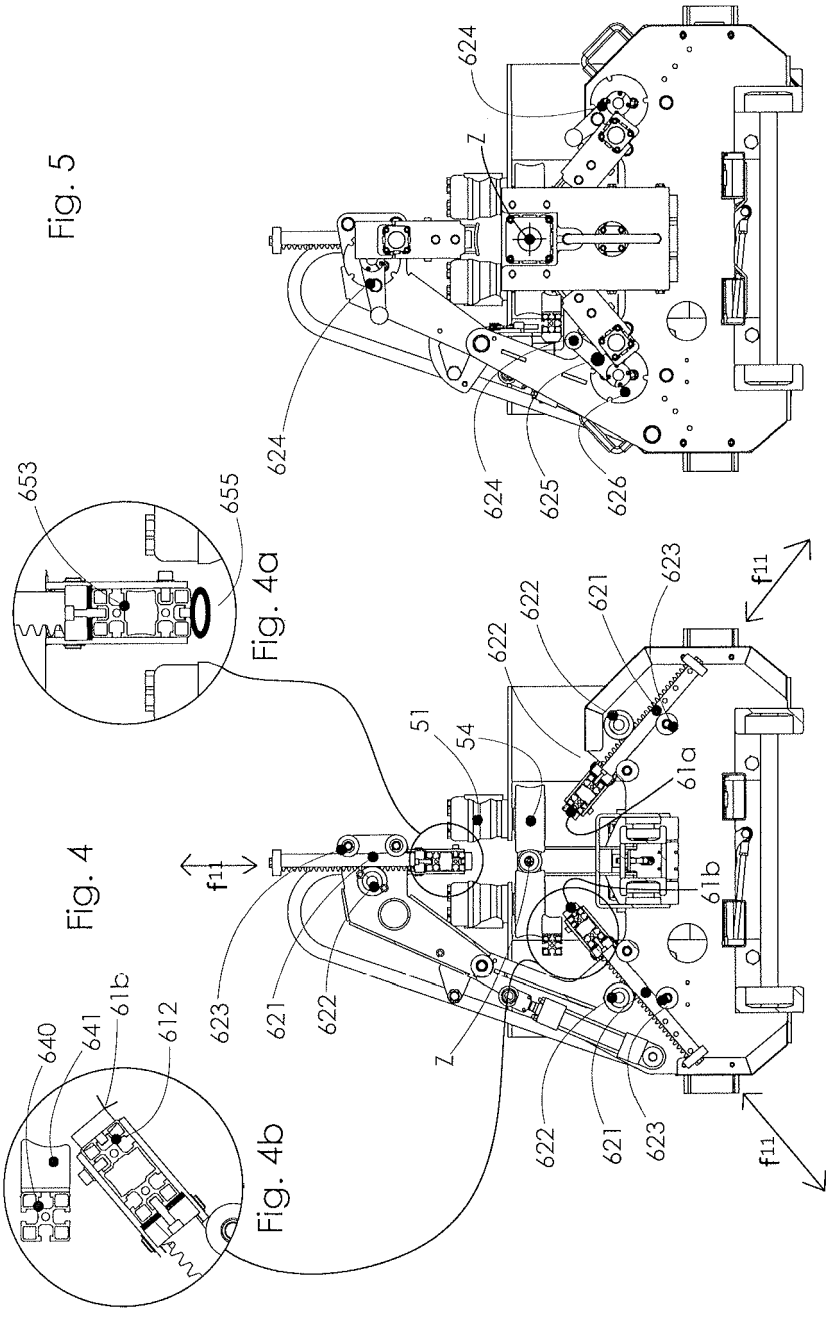


Fig. 5
624
Z
624
624
625
626
Fig. 4a
653
655
Fig. 4
f11
623
621
622
622
51
54
622
621
623
61a
61b
f11
Z
622
621
623
f11
Fig. 4b
640
641
61b
612

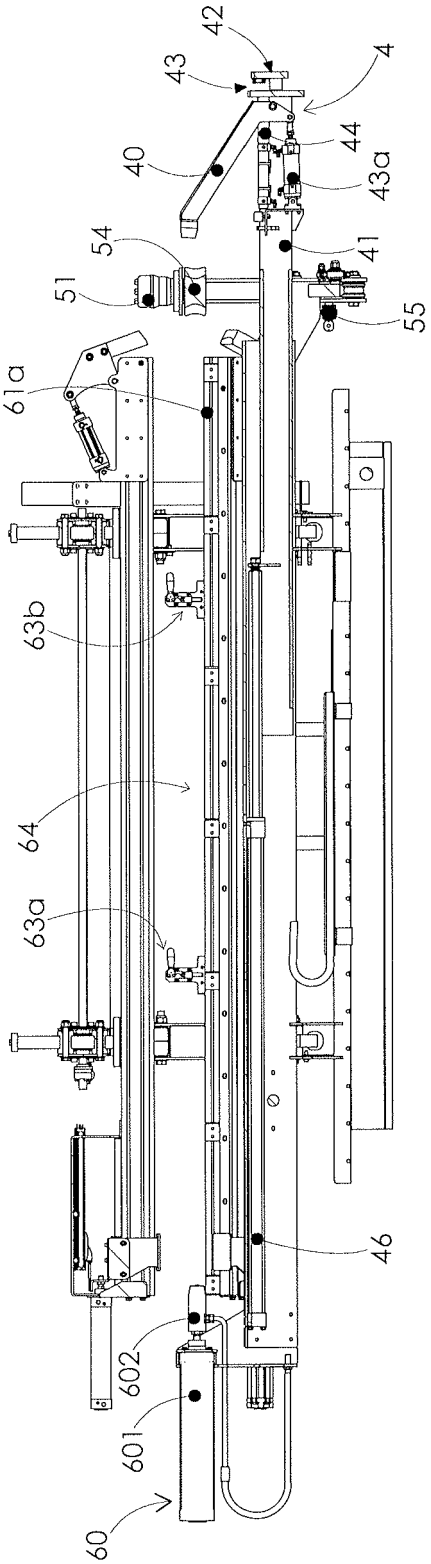


Fig. 6

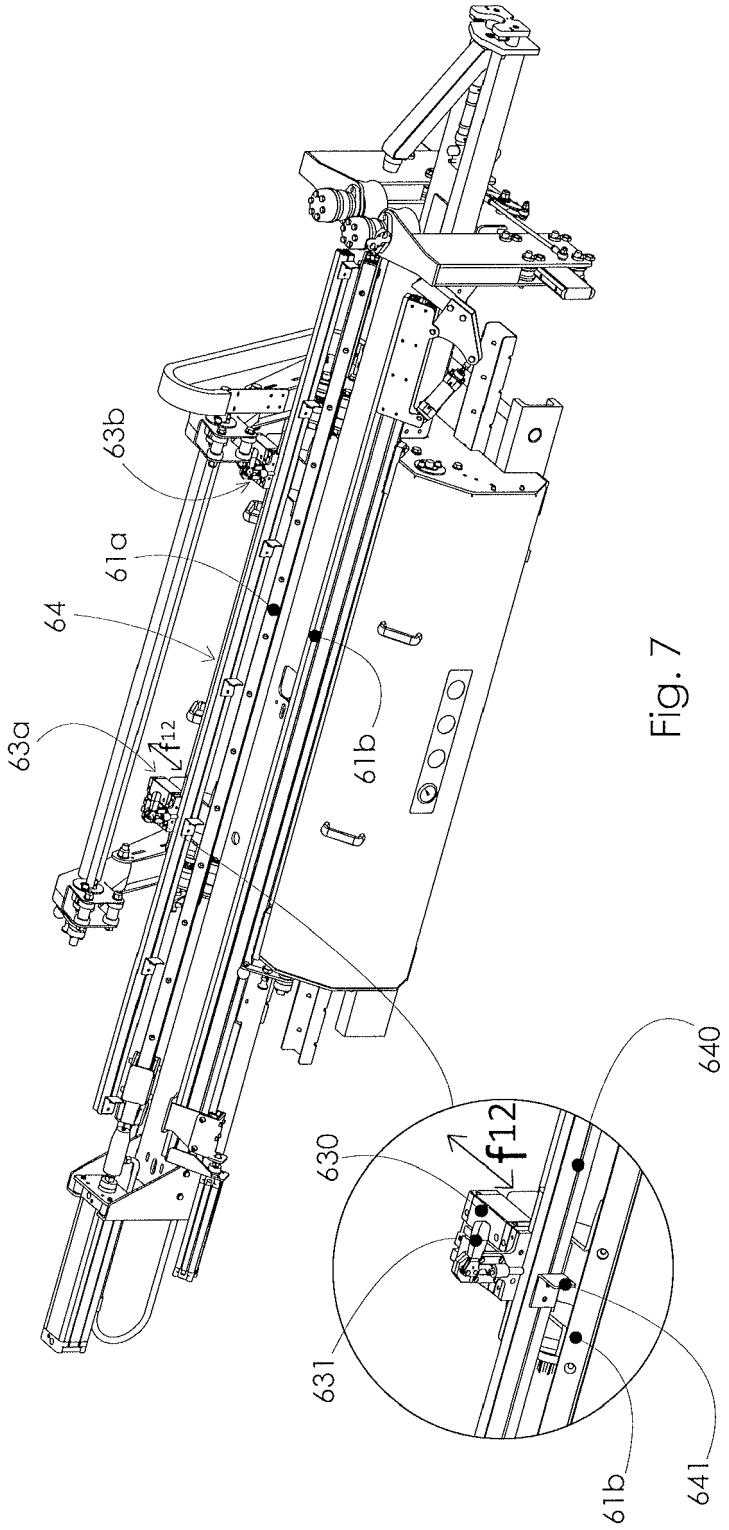


Fig. 7

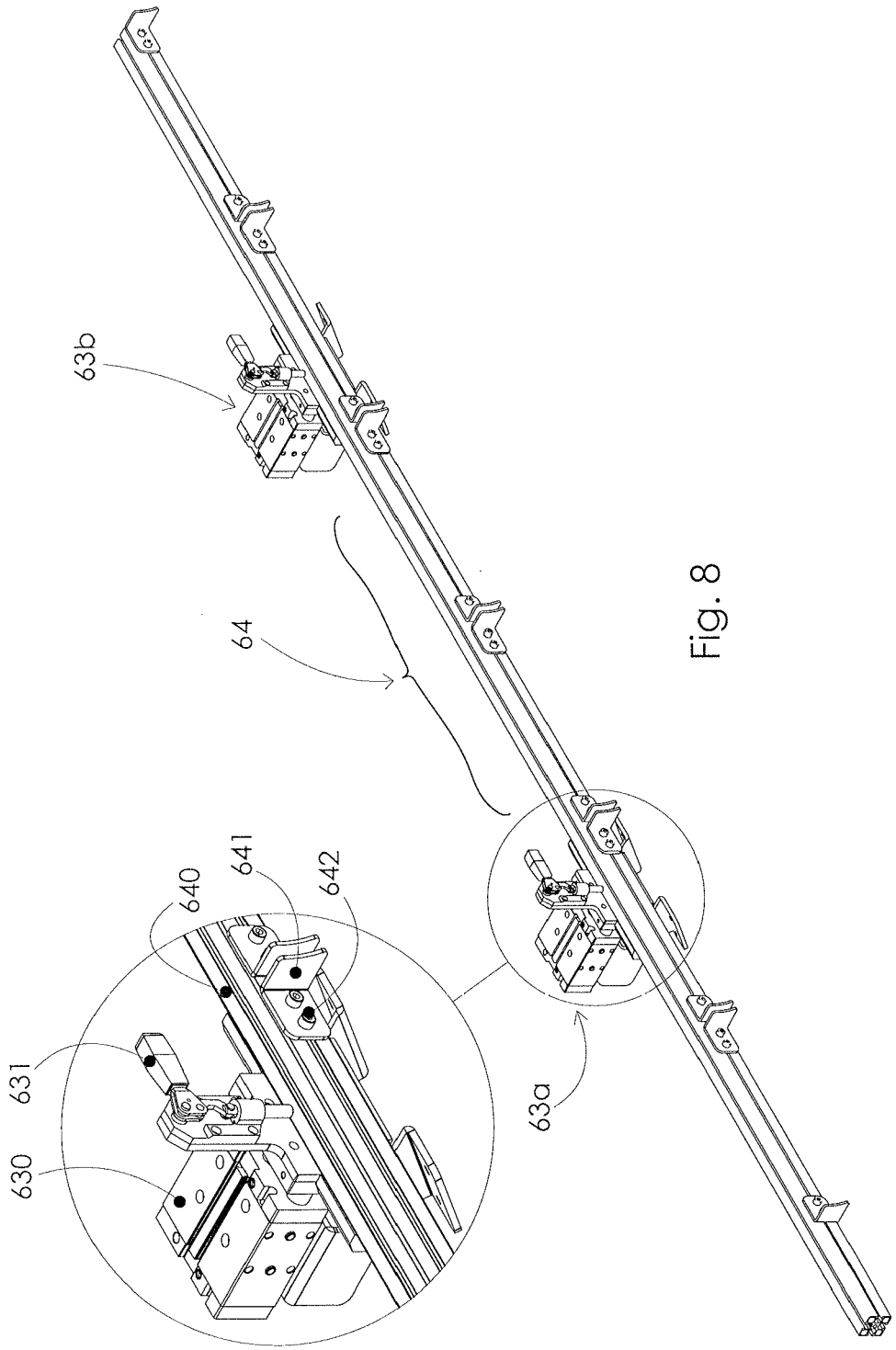


Fig. 8

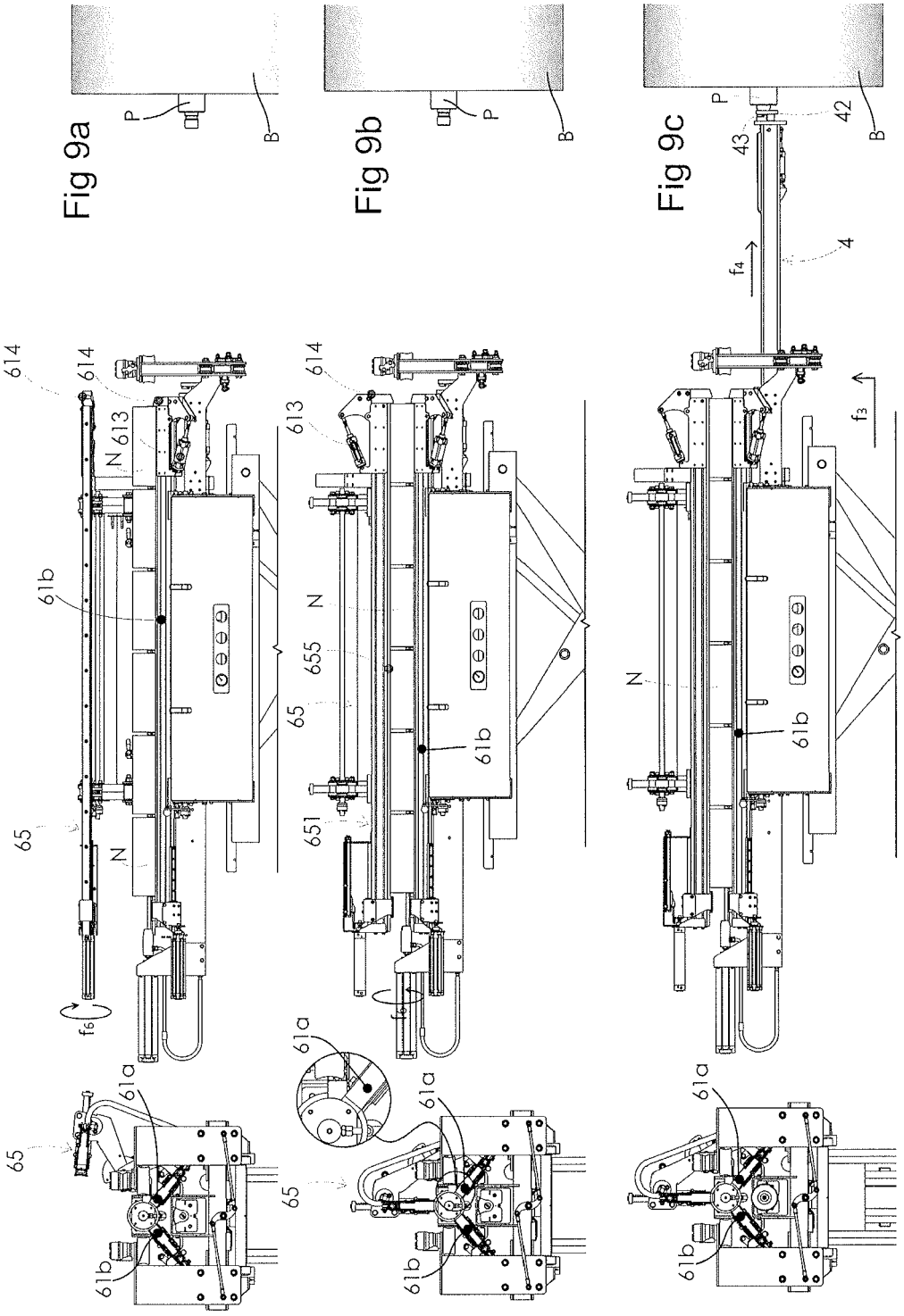


Fig 9a
Fig 9b
Fig 9c
P
B
42
43
4
f4
f3
f6
614
613
N
61b
65
655
651
61a

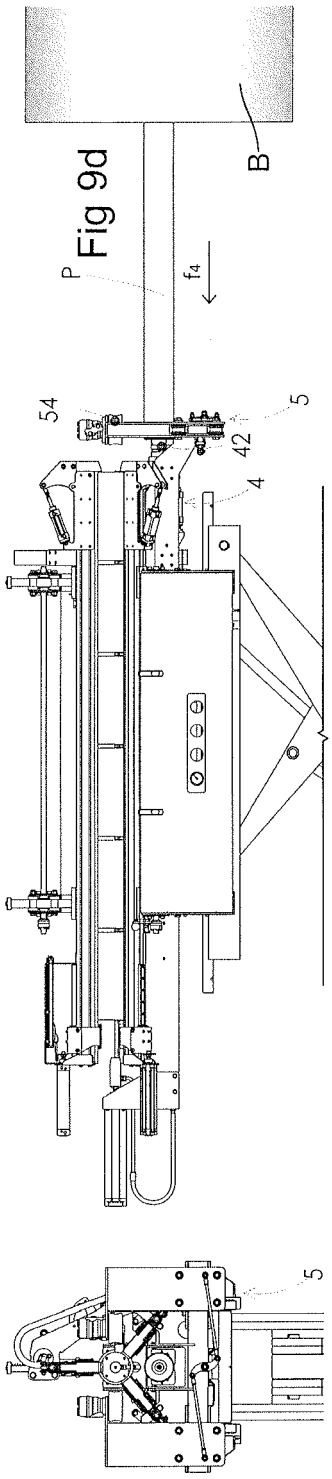


Fig 9d

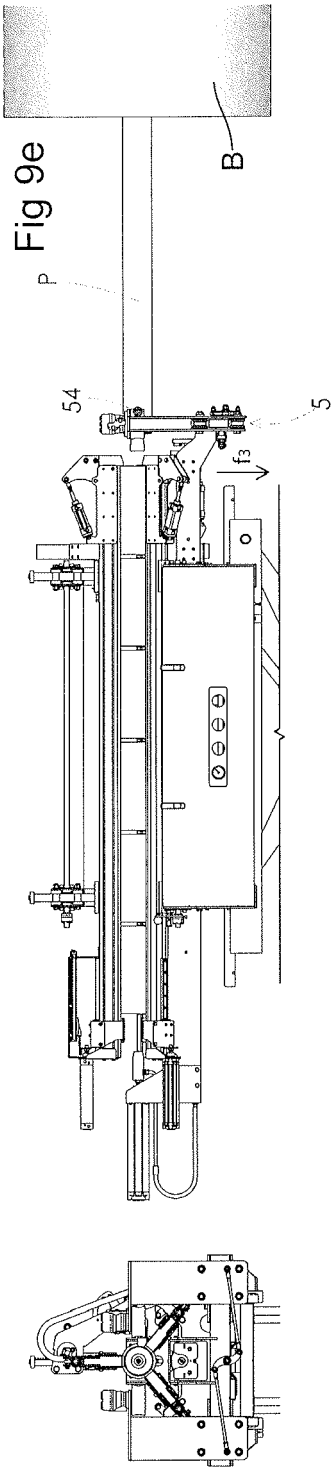


Fig 9e

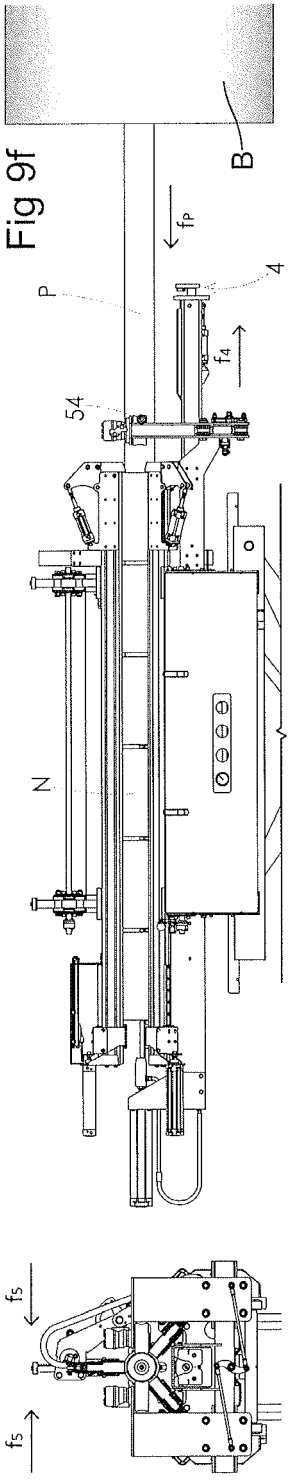


Fig 9f

Fig 9g

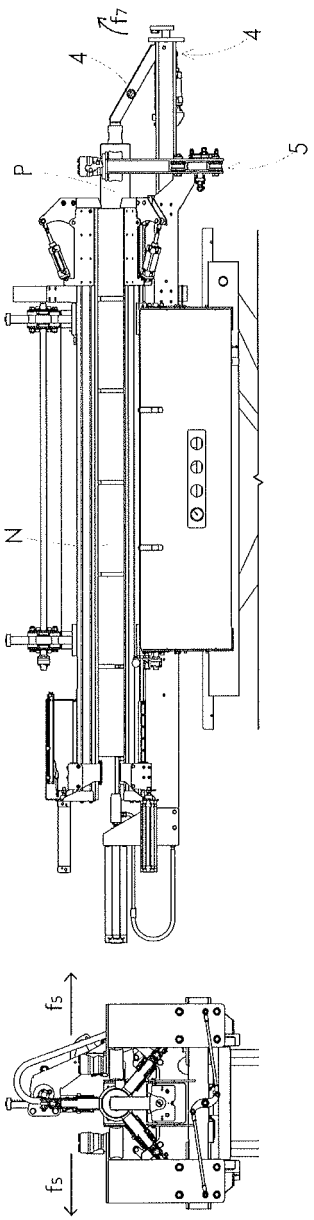


Fig 9h

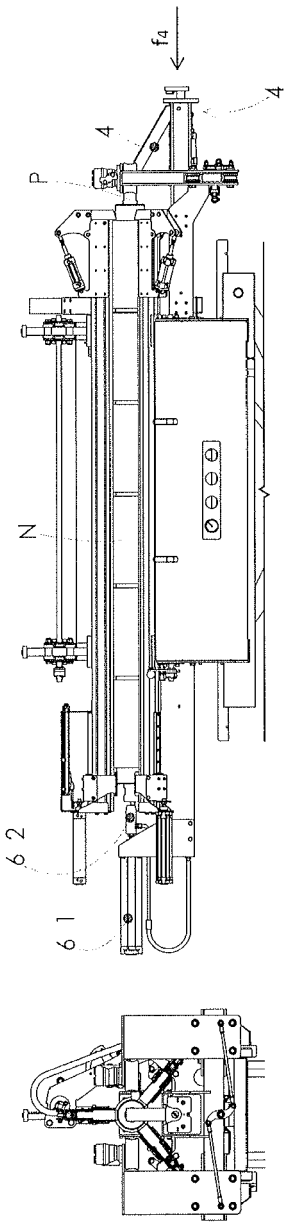


Fig 9i

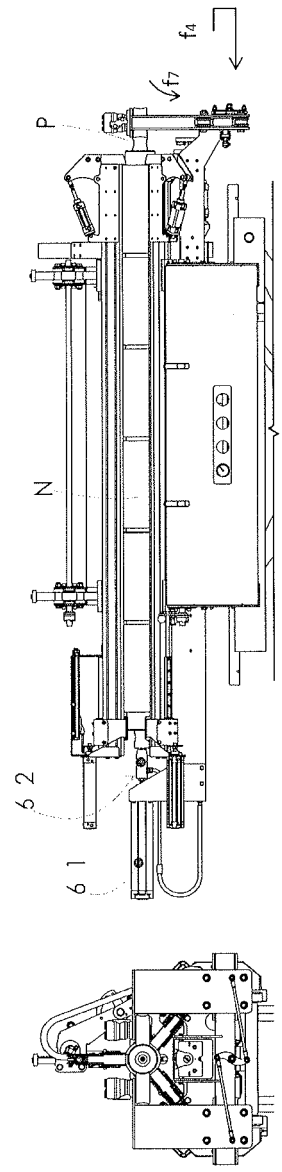


Fig 9j

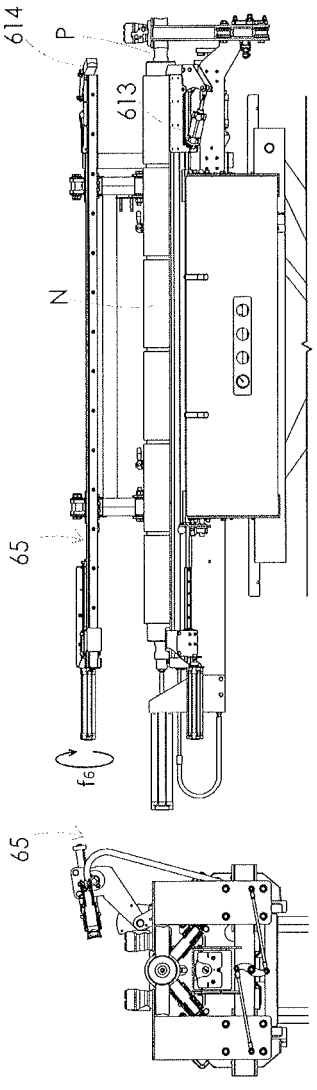


Fig 9k

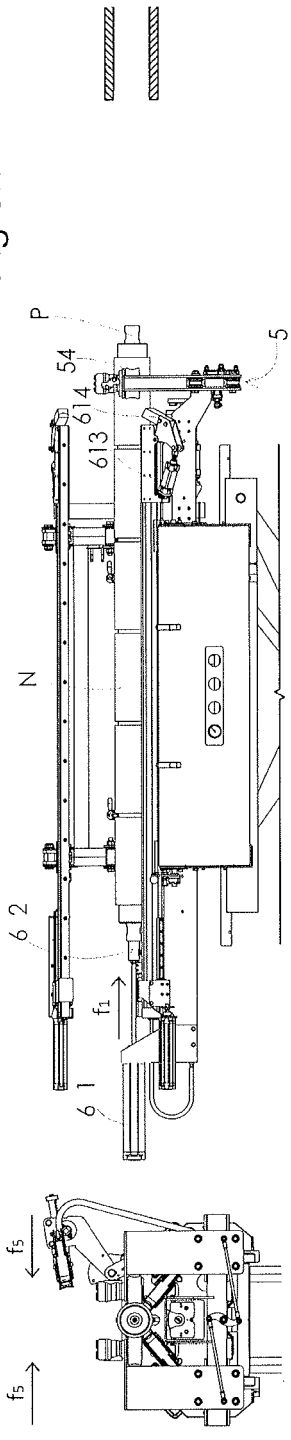


Fig 9l

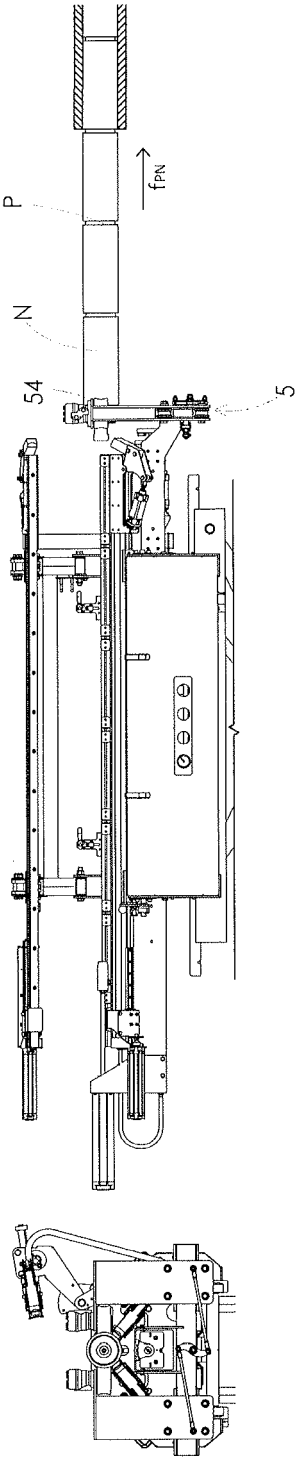


Fig 9m

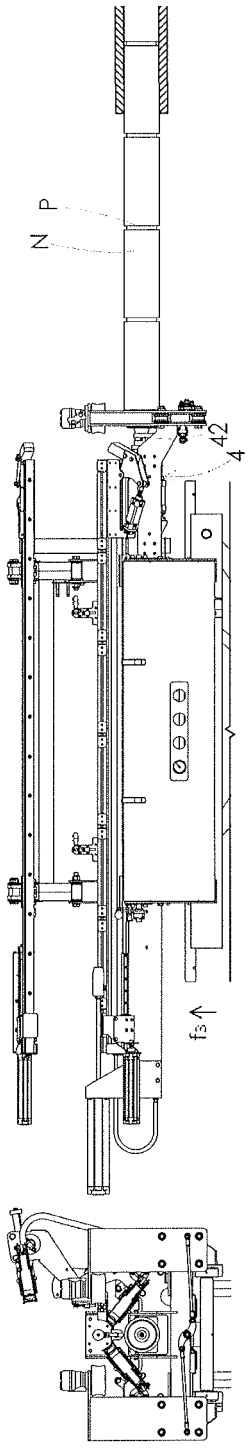


Fig 9n

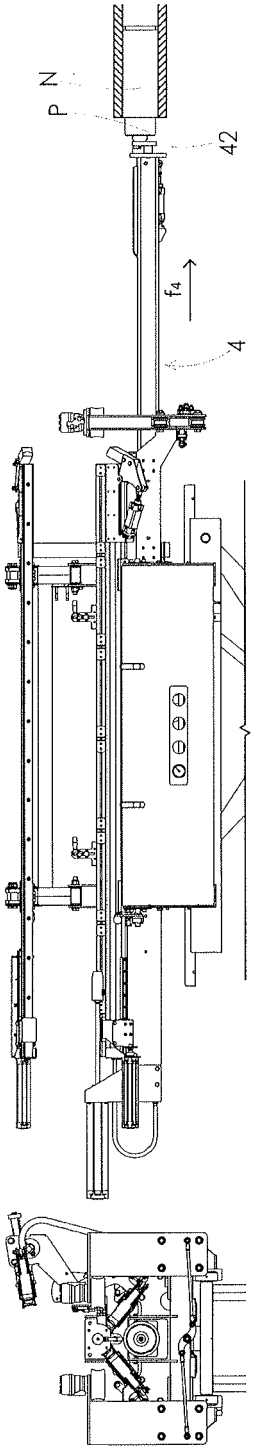


Fig 10a

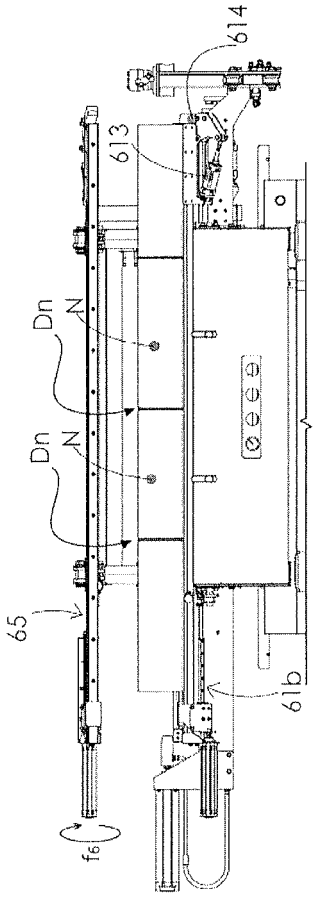


Fig 10b

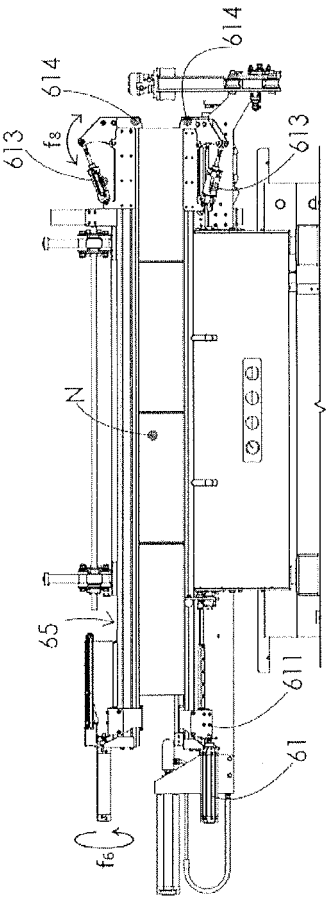


Fig 10c

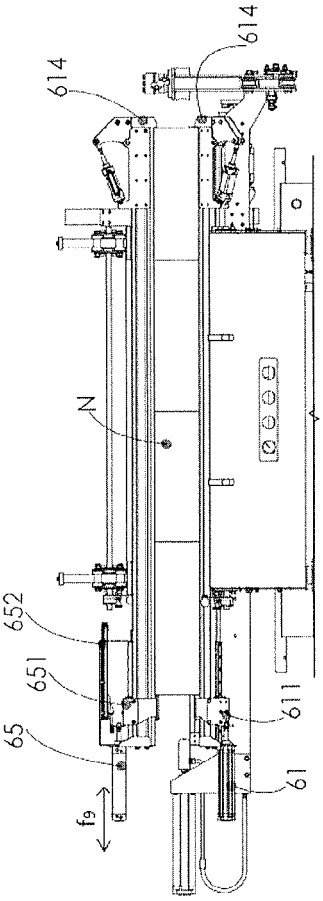


Fig 10d

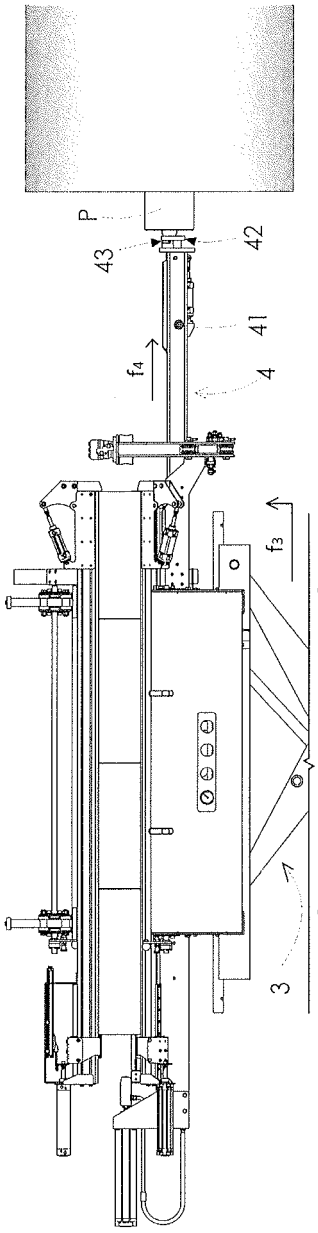


Fig 10e

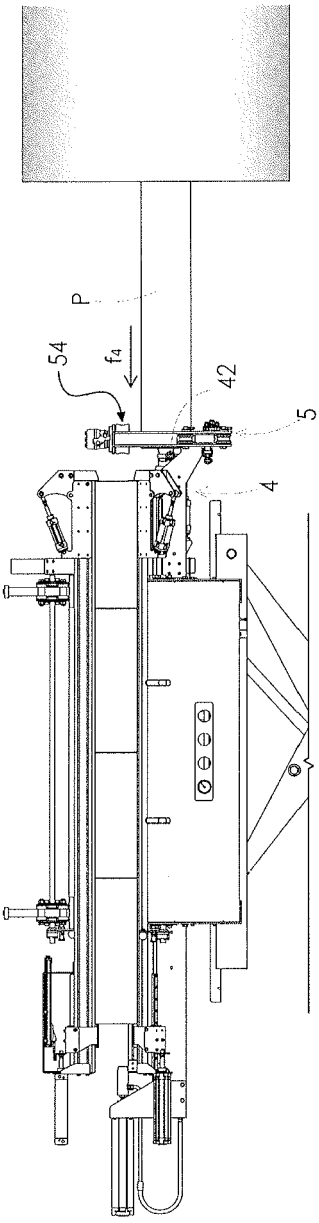


Fig 10f

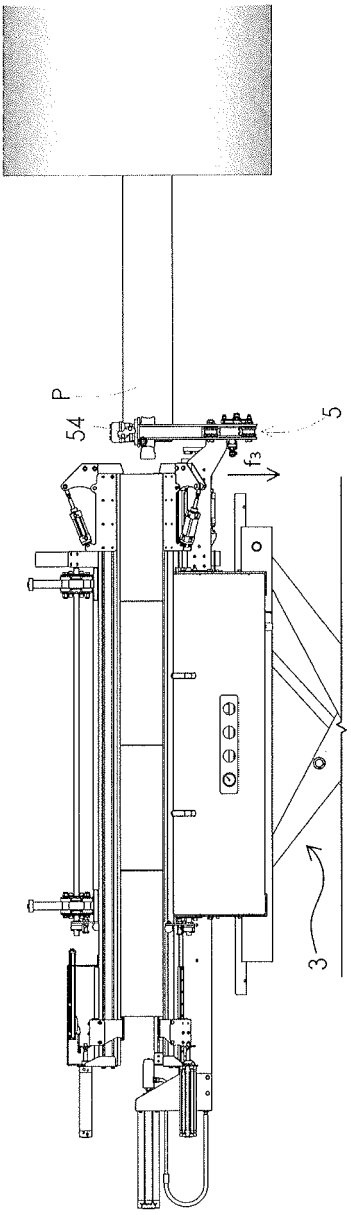


Fig 10g

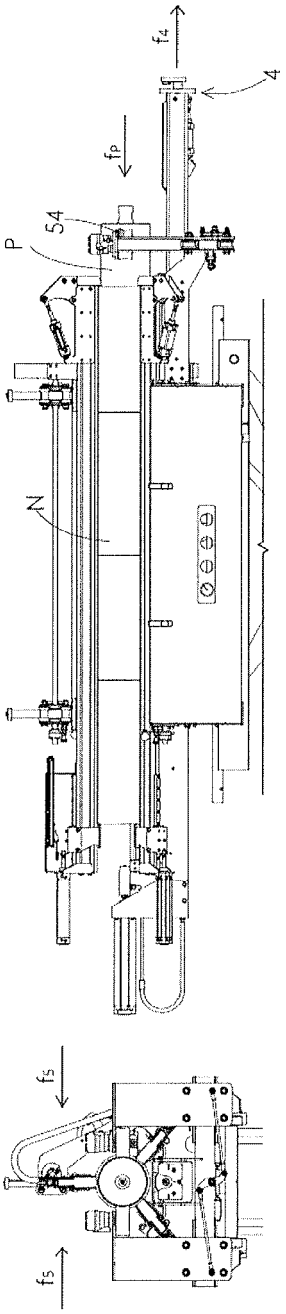


Fig 10h

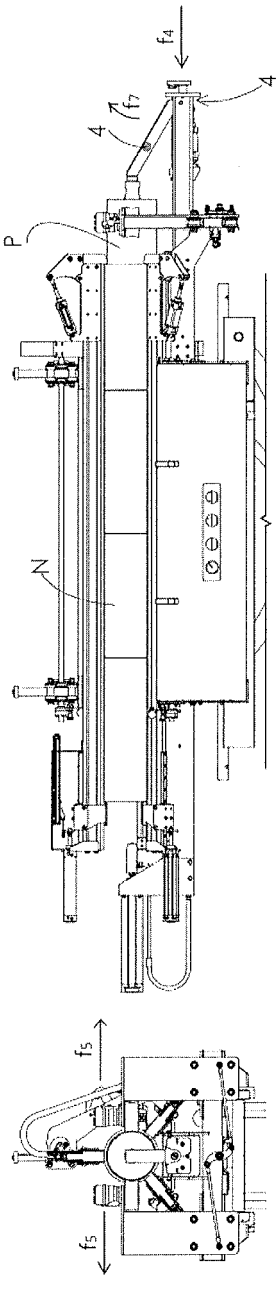


Fig 10i

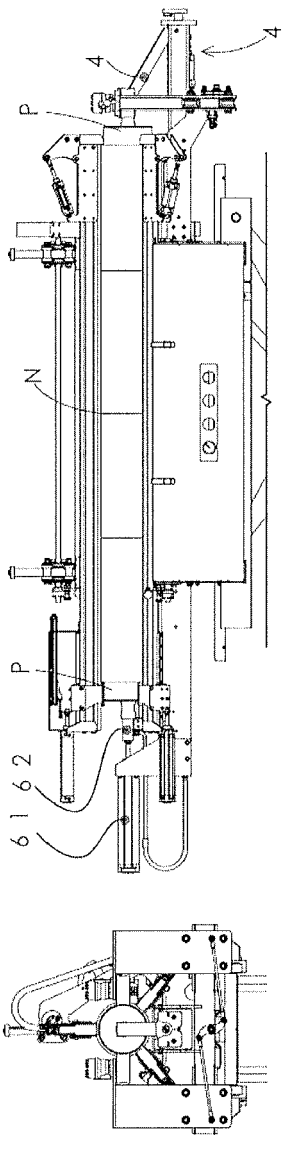


Fig 10j

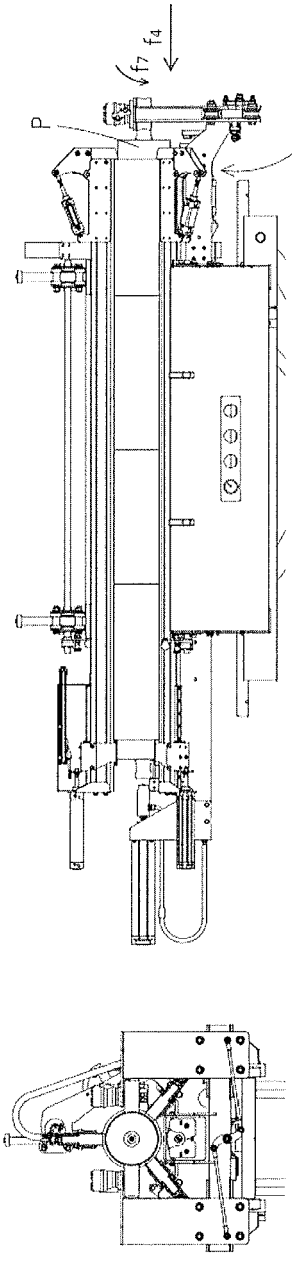


Fig 10k

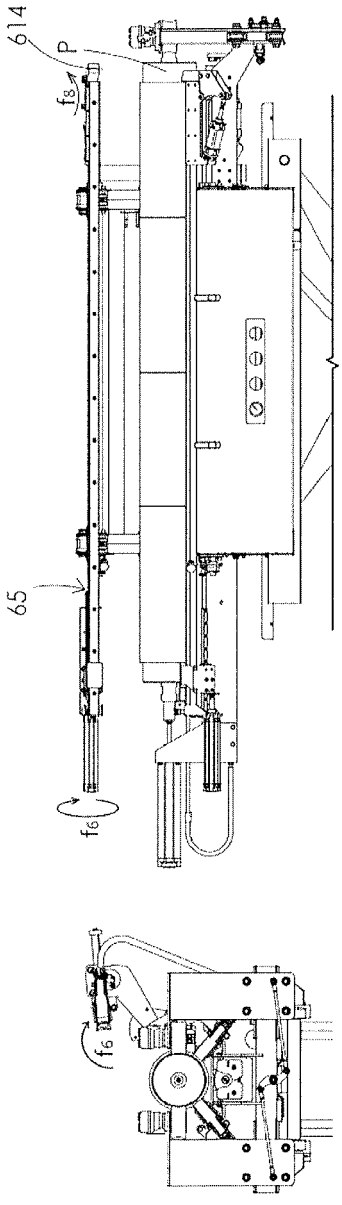


Fig 10l

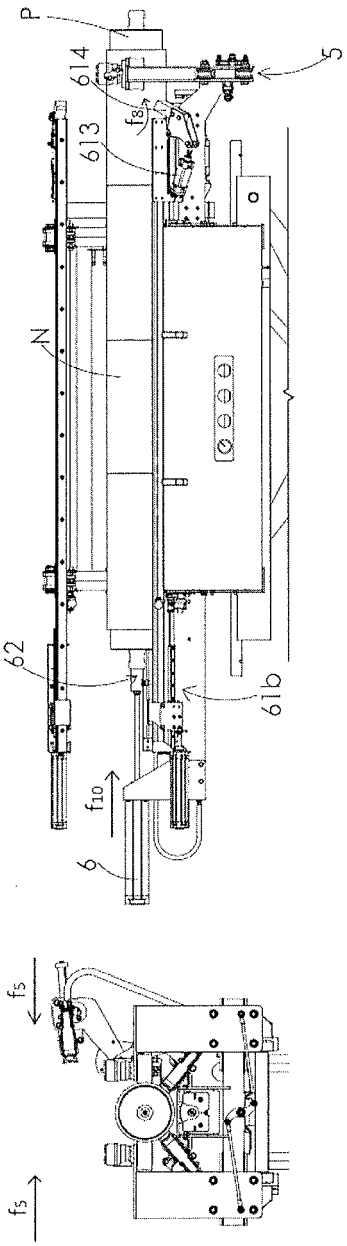


Fig 10m

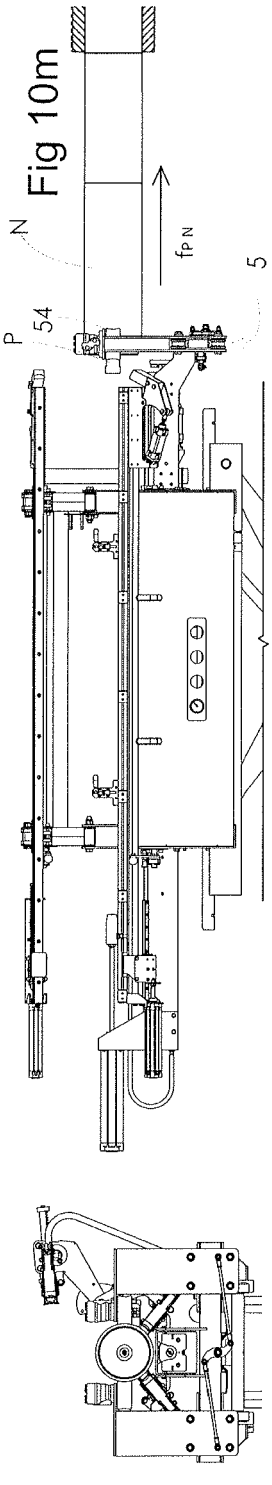


Fig 10n

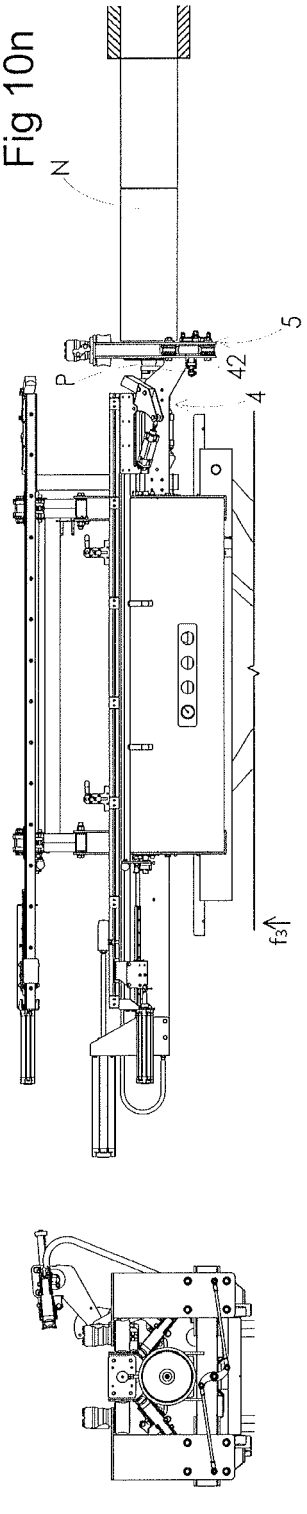
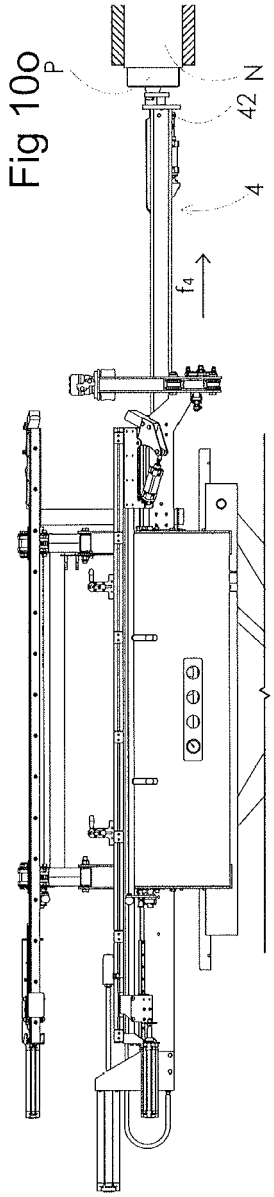


Fig 10o



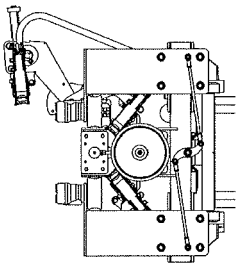


Fig 10p

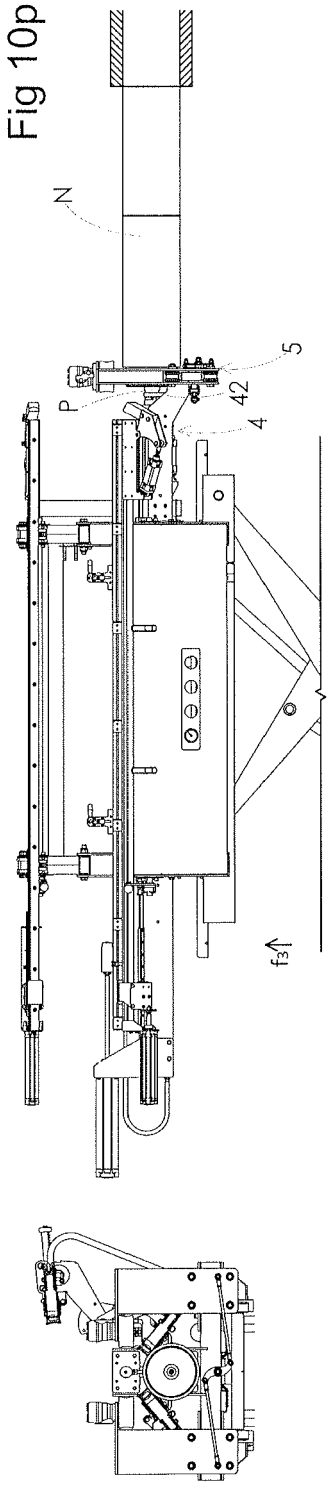
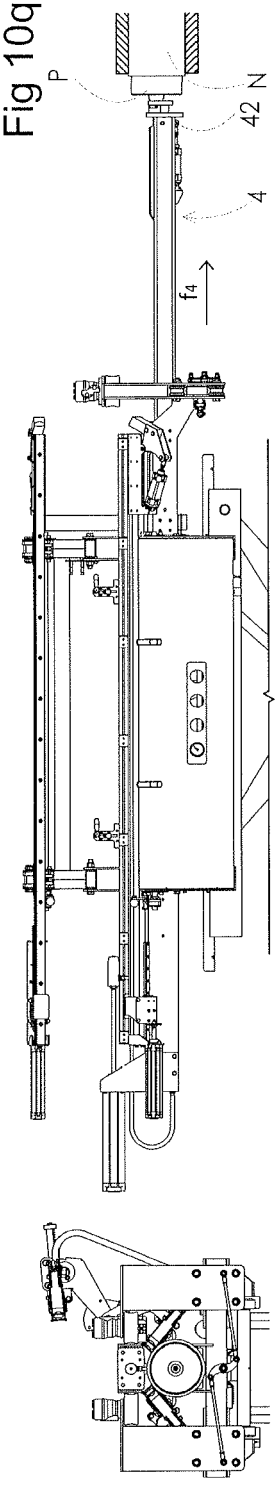


Fig 10q



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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 0658

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A,D	WO 2009/004659 A1 (CELLI NONWOVENS SPA [IT]; ACCIARI GIUSEPPE [IT]) 8 January 2009 (2009-01-08) * page 5, line 25 - line 29 * * page 12, line 14 - page 13, line 2; figures *	1,19	INV. B65H19/30
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 July 2015	Haaken, Willy

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