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(54) METHOD AND APPARATUS FOR MAKING STIRRUPS

VERFAHREN UND VORRICHTUNG ZUR HERSTELLUNG VON BÜGELN

PROCÉDÉ ET APPAREIL PERMETTANT DE FABRIQUER DES ÉTRIERS

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(73) Proprietor: **Schnell S.p.A.**

61030 Montemaggiore al Metauro PU (IT)

(72) Inventor: **MONTEMARANI, Massimo**

I-61030 Montemaggiore Al Metauro (PU) (IT)

(74) Representative: **Manzella & Associati**

Via dell'Indipendenza, 13

40121 Bologna (IT)

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Description

Technical Field

[0001] The present invention concerns a method and an apparatus for making stirrups, in particular tridimensional stirrups.

Background Art

[0002] It has been known the use of apparatuses for making variously shaped metal stirrups starting from a metal rod. In particular, it has been known the requirement of making also tridimensional stirrups, intended, for example, to be used as spacing element suitable to be inserted between two metal nets. In order to accomplish this task, at present electro-welded lattice girders are also used, even though this solution proves to be expensive, considering that lattice girders are only available of standard sizes. The use of tridimensional stirrups, of suitable dimensions and therefore made to measure for every requirement, is vice versa cheaper and more practical.

[0003] A problem generally complained in this specific field lays in the difficulty of producing tridimensional stirrups. At present, folding apparatuses exist able to fold an iron rod for making bidimensional stirrups, while the making of tridimensional stirrups has not yet found efficacious solutions.

[0004] EP 0519865 discloses a tridimensional apparatus which allows to make stirrups of considerable size. Nevertheless, such solution does not well suit to the use in the field of metal rods for reinforced concrete, furthermore it results to be very complicated and expensive to produce.

[0005] EP 0396489 discloses a supplementary fold device suitable for apparatuses intended for the field of metal rods for reinforced concrete. Such device is able to create folds in a metal wire on different planes with respect to the work plane, allowing in this way the shaping of tridimensional stirrups in an easy way. WO 2011/064222 discloses an apparatus for making tridimensional stirrups comprising a first fold unit provided with first contrasting means, a support rotatable with respect to the first contrasting means and first bending means mounted mobile around said first contrasting means. The first bending means are predisposed to cooperate with the first contrasting means in order to bend elongated metal elements on a first bending plane defined by said support. The apparatus further comprises a second fold unit comprising second contrasting means mounted on said first bending means and second bending means arranged mobile with respect to the support in a slanting direction with respect to the first bending plane. Known solutions of this type comprise two clearly distinct fold units, operatively aligned along the rod feeding axis, which, therefore, do not allow to easily make structures of reduced size. Moreover, the presence of two fold units, besides burdening on the apparatus costs,

may also be an obstacle to the working of bidimensional stirrups. In order to remedy this problem, the two fold units are arranged reciprocally spaced from one another at a certain distance, penalizing nevertheless the production of tridimensional elements which often require the alternation of folding phases between the two fold units and the transfer from one unit to another till the product is complete.

10 Disclosure

[0006] The task of the present invention is that of solving the aforementioned problems, devising a method and an apparatus which allow to make in an optimal manner both bidimensional and tridimensional stirrups.

[0007] Within such task, it is a further scope of the present invention that of providing for a method and an apparatus which enable to make tridimensional stirrups having any size and shape.

[0008] Another scope of the present invention is that of providing an apparatus for making tridimensional stirrups having a simple conception, a securely reliable functioning and versatile use, as well as relatively economic costs.

[0009] The cited scopes are attained, according to the present invention, by the method for making stirrups according to claim 1, as well as by the apparatus for making stirrups according to claim 9.

[0010] The method for making stirrups provides to prearrange at least one handling unit for a metal rod feeding and/or backing according to a handling direction, a fold unit provided with a central folding mandrel and with an eccentric fold pin rotatable about a central mandrel for folding the same metal rod. The fold unit works on a work plane represented by the geometrical plane orthogonal to the central mandrel axis and comprising the above mentioned handling direction. A grip means mobile transversally to the work plane is provided so as to intercept the metal rod to be folded, the grip means being as well rotatable about the axis of the intercepted metal rod in order to rotate the same intercepted metal rod and perform the folding by means of said fold unit for making a tridimensional stirrup.

[0011] The method provides then to handle the metal rod along the handling direction by means of the above mentioned handling unit; performing the folding of the metal rod on the above mentioned work plane by means of the fold unit, by operating in rotation the eccentric folding pin about the central mandrel in suitable step relationship.

[0012] The method provides as well, in suitable step relationship with the cited handling and with folding steps, to operate the grip means in a direction transversal to the work plane for intercepting and tightening the rod.

[0013] According to the method object of the invention, when the rod is tightened by the grip means, the other members which are in contact with the rod release it. The grip means rotates about the axis of the tightened rod,

in a controlled way, thus producing the corresponding rotation of the same rod.

[0014] The axial rotation of the rod, tightened by the grip means, enables the fold unit to make a tridimensional stirrup. In particular, the method provides to perform a sequence of folding steps of the rod by means of the same fold unit suitable to perform such folding steps on the same work plane, which orientation is fixed. When the rod, which has already at least partially been folded, is axially rotated, its folds, which have been already made, result oriented on respective surfaces, or fold planes, correspondently rotated, distinct from the work plane on which the fold unit, having fixed orientation, works.

[0015] The rotation of the metal rod performed by the grip means occurs in controlled way, so as to ensure the making of the tridimensional stirrup according to the desired design.

[0016] Moreover, in the rotation step, it is important that the rod is free as much as possible, that is, being gripped merely by the grip means, at least for a considerable tract, so as to avoid or minimize twisting stress.

[0017] The apparatus according to the invention comprises, in a corresponding way, a fold unit, working in an operative station for the tridimensional folding of a metal rod on a respective work plane. The apparatus comprises a handling unit for handling and leading the rod to the fold unit, feeding and/or backing, and grip means mobile transversally to the cited work plane and rotatable about the handled rod, for intercepting, tightening and rotating the same rod about the same direction.

[0018] As it was said before, the rotation of the grip means, mobile on the work plane and substantially rotatable about the handling direction of the rod, allows to perform a series of folds for making tridimensional stirrups, starting from a handled metal rod, feeding and/or backing, along the above mentioned handling direction.

[0019] Moreover, the handling unit can be alternatively operated between an active configuration, gripping the rod to be handled, and an inactive configuration, releasing the same rod.

[0020] In particular, the grip means can be made up of one or more jaw clamps, foldaway mobile transversally to the work plane.

[0021] The above mentioned jaw clamps can be interposed between the handling unit and the fold unit for intercepting an intermediate portion of the metal rod to be worked.

[0022] According to a particular embodiment, the apparatus comprises a cutting and measuring station and transferring means from the cutting and measuring station to the operative station wherein the cited fold means, the grip means and the feed means are provided.

[0023] In particular, the operative station for the bidimensional and tridimensional folding of the metal rod can be placed on a different level, preferably parallel and overlaying with respect to the cutting and measuring station, in which the rod is firstly drawn and then possibly

straightened.

[0024] As an alternative, the operative station for the bidimensional and tridimensional folding of the rod can be placed on the same plane of the drawing and measuring station. In such case, the cited transferring means performs the transferring of the rod by shifting on the same work plane.

[0025] In both cases, a main drawing unit is preferably present, and the cited external handling unit is associated with it, opposed with respect to the fold unit.

[0026] As a further alternative, according to a further embodiment of the apparatus object of the invention, the handling unit for the tridimensional folding can coincide with the main drawing unit. In such case, the above described transferring means cannot be provided, since the feeding and cutting steps occur on the previously described work plane, on which the fold unit and the handling unit are suitable to cooperate. In such case, the cut means works on the already folded piece, instead of on the rod which is being fed and handled.

[0027] In any case, the apparatus results to be really compact and able to make a series of extremely close folds, for making tridimensional stirrups.

[0028] As a consequence, the specific limits of known apparatuses comprising two different and separated or reciprocally integrated folding heads, requiring repeated displacements of the working operations between the two heads and producing a considerable waste of energy and time, in spite of the overall performance of the apparatus, are overcome. It is as well to be underlined that the apparatus according to the invention does not entail risks about a wrong positioning of the stirrup being formed during the working steps, while in known apparatuses the need of repeated displacements considerably increases such risk, until the complete discharge of the piece from the working members, also because of the inevitable deformations of the rod material.

[0029] It is to be observed that the grip means does not interfere in the functioning of the other working unit of the apparatus. Therefore, the apparatus allows to make a series of folds on reciprocally oblique planes, for easily making bidimensional and tridimensional stirrups. Moreover the apparatus is intended to realize indistinctively both bidimensional and tridimensional kind of stirrups.

Description of Drawings

[0030] Details of the invention shall be more apparent from a detailed description of a preferred embodiment of the apparatus for making tridimensional stirrups according to the invention, illustrated for indicative purposes in the attached drawings, wherein:

figures 1 to 14 show a perspective view of the apparatus for making tridimensional stirrups object of the invention, in a sequence of operating steps;
figures 15a and 15b show a perspective view of the same apparatus in different final working steps;

figures 16 to 27 show a perspective view of the apparatus for making tridimensional stirrups object of the invention in a second embodiment, in a sequence of working steps;

figures 28a and 28b show a perspective view of the apparatus shown in figures 16 to 27 in different final working steps;

figure 29 shows a perspective view of a further embodiment of the apparatus according to the invention;

figures 30 to 37 show a perspective view of the apparatus shown in figure 29 in following working steps; figures 38a and 38b show a perspective view of the same apparatus illustrated in figure 29.

Best Mode

[0031] With particular reference firstly to figures 1 to 15a, 15b, the apparatus for making bidimensional and tridimensional stirrups according to the invention is indicated in its entirety with 1. The apparatus comprises an operative station 10 for the folding, particularly tridimensional, on a work plane 2 on which a metal rod 3 is handled feeding and/or backing, according to a handling direction A. More in particular, the operative station 10 of the apparatus 1 firstly comprises a handling unit 4, for exemplar supplementary or external with respect to a main drawing unit not shown in figures and working upstream of a cutting and measuring station, as it is better described in the following. The operative station 10 comprises as well a fold unit 5 for folding the handled rod 3. Preferably, the fold unit 5 is made up of a traditional folding head, provided for example, in known way, with a central mandrel 6 or with a template and with an eccentric fold pin having axes parallel to one another and substantially orthogonal to the work plane 2, so as to fold the metal rod 3 on the same plane 2. More precisely, the eccentric fold pin 7 is operated rotatable about the central mandrel 6, so as to fold the metal rod 3 on the work plane 2 according to the winding produced about the central mandrel 6. Nevertheless it is possible to provide the use of a folding head of different type, which is suitable to make the folding of the metal rod 3 on the work plane 2.

[0032] In practice, the work plane 2 represents the geometrical plane orthogonal to the axis of the central mandrel 6 and containing the handling direction A.

[0033] Preferably, the handling unit 4 is made up of couples of handling or drawing wheels, counter-rotating and opposite with respect to the above mentioned handling direction A, for peripherally engaging and drawing the rod 3. The drawing wheels 4 can be arranged on the work plane 2, coplanar, so as to shape between them, at the handling direction A, a passage channel 8 for the rod 3. More precisely, the drawing wheels 4 can be operated, in each couple, alternatively between an inactive configuration and an active configuration. In the inactive configuration, the opposite wheels 4 are arranged separated from each other, for widening the passage chan-

nel 8 so as to receive the rod 3 to be handled towards the fold unit 5.

[0034] In the active drawing configuration, the drawing wheels 4 are approached to each other for tightening the rod 3 prearranged in the passage channel 8. A respective command means, not represented in drawings, is prearranged for mutually approaching and spacing the drawing wheels 4 of each couple, synchronically, and for driving in rotation at least one wheel of each couple. The driving in rotation of the drawing wheels in approached active configuration causes the feeding of the rod 3 tightened between the same wheels. In the illustrated case, the external drawing unit 4 comprises two couples of opposed drawing wheels, but the apparatus 1 according to the invention can comprise as well a different number of them.

[0035] The metal rod 3 to be fold for making a stirrup, in particular a tridimensional one, can be cut, for example by means arranged upstream of the operative station 10. As an alternative, it is possible to provide that the apparatus is prearranged for folding tridimensional stirrups starting from a rod 3 which has not yet been cut, as it is described in the following.

[0036] In the case disclosed in figures 1 to 15a and 15b, the rod 3 reaches the handling unit 4 joined to the row material which is located upstream, and after being tightened by the wheels of the handling or external drawing unit 4 is cut to size (see for example figures 5 and 6). More precisely, the disclosed apparatus comprises as well a feeding and cutting station 20, in which the metal rod 3 coming from a bar or unwound from a coil not represented, is prearranged along a feeding and cutting direction A_0 , possibly straightened through a straightening device non illustrated, for example having counter-rotating rolls, for being cut to measure by a cutting member 22. In particular, the wheels of the straightening unit can be suitably protected by a protection housing so as to avoid any interference with the handled rod 3 during the working.

[0037] The apparatus 1 can therefore comprise transferring means for transferring the rod 3, which have been cut to measure, from the feeding and cutting station, in which the straightening unit, possible in case the row material is a coil, and the cutting member 22 work, to the operative station 10, in which the work plane 2 is defined and in which the fold unit 5 and the external drawing unit 4 work, for making bidimensional and tridimensional elements.

[0038] In the illustrated case, for example, the feeding and cutting station 20 and the work plane lay upon different levels or planes. Therefore the transferring means, which is made up of known command means, not represented, is suitable to perform the shifting of the external drawing unit 4 and of the fold unit 5 from the level in which the rod 3 is located for its feeding and cutting to the level of the work plane 2, respectively reaching the configuration 4b and 5b, shown in figures 4 to 15a and 15b.

[0039] In practice, in the disclosed case, the feed and

cut level is on a plane which is substantially parallel to the work plane 2. The transferring means alternatively performs the required shifting motion, suitable to transfer in suitable sequence the working units of the operative station 10 to a plane spaced from the feed and cut plane so as to enable the rod to be displaced above the cut members for its unwinding, without interferences of the folding operations. Moreover, the transferring means performs the placing of the cited units preferably in separated and autonomous manner on each unit. More precisely, the drawing unit 4 can be transferred and placed on three working levels: a position 4' on a first level, underlying the feed and cut plane, which does not engage in any case the space engaged by the feed and cut operations or by the making of bidimensional stirrups; a position 4a on a second level, lifted and parallel to the first, in which the drawing unit is arranged on the feed and cut plane, for intercepting the feeding rod 3; a position 4b on a third level, lifted with respect to the above mentioned second level, coinciding with the work plane 2, for making tridimensional stirrups. In the same way, the fold unit 5 can be placed by the above mentioned transferring means for being prearranged on the level suitable to allow the different working steps. For example, the fold unit 5 can be transferred at least from the configuration 5a on the cited second level, for carrying out the folding of the feeding rod 3 or for receiving the same rod, freely passing, to the cited configuration 5b on the cited third level, for cooperating with the drawing unit in the corresponding position 4b for making tridimensional stirrups.

[0040] The apparatus 1 comprises as well a grip means 11 which is suitable to intercept the handled rod 3 and substantially rotatable about the handling direction A on the work plane 2. The grip means 11 is suitable to tighten and to rotate the rod 3 for a determined angular width about the handling direction A on the work plane 2, in order to bring sections correspondently turned of the rod 3 to the same fold unit 5 and thus to enable the folding of the same rod 3 on laying planes being oblique to one another, for making a tridimensional product.

[0041] For laying plane of any fold it is meant in particular the plane defined by tracts of the rod converging towards a folded rod portion.

[0042] The grip means 11 is preferably interposed along the handling direction A between the fold unit 5 and the drawing unit 4 and it can act as well as an abutment during the folding step.

[0043] The grip means 11 is preferably made up by a jaw clamp, which can be operated in sequence among different positions. In an inactive position, the pincer 11 is spaced from the handling direction A in which the rod 3 is fed or backed by the drawing unit 4 on the work plane 2. In an interception position 11 a, the jaws 12 of the pincer are interposed open along the handling direction A between the drawing unit 4 and the fold unit 5 on the work plane 2. In a tightening position the jaws 12 of the pincer 11 are tightened along the handling direction A gripping the rod 3. Finally in a tightened turned position

11 b the jaws 12 are kept tightened and turned substantially about the handling direction A of an angle having determined width, for rotating in correspondent manner the metal rod 3 to be fold.

[0044] Substantially, the pincer 11 is operated mobile through the work plane 2, for example perpendicularly, for protruding through an opening obtained on the work plane 2, from the described inactive position, preferably underlying the work plane 2, to the interception position 11 a of the rod 3, protruded with respect to the above mentioned work plane 2 and with the jaws prearranged for receiving between them the rod 3.

[0045] The controlled rotation of the pincer 11 is performed by command means of known type, in suitable step relationship with the feeding and folding operations of the rod by means of the fold unit 5.

[0046] The functioning of the apparatus for making bidimensional and tridimensional stirrups is easy to understand from the previous description.

[0047] The metal rod 3 is firstly prearranged in the feeding and cutting station 20 in which the main drawing unit 21 and the cutting member 22 operate. More precisely, in the first step, the rod 3 is fed on the working level of the feeding and cutting station 20, according to the feeding and cutting direction A_0 (see figure 2). In the same step, the fold unit 5 and the external drawing unit 4 are both spaced from the work plane 2. More precisely, in a first step, the drawing wheels 4 lay rearward at the described first level, in order not to interfere with the feeding operations of the rod, or at the second level but with the wheels spaced from each other in the inactive configuration. In the same way, the fold unit 5 can be in a rearward position below the work plane 2 or arranged on the cited second work level, so as to freely receive the feeding rod 3, between the central mandrel 6 and the eccentric pin 7 (see figure 2). Subsequently, according to the case, the drawing unit 4 is operated by the transferring means for being brought to the second work level, in inactive configuration, that is with the wheels reciprocally spaced, so as to freely receive in the passage channel 8 the rod 3 feeding along the feeding and cutting direction A_0 . The fold unit 5 is placed so as to freely receive the rod 3 passing between the central mandrel 6 and the eccentric folding pin 7 (see figure 3).

[0048] When the rod 3 is fed in the feeding and cutting direction A_0 for a tract of predetermined length, the drawing unit 4 is operated in the active tightening configuration, so as to engage the rod 3. Subsequently, the cutting member 22 is operated for cutting to measure the fed rod 3. By keeping the grip on the cut rod 3, the drawing unit 4 together with the fold unit 5 are brought to the third level, coinciding with the work plane 2, through the activation of the transferring means (see figure 4 and 5).

[0049] At this point, the folding steps for the rod 3, which has been cut to measure, start, by performing the controlled feeding or backing of the rod 3, along the handling direction A on the third level, parallel to the feeding and cutting direction A_0 previously cited, by means of the

drawing unit 4, so as to position the rod 3 in suitable way with respect to the central mandrel 6 and to the eccentric pin 7, so as to perform the desired folds. In suitable step relationship, the grip means 11 is operated for tightening corresponding portions of the rod 3, and for rotating the same rod 3, so as to make folds laying on different planes, in order to obtain tridimensional stirrups.

[0050] As an example, according to the folding cycle shown in figures 6 to 15a, 15b, the rod 3 is firstly backed with respect to the handling direction A (see fig 6), folded by the fold unit 5 on the work plane 2 (see figure 7), being the pincer 11 in an inactive position, underlying the same plane. More precisely, for "backing" it is meant the displacement along the handling direction A, oriented from the handling or drawing unit 4 towards the fold unit 5.

[0051] Subsequently, the rod 3 being worked is again backed with respect to the handling direction A and, at the same time, the pincer is led in the interception position 11 a, with the jaws firstly opened, so as to freely receive the rod 3, then closed (see figure 8).

[0052] The drawing unit 4 releases then the rod 3, for allowing the pincer 11 to be operated in rotation until reaching the rotated configuration 11 b, for performing a corresponding rotation of the worked rod 3 (see figure 9). In the shown case, the rod 3 is rotated of an angle substantially equal to 90° about its axis, substantially corresponding to the handling direction A, which results, as previously described, parallel but on a different level with respect to the feeding and cutting direction A_0 .

[0053] Then, a second fold is made by the fold unit 5, creating tracts on distinct planes of the stirrup being made (see figure 10).

[0054] Subsequently, the pincer 11 releases the rod 3 and comes back to the inactive position below the work plane 2. Then the worked rod 3 is brought back again with respect to the handling direction A in order to position a new portion to be folded at the fold unit 5 (see figure 11).

[0055] Then a new folding of the rod 3 is made on the work plane 2 by the fold unit 5 (see figure 12). The rod is again backed by means of the drawing unit 4 (see figure 13), tightened by the pincer 11, released by the drawing unit 4, for being again rotated about the handling direction A, for example of an angle substantially equal to 90° (see figure 14).

[0056] Finally, the rod is folded in one direction or in an opposed one, according to the shape of the stirrup to be produced (see figures 15a, 15b) and released by the pincer 11 which comes back in the inactive position for freeing the stirrup. The pincer 11 can remain in the gripping position even during the folding step, acting, in an efficient way, as an abutment, thanks to its closeness to the fold unit 5. In fact, the pincer 11 is closer to the fold unit 5 than the drawing unit 4 which can act as abutment too.

[0057] According to a different embodiment, shown in figures 16 to 28a and 28b, it is possible to provide, as an alternative, that the feeding and cutting station 200, comprising the main drawing unit, and the operative station

100, for the tridimensional folding, are substantially coplanar, that is on the same work plane 2. More precisely, in such case, the handling direction B, aligned with the drawing unit 40, this latter being opposite to the main drawing unit, results parallel and shifted with respect to the feeding and cutting direction A_0 . In particular, the fold unit 50 is carried mobile by the cited transferring means between a starting position 50a, in which the unit is suitable to make bidimensional stirrups, and a displaced position 50b, for example arranged below on the same work plane 2, for making tridimensional products.

[0058] In such case, for example, the feeding and cutting direction A_0 is substantially parallel to the handling direction B for folding the rod 3, and laying on the same work plane 2. The fold head 50 is then carried mobile on the work plane 2, between the starting position 50a, at the feeding and cutting station 200 aligned to the feeding and cutting direction A_0 , and the shifted position 50b aligned with the handling direction B. As an alternative, an autonomous fold head can be provided for each position 50a and 50b of the fold unit.

[0059] Substantially, in such case, the rod 3 to be fold is not handled between levels parallel to the work plane 2, as it was in the previously described case, but it is shifted on the same work plane 2 between a positioning aligned to the feeding and cutting direction A_0 and a shifted positioning, aligned to the handling direction B for the tridimensional folding (see figure 17).

[0060] The working steps for making a tridimensional stirrup starting from the rod 3 cut to measure are performed as previously described (see figures 18 to 28a, 28b). In particular, in the shown embodiment further members of known type can be provided, for example an auxiliary pincer, suitable to cooperate for the shifting of the rod 3 being made between the cited directions. As a further alternative, the rotatable grip means 11 can be mobile for performing as well the transferring of the rod 3 from the position aligned to the feeding and cutting direction A_0 to the handling direction B.

[0061] According to a further embodiment of the apparatus according to the invention, shown in figures 29 to 38a, 38b, it is possible to provide that the rod 3 is fold and rotated for making tridimensional stirrups, before being separated from the raw material in bars or coils. Substantially, the main drawing unit 201 provided for equipping the feeding and cutting station or, in case the row material is in coil, the feeding cutting and straightening station, acts also as external drawing unit 4 as previously described, thus being suitable for the handling of the row material to the operative station 101 for making tridimensional products. According to such embodiment, it is therefore possible to proceed with separating the product from the row material by means of the cutting means 221 only at the end of the folding steps at the work station 101.

[0062] Moreover, it is to be noted that, in such case, the handling direction A in the operative station 101 coincides with the feeding, cutting and possible straightening direction A_0 .

[0063] More precisely, in the illustrated embodiment the only present drawing unit is the main one 201, arranged for example in a suitable housing, upstream of the fold unit 5, while the grip means 11 comprises one or preferably more pincers which can be arranged upstream of the drawing unit 201 and the fold unit 5 and/or downstream of this latter (see figure 29).

[0064] The presence of a plurality of suitably spaced pincers 11 allows to synchronically tighten and rotate a corresponding plurality of portions of the worked rod 3, so as to obtain an optimal grip and the desired rotation of the rod 3 interposed between the tightened sections, for allowing the making of the required tridimensional product.

[0065] Obviously, it is possible to make bidimensional and tridimensional stirrups of any shape, by simply combining in suitable way the feeding, the backing, the rotation and the folding of the rod 3 by means of the fold unit 5, of the drawing unit 201 and of the grip means 11.

[0066] The apparatus in object attains the scope of performing in an optimal and quick way the automatic making of tridimensional as well as bidimensional stirrups and it is susceptible of numerous variants. For example, it is possible to provide that the grip means, such as one or more jaws and the relative mechanical members, are housed and supported by structures overlaying instead of underlying the work plane 2, mobile transversally to it from a lifted position to a lowered position on the work plane 2, so as to free the space engaged by the working members, in suitable step relationship with respect to the folding steps.

[0067] A characteristic of the apparatus lays in the extreme compactness of the different working units, which allows in particular to make tridimensional stirrups of reduced size.

[0068] In practice, the embodiment of the invention, the materials used, as well as the shape and dimensions, may vary depending on the requirements.

[0069] Should the technical characteristics mentioned in each claim be followed by reference signs, such reference signs were included strictly with the aim of enhancing the understanding the claims and hence they shall not be deemed restrictive in any manner whatsoever on the scope of each element identified for exemplifying purposes by such reference signs.

Claims

1. Method for making tridimensional stirrups, comprising the steps of:

(a). in an operative station (10, 100, 101), in particular for the tridimensional folding, prearranging at least one metal rod (3) to be folded, a handling unit (4, 40, 201) for a metal rod (3) for feeding and/or backing according to a handling direction (A_0 , A, B), said handling unit being op-

erable between an active position, for gripping and handling said metal rod (3), and an inactive position, for releasing said rod (3), a fold unit (5, 50) provided with a central fold mandrel (6) and an eccentric fold pin (7) rotatable about said central mandrel (6) for folding said metal rod (3) on a work plane (2) orthogonal to the axis of said central mandrel (6) and comprising said handling direction (A_0 , A, B), grip means (11) mobile transversely to said work plane (2) so as to intercept said handled metal rod (3), said grip means (11) being rotatable about the axis of the intercepted metal rod (3) for rotating said intercepted metal rod (3) in order to carry out the tridimensional folding of said rod (3) through said fold unit (5, 50);

(b). performing through said fold unit (5, 50) a first folding of said metal rod (3) by operating in rotation said eccentric fold pin (7) around said central mandrel (6) in suitable step relationship, said first folding coming out on a respective first folding plane delimited on said rod (3) by the two rod tracts converging towards the corresponding folded portion of the rod (3);

(c). handling said metal rod (3) along said handling direction (A_0 , A, B) on said work plane (2) through said handling unit (4, 40, 201) operated in said active position;

(d). operating said grip means (11) in a direction transversal to said work plane (2) so as to intercept a portion of said rod (3) handled along said handling direction (A_0 , A, B);

(e). tightening said portion of said rod (3) intercepted through said grip means (11);

(f). operating at least said handling unit (201, 4, 40) to one said inactive configuration, so as to release said rod (3) tightened by said grip means (11);

(g). operating said grip means (11) in rotation about the axis of said tightened rod (3), so as to rotate the same rod (3) in a corresponding manner;

(h). performing through said fold unit (5, 50) a second folding of said metal rod (3) on said work plane (2), by operating in rotation said eccentric fold pin (7) around said central mandrel (6), said second folding coming out on a respective second folding plane rotated in a corresponding manner with respect to said first folding plane of said first folding.

2. Method according to claim 1, **characterized in that** it comprises the further step of prearranging a measuring and cutting station (20) provided with a cutting member (22) for cutting said rod (3), operating said cutting member (22) for cutting to measure said rod (3) and for transferring said rod (3) cut to measure from said measuring and cutting station (20) to said

operative station (10, 100, 101) on said work plane (2) through transfer means.

3. Method according to claim 2, **characterized in that** said step of transferring said rod (3) cut to measure from said measuring and cutting station (20) to said operative station (10, 100, 101) on said work plane (2) comprises the step of shifting said handling unit (4) among a first level configuration (4'), in which said handling unit (4) is inactive on a plane below and parallel to said work plane (2), a second level configuration (4a) parallel to said first level (4') in which said handling unit (4) is suitable to receive said rod (3) along a feeding and cutting direction (A_0) and a third level configuration (4b) parallel to said first level (4') and to said second level (4a) in which said handling unit (4) is suitable to handle said rod (3) on said work plane (2) for the folding of said rod (3).
4. Method according to claim 2, **characterized in that** said step of transferring said rod (3) cut to measure from said measuring and cutting station (20) to said operative station (100) on said work plane (2) occurs through the transfer on said work plane (2).
5. Method according to claim 1, **characterized in that** said handling unit (201) performs both the feeding of the metal rod (3) along a feeding and cutting direction (A_0) and the said handling along a handling direction (A), being said handling direction substantially coinciding with said feeding and cutting direction (A_0).
6. Apparatus for making bidimensional and tridimensional stirrups, comprising at least an operative station (10, 100, 101) in particular for the tridimensional folding, provided with a handling unit (4, 40, 201) for handling a metal rod (3) along a handling direction (A_0 , A, B), with a fold unit (5, 50) comprising a central fold mandrel (6) and an eccentric fold pin (7) rotatable about said central mandrel (6) for folding said metal rod (3) on a work plane (2) orthogonal to the axis of said central mandrel (8) and comprising said handling direction (A_0 , A, B), each folding plane of a said stirrup being formed starting from said rod (3), being delimited by two tracts converging towards a respective folded portion of said rod (3), said apparatus being **characterized in that** it comprises grip means (11) mobile transversally to said work plane (2), suitable to intercept said handled metal rod (3), said grip means (11) being rotatable about the axis of the intercepted metal rod (3) for rotating said intercepted metal rod (3) and for performing folds on corresponding work planes rotated to each other in a corresponding manner in order to obtain the tridimensional shaping of said rod (3) through said fold unit (5, 50), said handling unit (4, 40, 201) being operable between an active position of gripping and handling

of said rod (3), and an inactive position of release of said rod (3).

7. Apparatus for making bidimensional and tridimensional stirrups according to claim 6, **characterized in that** said grip means (11) is mobile about a direction substantially perpendicular to said work plane (2).
8. Apparatus for making bidimensional and tridimensional stirrups according to claim 6 or 7, **characterized in that** said grip means (11) is mobile alternatively between an inactive position, underneath said work plane (2) where said rod (3) being made is placed, and an active position on said work plane (2), for interacting on said rod (3) being made.
9. Apparatus for making bidimensional and tridimensional stirrups according to claim 6 or 7, **characterized in that** said grip means (11) shapes at least a jaw clamp (12).
10. Apparatus according to claim 9, **characterized in that** it comprises as well a cutting station (20) comprising a cutting member (22) for the cutting to measure of said metal rod (3) folded or to be folded.
11. Apparatus according to claim 10, **characterized in that** it comprises a main drawing unit (21) for drawing said rod (3) to be folded to said fold unit (5, 50), said handling unit (4, 40) being opposed to said main drawing unit (2) with respect to said fold unit (5, 50) and being provided transfer means for transferring said rod (3) cut by means of said cutting member (22) from said cutting station (20) to said operative station (10; 100, 101) on said work plane (2).
12. Apparatus according to claim 11, **characterized in that** said transfer means is associated with said fold unit (5) and with said handling unit (4), for making the transfer of said cut rod (3) to be folded, on different levels, in a direction substantially orthogonal to said work plane (2).
13. Apparatus according to claim 11, **characterized in that** said transfer means is associated with said fold unit (50) for making the transfer of said cut rod (3) to be folded, in a direction substantially coplanar to said work plane (2).

Patentansprüche

1. Verfahren zum Herstellen von dreidimensionalen Bügeln, das folgende Phasen umfasst:
 - (a) Vorbereitung in einer insbesondere für die dreidimensionale Faltung vorgesehenen Be-

triebsstation (10, 100, 101) von mindestens einem zu faltenden Metallstab (3), einer Handhabungseinheit (4, 40, 201) für die Speisung und/oder Stützung eines Metallstabs (3) entsprechend einer Handhabungsrichtung (Ao, A, B), wobei diese Handhabungseinheit zwischen einer aktiven Position zum Ergreifen und Handhaben des genannten Metallstabs (3) und einer inaktiven Position zur Freigabe des genannten Stabs betätigt werden kann, einer Falteinheit (5, 50), die mit einem Dorn zum Falten (6) in der Mitte und einem Exzenterbolzen zum Falten (7) ausgestattet ist, der zum Falten des genannten Metallstabs (3) auf einer zur Achse des genannten Dorns in der Mitte (6) im rechten Winkel stehenden Arbeitsfläche (2) um genannten Dorn in der Mitte (6) gedreht werden kann und genannte Handhabungsrichtung (Ao, A, B) umfasst, schräg zu genannter Arbeitsfläche (2) beweglichen Greifmitteln (11), sodass genannter handgehabter Metallstab (3) abgefangen wird, wobei genannte Greifmittel (11) um die Achse des abgefangenen Metallstabs (3) gedreht werden können, um genannten abgefangenen Metallstab (3) zu drehen, um die dreidimensionale Faltung des genannten Stabs (3) mittels genannter Falteinheit (5, 50) durchzuführen;
 (b) Durchführung einer ersten Faltung des genannten Metallstabs (3) mittels genannter Falteinheit (5, 50), indem die Drehung des genannten Exzenterbolzens zum Falten (7) um genannten Dorn in der Mitte (6) in einem angemessenen Schrittverhältnis betätigt wird, wobei genannte erste Faltung auf eine jeweilige erste Faltfläche herauskommt, die auf genanntem Stab (3) von den zwei Stababschnitten, die in Richtung der entsprechenden gefalteten Portion des Stabs (3) zusammenlaufen, begrenzt wird;
 (c) Handhabung des genannten Metallstabs (3) entlang genannter Handhabungsrichtung (Ao, A, B) auf genannter Arbeitsfläche (2) mittels genannter in genannter aktiver Position betätigter Handhabungseinheit (4, 40, 201);
 (d) Betätigung genannter Greifmittel (11) in einer schräg zu genannter Arbeitsfläche (2) liegenden Richtung, sodass eine Portion des genannten entlang genannter Handhabungsrichtung (Ao, A, B) gehandhabten Stabs (3) abgefangen wird;
 (e) Einspannen genannter Portion des genannten mittels genannter Greifmittel (11) abgefangenen Stabs (3);
 (f) Betätigung mindestens genannter Handhabungseinheit (201, 4, 40) in einer genannten inaktiven Konfiguration, sodass genannter von genannten Greifmitteln (11) eingespannter Stab (3) losgelassen wird;
 (g) Betätigung der genannten Greifmittel (11) in

Drehung um die Achse des genannten eingespannten Stabs (3), sodass der Stab (3) in entsprechender Weise gedreht wird;

(h) Durchführung einer zweiten Faltung des genannten Metallstabs (3) mittels genannter Falteinheit (5, 50) auf genannter Arbeitsfläche (2), indem die Drehung des genannten Exzenterbolzens zum Falten (7) um genannten Dorn in der Mitte (6) betätigt wird, wobei genannte zweite Faltung auf eine jeweilige zweite Faltfläche herauskommt, die in entsprechender Weise in Hinsicht auf genannte erste Faltfläche der genannten ersten Faltung gedreht wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** es eine weitere Vorbereitungsphase einer Schneid- und Messstation (20) umfasst, die mit einem Schneidelement (22) zum Schneiden des genannten Stabs (3) ausgestattet ist, indem genanntes Schneidelement (22) für den Schnitt nach Maß des genannten Stabs (3) und für die Übertragung des genannten von genannter Schneid- und Messstation (20) maßgeschnittenen Stabs (3) zu genannter Betriebsstation (10, 100, 101) auf genannter Arbeitsfläche (2) mittels Übertragungsmitteln betätigt wird.
3. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** genannte Phase der Übertragung des genannten von genannter Schneid- und Messstation (20) maßgeschnittenen Stabs (3) zu genannter Betriebsstation (10, 100, 101) auf genannter Arbeitsfläche (2) die Phase der Versetzung genannter Handhabungseinheit (4) zwischen einer Konfiguration einer ersten Ebene (4'), in der genannte Handhabungseinheit (4) inaktiv auf einer darunter liegenden Fläche und parallel zu genannter Arbeitsfläche (2) ist, einer Konfiguration einer zweiten, zur genannten ersten Ebene (4') parallelen Ebene (4a), in der genannte Handhabungseinheit (4) geeignet ist, genannten Stab (3) entlang einer Schnitt- und Speisungsrichtung (A₀) aufzunehmen, und einer Konfiguration einer zur genannten ersten Ebene (4') und zur genannten zweiten Ebene (4a) parallelen dritten Ebene (4b), in der genannte Handhabungseinheit (4) geeignet ist, genannten Stab (3) auf genannter Arbeitsfläche (2) zur Faltung des genannten Stabs (3) handzuhaben, umfasst.
4. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** genannte Phase der Übertragung des genannten von genannter Schneid- und Messstation (20) maßgeschnittenen Stabs (3) zu genannter Betriebsstation (100) auf genannter Arbeitsfläche (2) mittels Übertragung auf genannte Arbeitsfläche (2) erfolgt.
5. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** genannte Handhabungseinheit

- (201) sowohl die Speisung des Metallstabs (3) entlang einer Schnitt- und Speisungsrichtung (A_0) als auch genannte Handhabung entlang einer Handhabungsrichtung (A) durchführt, wobei genannte Handhabungsrichtung im Wesentlichen mit genannter Schnitt- und Speisungsrichtung (A_0) übereinstimmt.
6. Vorrichtung zum Herstellen von zweidimensionalen und dreidimensionalen Bügeln, die mindestens eine insbesondere für die dreidimensionale Faltung vorgesehene Betriebsstation (10, 100, 101) umfasst, die mit einer Handhabungseinheit (4, 40, 201) für die Handhabung eines Metallstabs (3) entlang einer Handhabungsrichtung (A_0 , a, B) ausgestattet ist, mit einer Falteinheit (5, 50), die einen Dorn zum Falten (6) in der Mitte und einem Exzenterbolzen zum Falten (7) umfasst, der zum Falten des genannten Metallstabs (3) auf einer zur Achse des genannten Dorns in der Mitte (6) im rechten Winkel stehenden Arbeitsfläche (2) um genannten Dorn in der Mitte (6) gedreht werden kann und genannte Handhabungsrichtung (Ao, a, B) umfasst, wobei jede Faltfläche eines genannten Bügels von genanntem Stab (3) ausgehend gebildet wird und von zwei auf die jeweilige gebogene Portion des genannten Stabs (3) zusammenlaufenden Stababschnitten begrenzt wird, wobei diese Vorrichtung **dadurch gekennzeichnet ist, dass** sie Greifmittel (11) umfasst, die schräg zu genannter Arbeitsfläche (2) beweglich und geeignet sind, genannten gehandhabten Metallstab (3) abzufangen, wobei genannte Greifmittel (11) um die Achse des abgefangenen Metallstabs (3) gedreht werden können, um den genannten abgefangenen Metallstab (3) zu drehen und Falten auf den entsprechenden einander in entsprechender Weise zugeordneten Arbeitsflächen durchzuführen, um die dreidimensionale Formung des genannten Stabs (3) mittels genannter Falteinheit (5, 50) zu erzielen, wobei genannte Handhabungseinheit (4, 40, 201) zwischen einer aktiven Position zum Ergreifen und Handhaben des genannten Stabs (3) und einer inaktiven Position zur Freigabe des genannten Stabs (3) betätigt werden kann.
7. Vorrichtung zum Herstellen von zweidimensionalen und dreidimensionalen Bügeln nach Anspruch 6, **dadurch gekennzeichnet, dass** genannte Greifmittel (11) um eine im Wesentlichen zu genannter Arbeitsfläche (2) senkrechten Richtung beweglich sind.
8. Vorrichtung zum Herstellen von zweidimensionalen und dreidimensionalen Bügeln nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** genannte Greifmittel (11) alternativ zwischen einer inaktiven Position unter genannter Arbeitsfläche (2), an der sich genannter gerade bearbeiteter Stab (3) befindet, und einer aktiven Position auf genannter Arbeitsfläche (2) beweglich sind, um mit genanntem gerade bearbeitetem Stab (3) zu interagieren.
9. Vorrichtung zum Herstellen von zweidimensionalen und dreidimensionalen Bügeln nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** genannte Greifmittel (11) mindestens eine Spannbacke (12) verformen.
10. Vorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** sie auch eine Schnittstation (20) umfasst, die ein Schneidelement (22) für den Schnitt nach Maß des genannten gefalteten oder zu faltenden Metallstabs (3) umfasst.
11. Vorrichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** sie eine Hauptzieheinheit (21) umfasst, um genannten in genannter Falteinheit (5, 50) zu faltenden Metallstab (3) zu ziehen, wobei genannte Handhabungseinheit (4, 40) genannter Hauptzieheinheit (2) in Bezug auf genannte Falteinheit (5, 50) gegenüber liegt und Übertragungsmittel zur Übertragung des genannten mit genanntem Schneidelement (22) geschnittenen Stabs (3) von genannter Schnittstation (20) zu genannter Betriebsstation (10; 100, 101) auf genannter Arbeitsfläche (2) vorgesehen sind.
12. Vorrichtung nach Anspruch 11, **dadurch gekennzeichnet, dass** genannte Übertragungsmittel mit genannter Falteinheit (5) und genannter Handhabungseinheit (4) verbunden sind, um die Übertragung des genannten zu faltenden geschnittenen Stabs (3), auf verschiedenen Ebenen, in einer Richtung, die im Wesentlichen zu genannter Arbeitsfläche (2) im rechten Winkel steht, durchzuführen.
13. Vorrichtung nach Anspruch 11, **dadurch gekennzeichnet, dass** genannte Übertragungsmittel mit genannter Falteinheit (5) verbunden sind, um die Übertragung des genannten zu faltenden geschnittenen Stabs (3) in einer Richtung, die im Wesentlichen zu genannter Arbeitsfläche (2) koplanar ist, durchzuführen.

Revendications

1. Méthode de fabrication d'étriers tridimensionnels, comprenant les phases de :
- (a) dans une station de travail (10, 100, 101), en particulier pour le pliage tridimensionnel, prédisposer au moins une tige métallique (3) à plier, une unité de manipulation (4, 40, 201) pour l'alimentation et / ou le support d'une tige métallique (3) selon une direction de manipulation (Ao, A, B), ladite unité de manipulation étant actionna-

ble entre une position active, pour la préhension et la manipulation de ladite tige métallique (3), et une position inactive, pour le relâchement de ladite tige (3), une unité de pliage (5, 50) munie d'un mandrin central (6) de pliage et un pivot excentrique de pliage (7) pivotant autour dudit mandrin central (6) pour le pliage de ladite tige métallique (3) sur un plan de travail (2) orthogonal par rapport à l'axe dudit mandrin central (6) et comprenant ladite direction de manipulation (Ao, A, B), des moyens de préhension (11) mobiles de façon transversale par rapport audit plan de travail (2) de manière à intercepter ladite tige métallique (3) manipulée, lesdits moyens de préhension (11) étant pivotants autour de l'axe de la tige métallique (3) interceptée pour pivoter ladite tige métallique (3) interceptée afin d'effectuer le pliage tridimensionnel de ladite tige (3) au moyen de ladite unité de pliage (5, 50) ;

(b) effectuer au moyen de ladite unité de pliage (5, 50) un premier pliage de ladite tige métallique (3) en actionnant en rotation ledit pivot excentrique de pliage (7) autour dudit mandrin central (6) dans une relation de phase appropriée, ledit premier pliage sortant sur un respectif plan de premier pliage délimité sur ladite tige (3) par les deux tronçons de tige convergents vers la correspondante partie pliée de la tige (3) ;

(c) manipuler ladite tige métallique (3) le long de ladite direction de manipulation (Ao, A, B) sur ledit plan de travail (2) au moyen de ladite unité de manipulation (4, 40, 201) actionnée dans ladite position active ;

(d) actionner lesdits moyens de préhension (11) dans une direction transversale par rapport audit plan de travail (2) de manière à intercepter une partie de ladite tige (3) manipulée le long de ladite direction de manipulation (Ao, A, B) ;

(e) serrer ladite partie de ladite tige (3) interceptée au moyen desdits moyens de préhension (11) ;

(f) actionner au moins ladite unité de manipulation (201, 4, 40) dans une dite configuration inactive, de manière à relâcher ladite tige (3) serrée par lesdits moyens de préhension (11) ;

(g) actionner lesdits moyens de préhension (11) en rotation autour de l'axe de ladite tige (3) serrée, de manière à pivoter cette même tige (3) de la façon correspondante ;

(h) effectuer au moyen de ladite unité de pliage (5, 50) un second pliage de ladite tige métallique (3) sur ledit plan de travail (2), en actionnant en rotation ledit pivot excentrique de pliage (7) autour dudit mandrin central (6), ledit second pliage sortant sur un respectif second plan de pliage pivoté de façon correspondante par rapport audit premier plan de pliage dudit premier pliage.

2. Méthode selon la revendication 1, **caractérisée en ce qu'elle** comprend l'ultérieure phase de prédisposition d'une station de coupe et de mesure (20) munie d'un organe de coupe (22) pour la coupe de ladite tige (3), en actionnant ledit organe de coupe (22) pour la coupe aux dimensions voulues de ladite tige (3) et pour le transfert de ladite tige (3) coupée aux dimensions voulues à partir de ladite station de coupe et de mesure (20) vers ladite station de travail (10, 100, 101) sur ledit plan de travail (2) par le biais des moyens de transfert.
3. Méthode selon la revendication 2, **caractérisée en ce que** ladite phase de transfert de ladite tige (3) coupée aux dimensions voulues à partir de ladite station de coupe et de mesure (20) vers ladite station de travail (10, 100, 101) sur ledit plan de travail (2) comprend la phase de déplacement de ladite unité de manipulation (4) entre une configuration de premier niveau (4'), où ladite unité de manipulation (4) est inactive sur un plan situé au-dessous et parallèle audit plan de travail (2), une configuration de second niveau (4a) parallèle audit premier niveau (4'), où ladite unité de manipulation (4) est apte à recevoir ladite tige (3) le long d'une direction de coupe et d'alimentation (A₀) et une configuration de troisième niveau (4b) parallèle audit premier niveau (4') et audit second niveau (4a), où ladite unité de manipulation (4) est apte à manipuler ladite tige (3) sur ledit plan de travail (2) pour le pliage de ladite tige (3).
4. Méthode selon la revendication 2, **caractérisée en ce que** ladite phase de transfert de ladite tige (3) coupée aux dimensions voulues à partir de ladite station de coupe et de mesure (20) vers ladite station de travail (100) sur ledit plan de travail (2) s'effectue par le transfert sur ledit plan de travail (2).
5. Méthode selon la revendication 1, **caractérisée en ce que** ladite unité de manipulation (201) effectue aussi bien l'alimentation de la tige métallique (3) le long d'une direction de coupe et d'alimentation (A₀) et ladite manipulation le long d'une direction de manipulation (A), étant ladite direction de manipulation substantiellement coïncidente avec ladite direction de coupe et d'alimentation (A₀).
6. Appareil pour fabriquer des étriers bidimensionnels et tridimensionnels, comprenant au moins une station de travail (10, 100, 101), en particulier pour le pliage tridimensionnel, avec une unité de manipulation (4, 40, 201) pour la manipulation d'une tige métallique (3) le long d'une direction de manipulation (A₀, a, B), avec une unité de pliage (5, 50) comprenant un mandrin central (6) de pliage et un pivot excentrique de pliage (7) pivotant autour dudit mandrin central (6) pour le pliage de ladite tige métallique (3) sur un plan de travail (2) orthogonal par rapport à

- l'axe dudit mandrin central (8) et comprenant ladite direction de manipulation (A_0 , a, B), chaque plan de pliage d'un dit étrier étant formé à partir de ladite tige (3), étant délimité par deux tronçons convergeant vers une respective partie repliée de ladite tige (3), ledit appareil étant **caractérisé en ce qu'il** comprend des moyens de préhension (11) mobiles de façon transversale par rapport audit plan de travail (2), aptes à intercepter ladite tige métallique (3) manipulée, lesdits moyens de préhension (11) étant pivotants autour de l'axe de la tige métallique (3) interceptée pour pivoter ladite tige métallique (3) interceptée et pour l'exécution de pliages sur les plans de travail correspondants pivotés l'un par rapport à l'autre de manière correspondante afin d'obtenir le façonnage tridimensionnel de ladite tige (3) au moyen de ladite unité de pliage (5, 50), ladite unité de manipulation, (4, 40, 201) étant actionnable entre une position active de préhension et manipulation de ladite tige (3), et une position inactive de relâchement de ladite tige (3).
7. Appareil pour fabriquer des étriers bidimensionnels et tridimensionnels selon la revendication 6, **caractérisé en ce que** lesdits moyens de préhension (11) sont mobiles autour d'une direction substantiellement perpendiculaire audit plan de travail (2).
8. Appareil pour fabriquer des étriers bidimensionnels et tridimensionnels selon la revendication 6 ou 7, **caractérisé en ce que** lesdits moyens de préhension (11) sont mobiles alternativement entre une position inactive, au-dessous dudit plan de travail (2) lorsque ladite tige (3) étant réalisée est placée, et une position active sur ledit plan de travail (2), pour coopérer sur ladite tige (3) étant réalisée.
9. Appareil pour fabriquer des étriers bidimensionnels et tridimensionnels selon la revendication 6 ou 7, **caractérisé en ce que** lesdits moyens de préhension (11) façonnent au moins une pince de serrage (12).
10. Appareil selon la revendication 9, **caractérisé en ce qu'il** comprend aussi une station de coupe (20) comprenant un organe de coupe (22) pour la coupe aux dimensions voulues de ladite tige métallique (3) pliée ou à plier.
11. Appareil selon la revendication 10, **caractérisé en ce qu'il** comprend une unité d'étirage principale (21) pour étirer ladite tige métallique (3) devant être pliée en ladite unité de pliage (5, 50), ladite unité (4, 40) de manipulation étant opposée à ladite unité d'étirage principale (2) par rapport à ladite unité de pliage (5, 50) et étant muni des moyens de transfert pour transférer ladite tige (3) coupée à travers dudit élément de coupe (22) à partir de ladite station de coupe (20) vers ladite station de travail (10; 100, 101) sur ledit plan de travail (2).
12. Appareil selon la revendication 11, **caractérisé en ce que** lesdits moyens de transfert sont associés à ladite unité de pliage (5) et à ladite unité de manipulation (4), pour effectuer le transfert de ladite tige coupée (3) à plier, sur différents niveaux, dans une direction substantiellement orthogonale par rapport audit plan de travail (2).
13. Appareil selon la revendication 11, **caractérisé en ce que** lesdits moyens de transfert sont associés à ladite unité de pliage (50) pour effectuer le transfert de ladite tige coupée (3) à plier, dans une direction substantiellement coplanaire par rapport audit plan de travail (2).

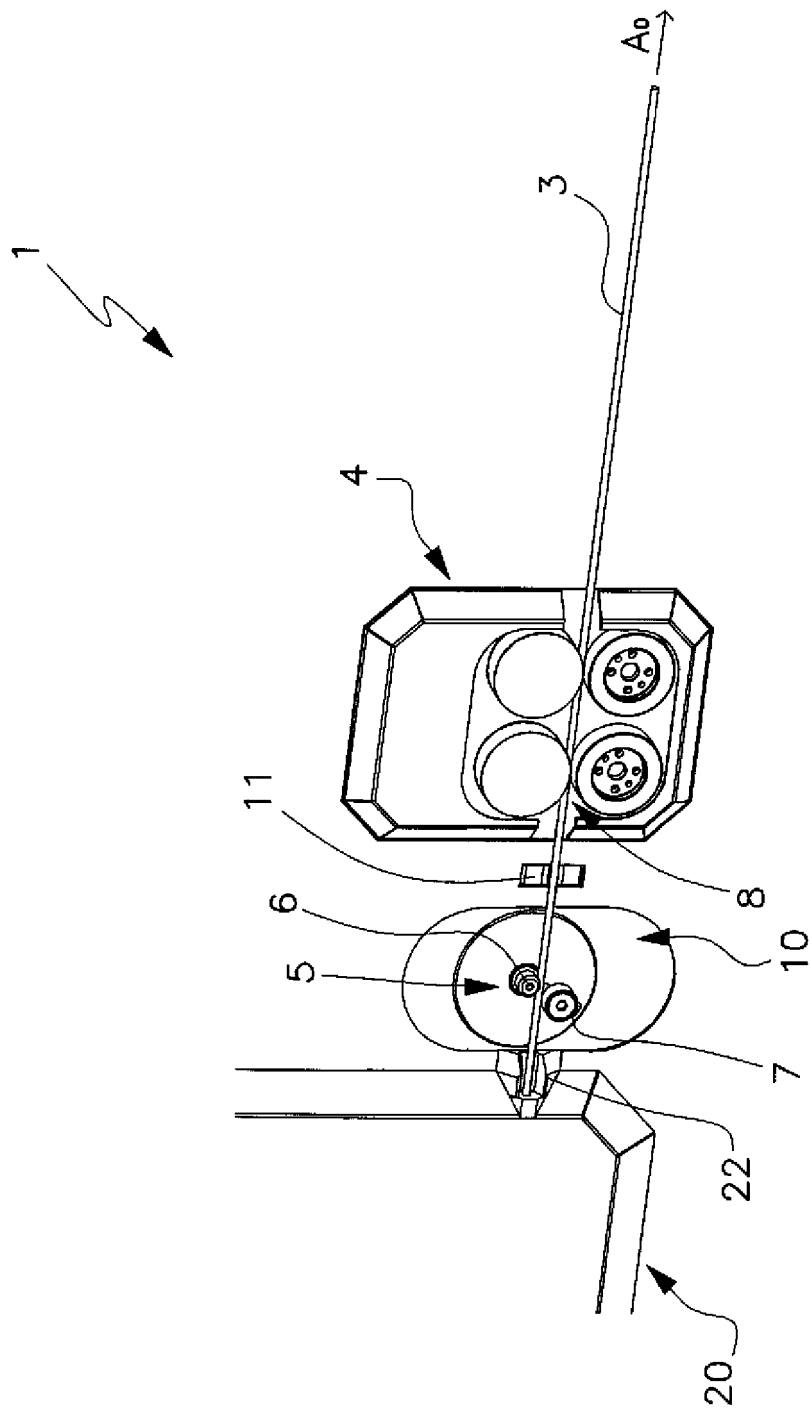


Fig.1

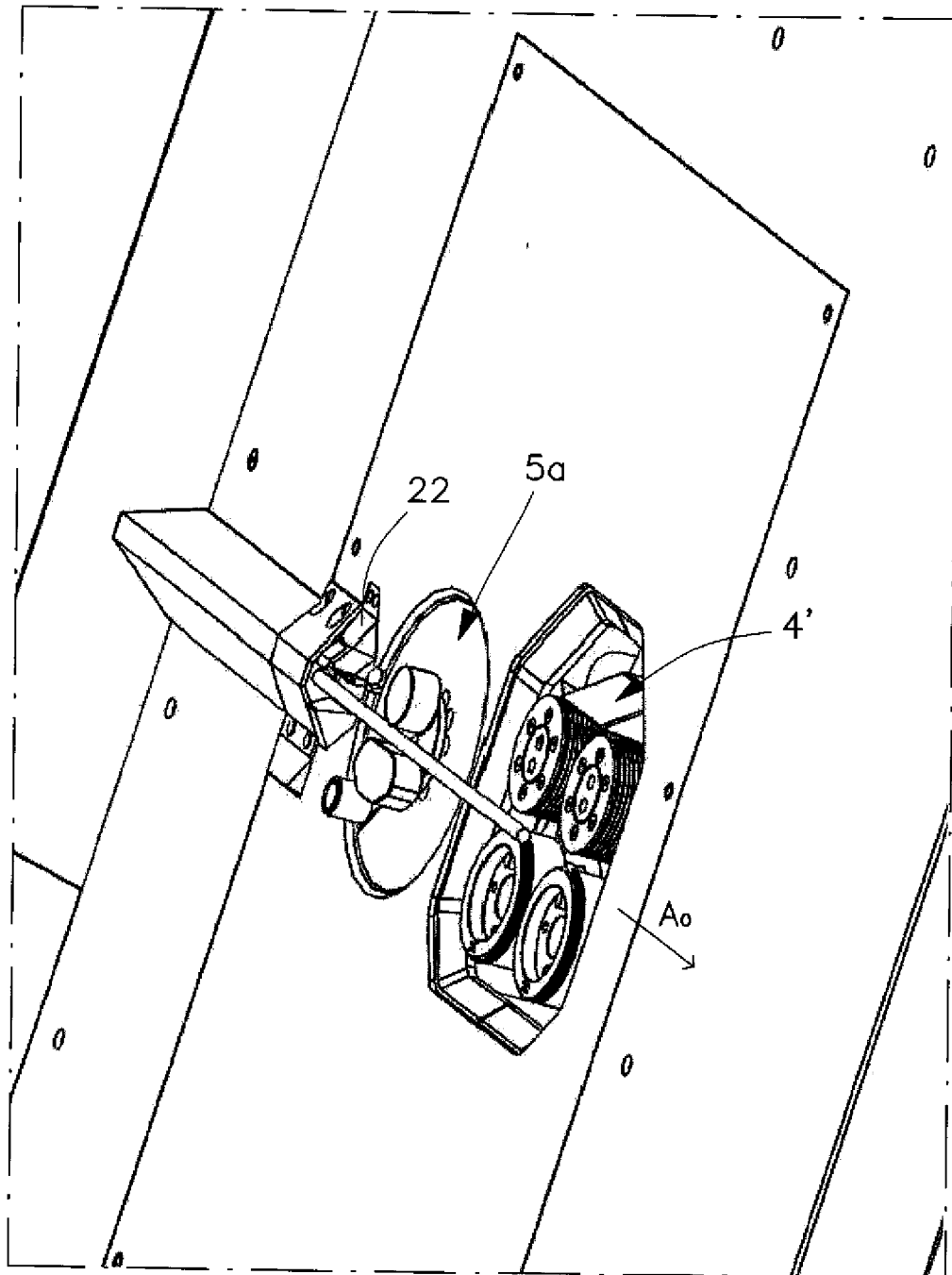


Fig.2

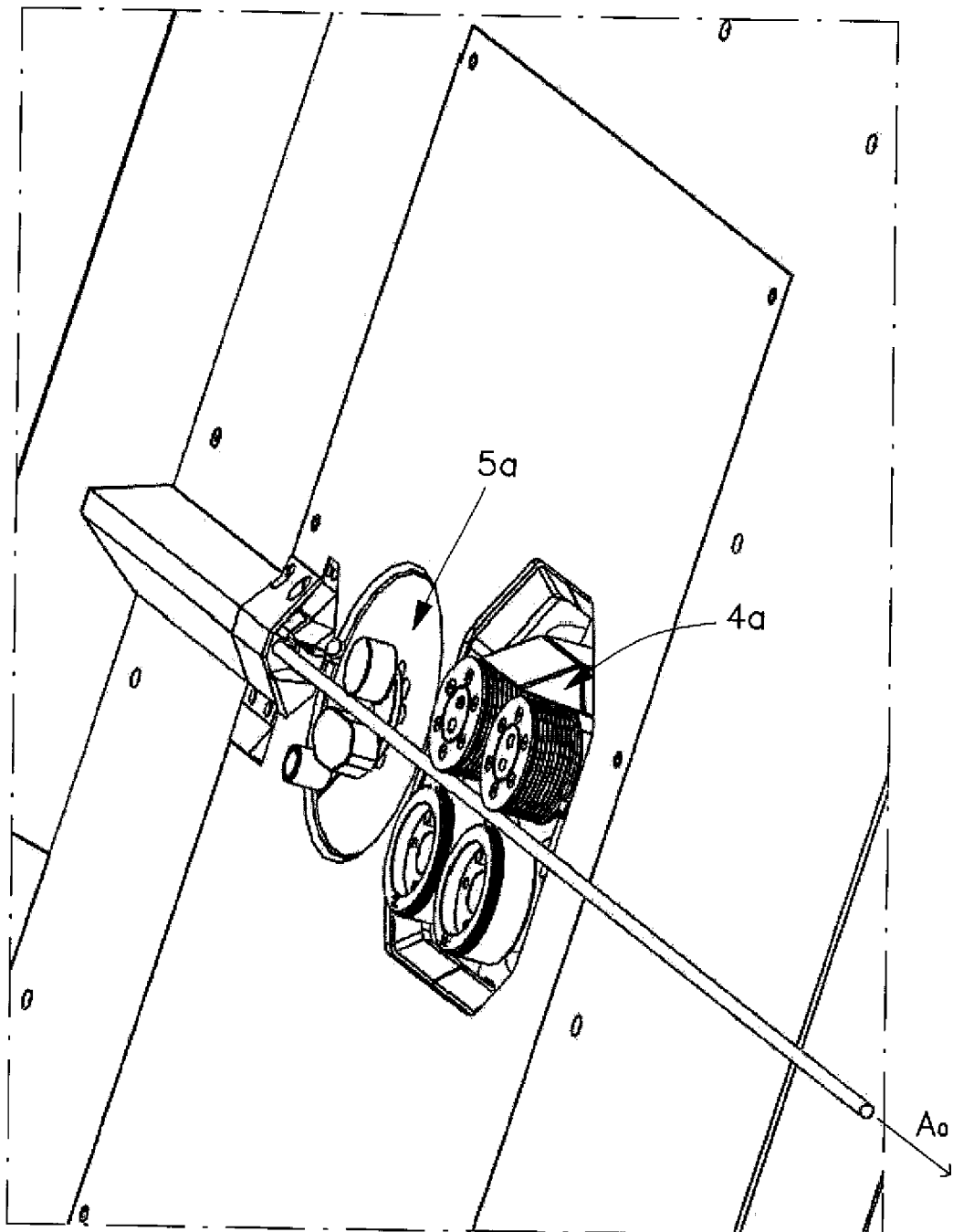


Fig.3

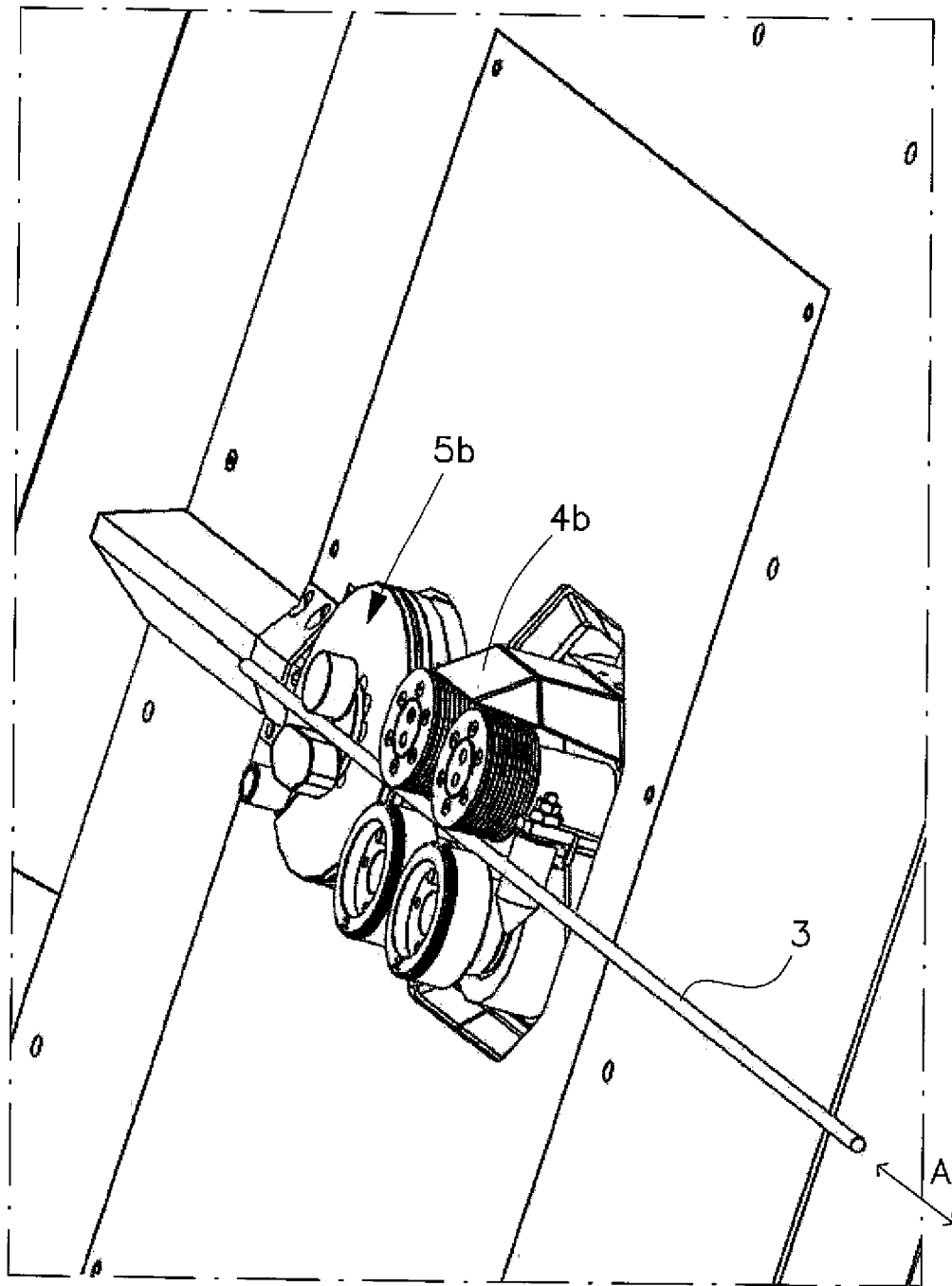


Fig.4

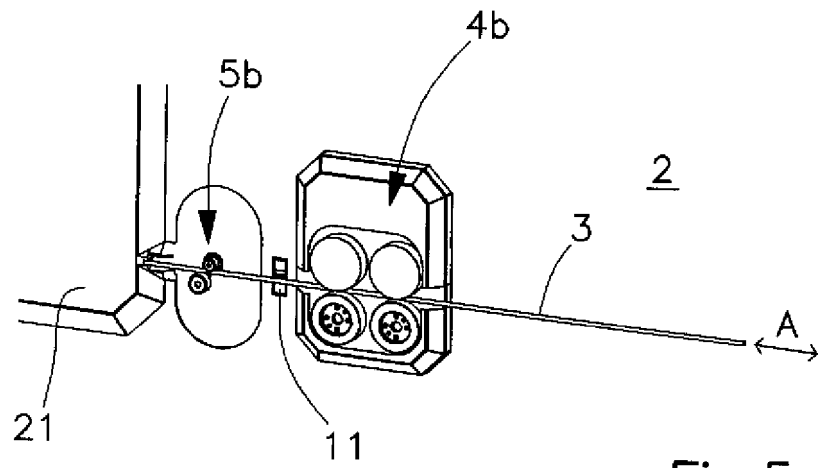


Fig.5

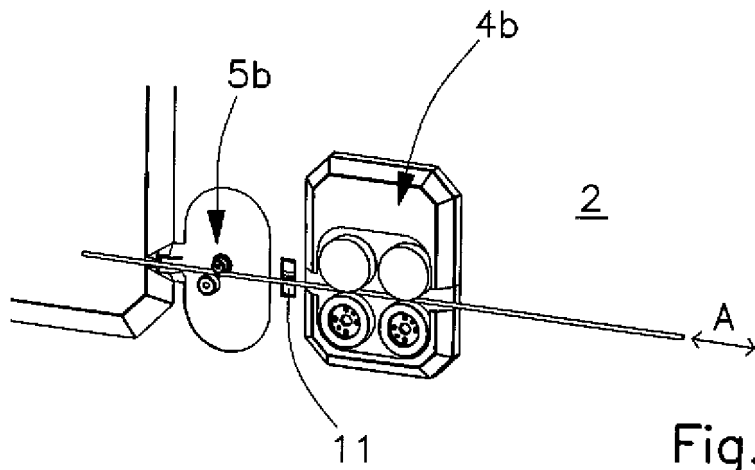


Fig.6

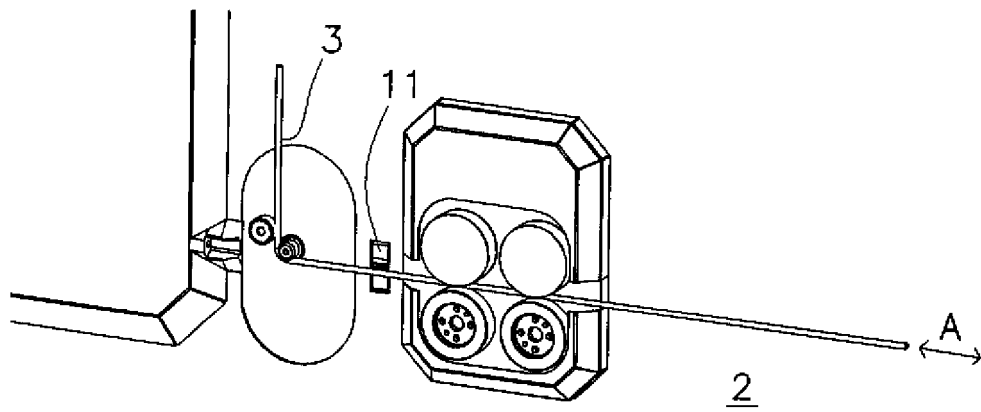


Fig.7

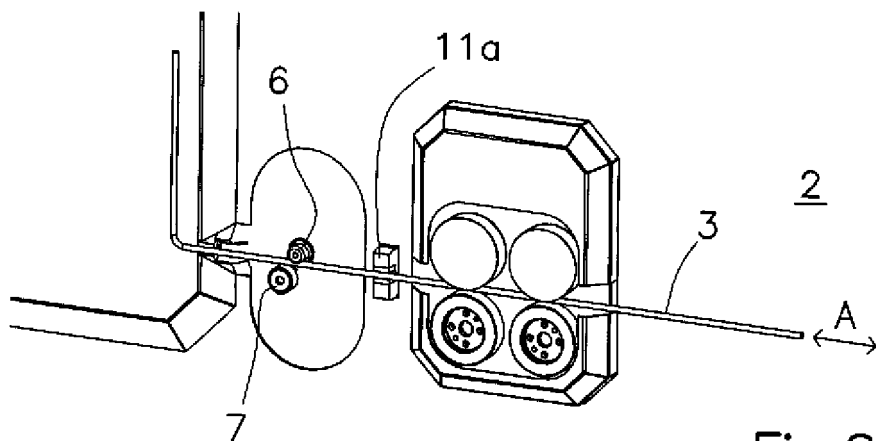


Fig.8

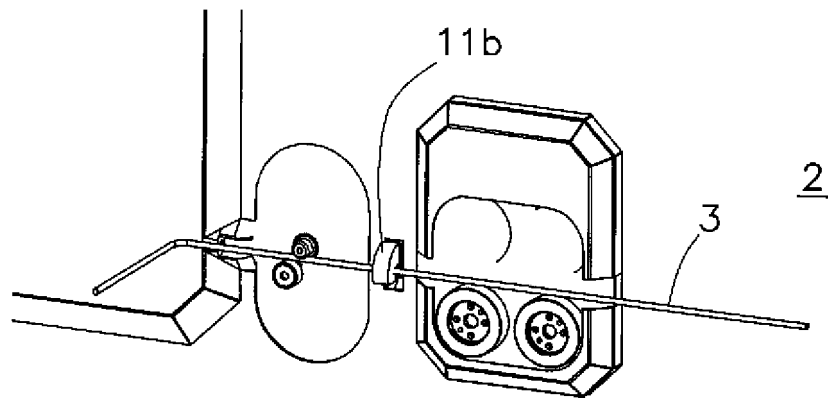


Fig.9

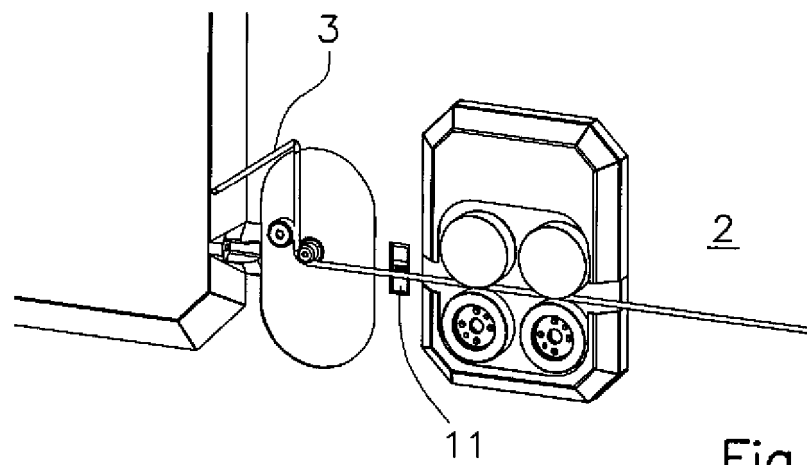


Fig.10

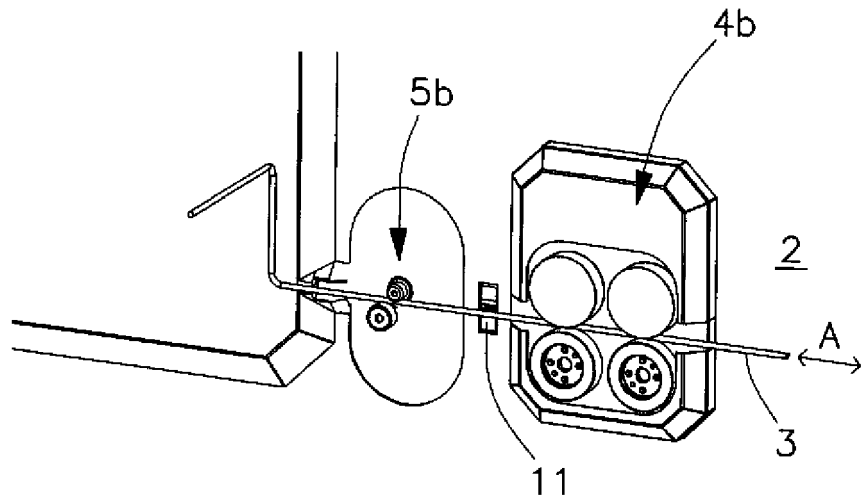


Fig.11

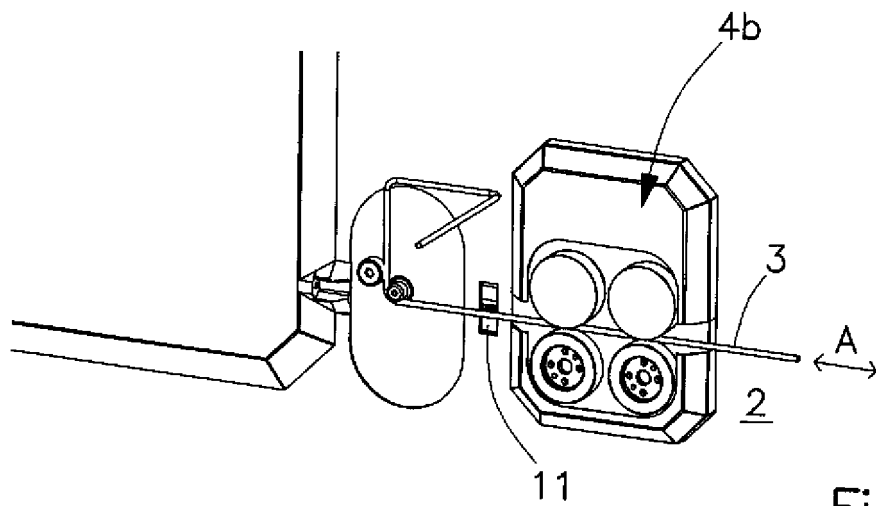


Fig.12

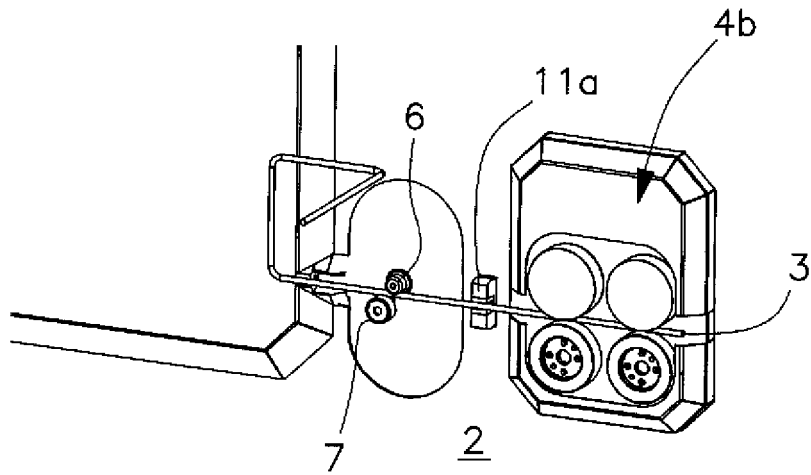


Fig.13

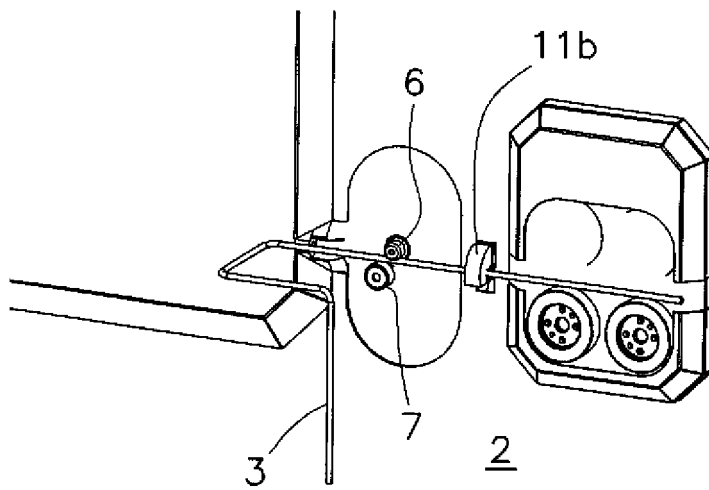


Fig.14

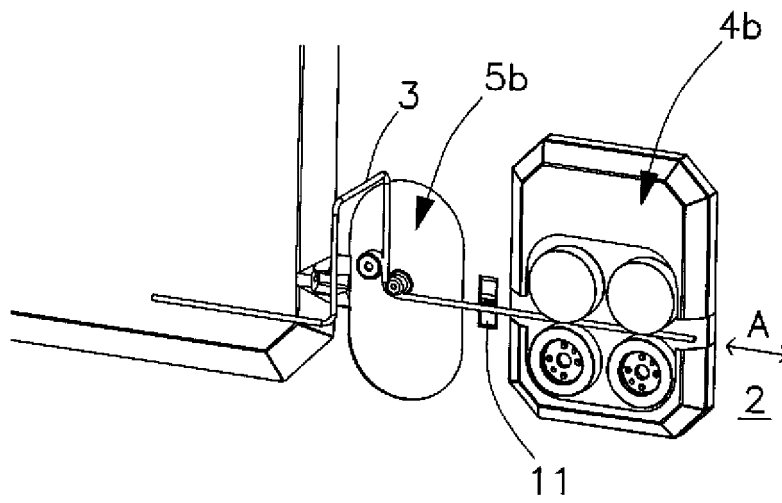


Fig.15a

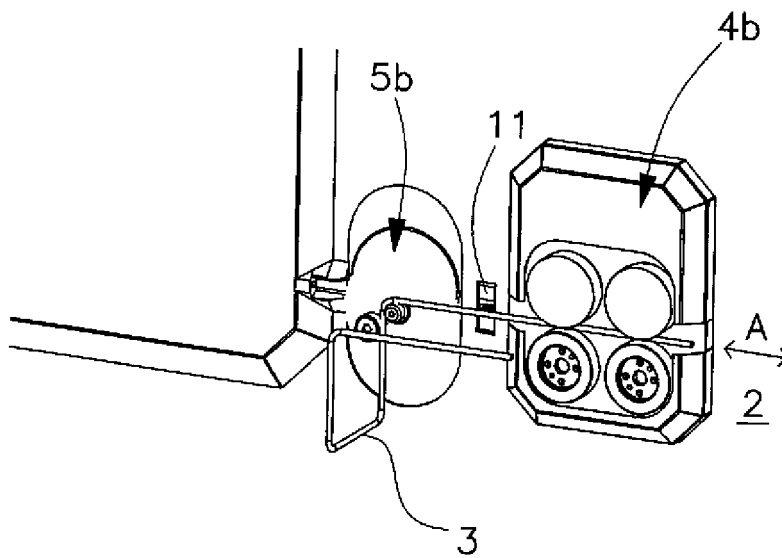


Fig.15b

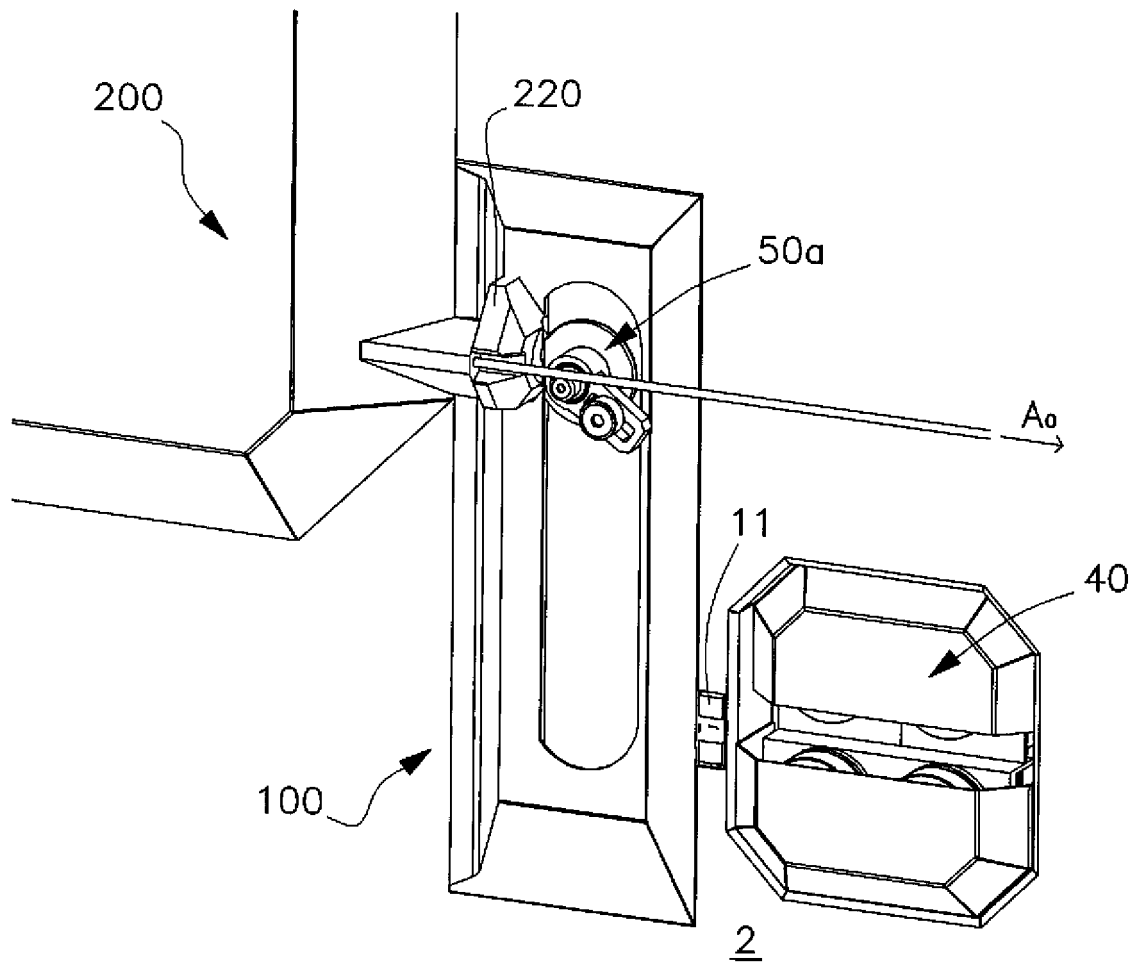


Fig.16

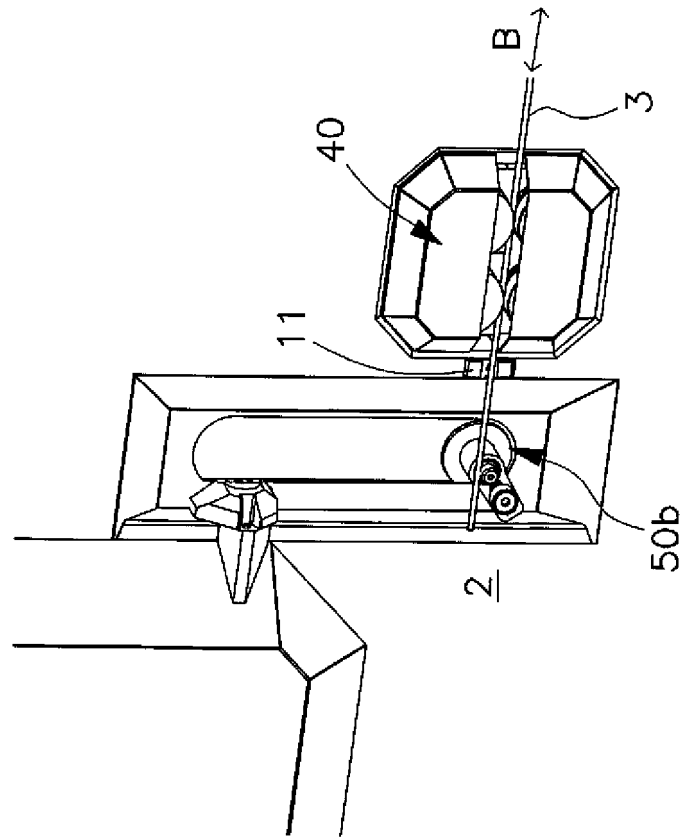


Fig. 17

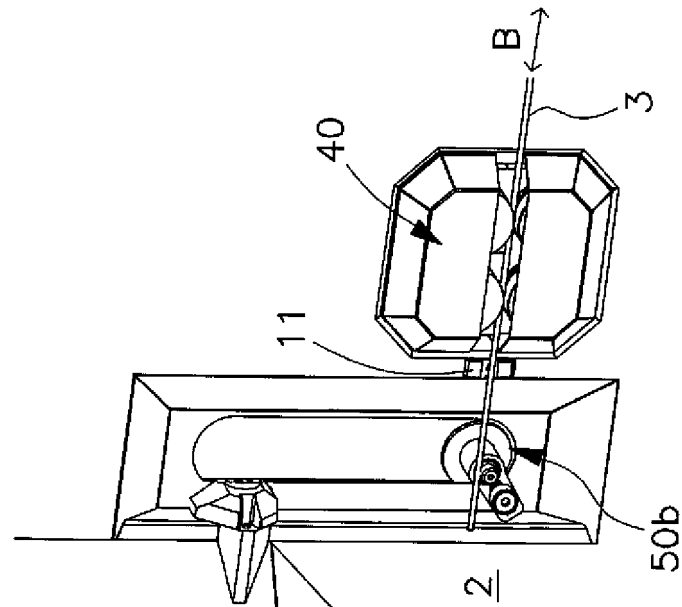


Fig. 18

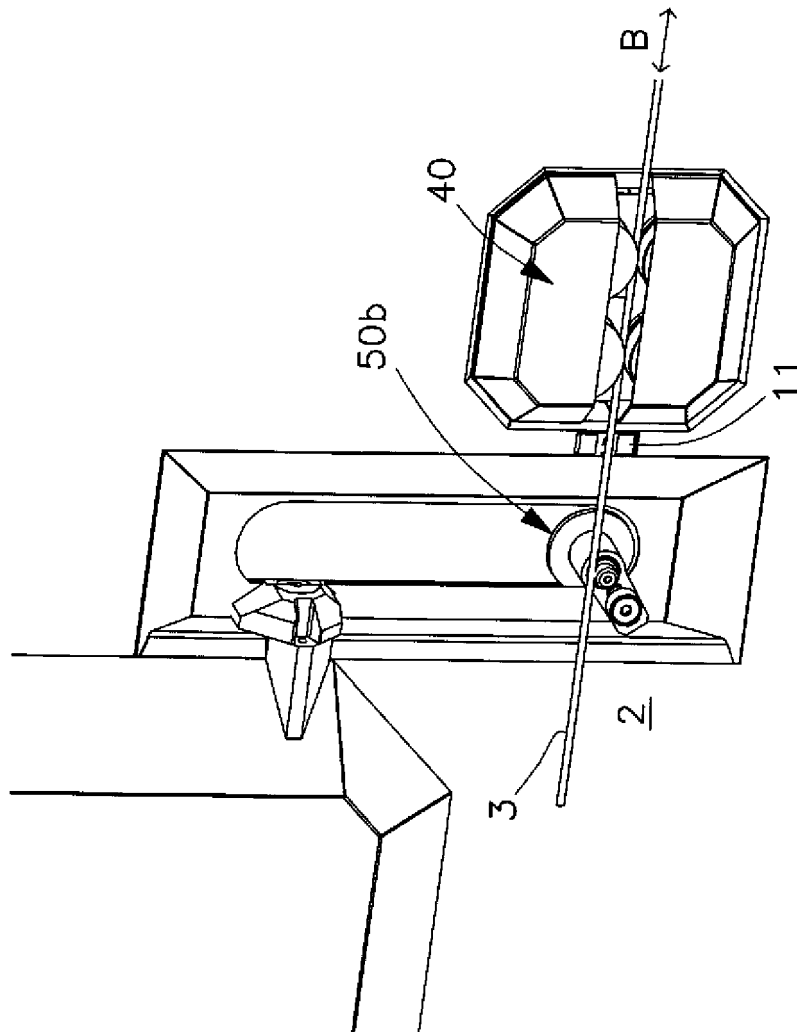


Fig.19

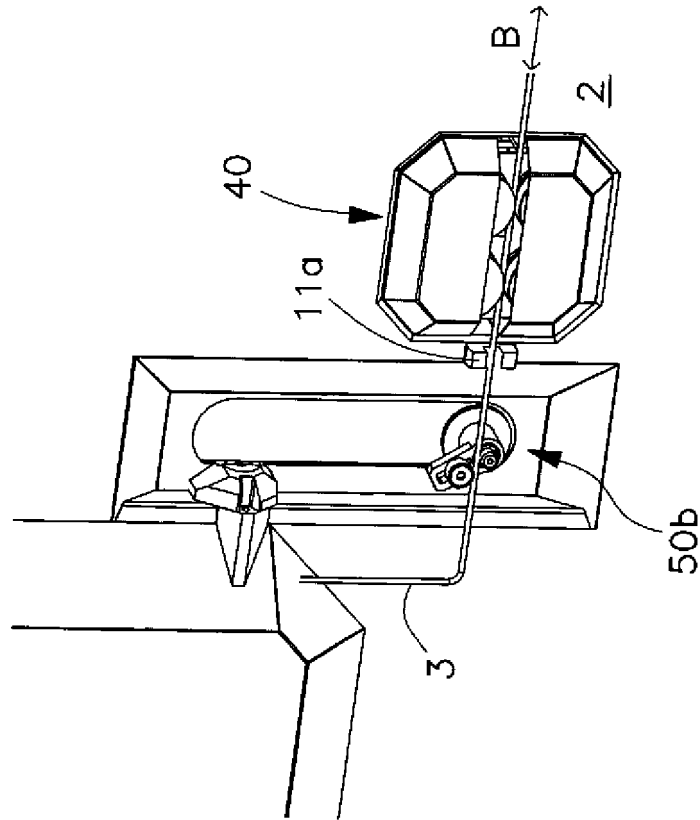


Fig. 20

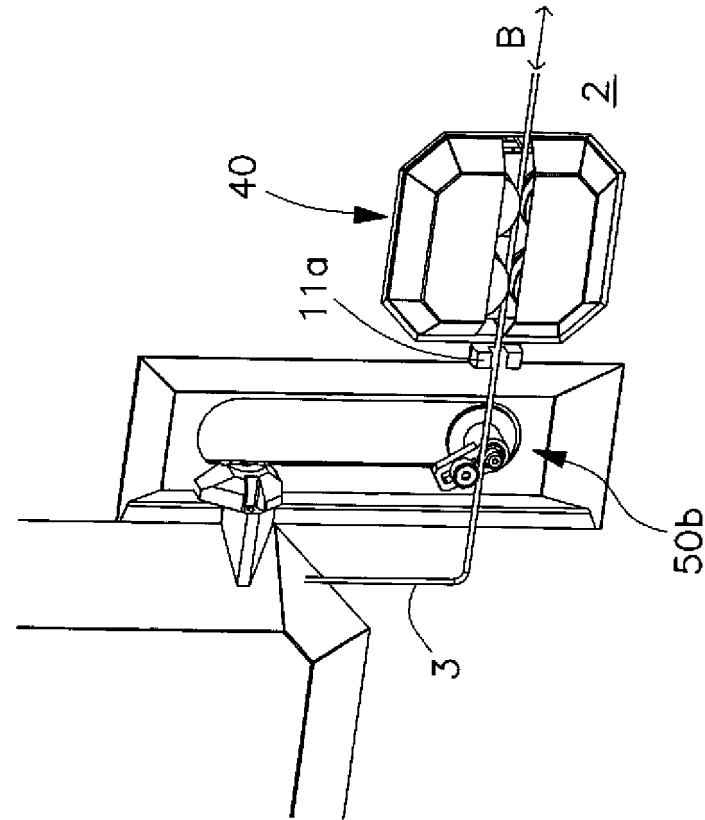


Fig. 21

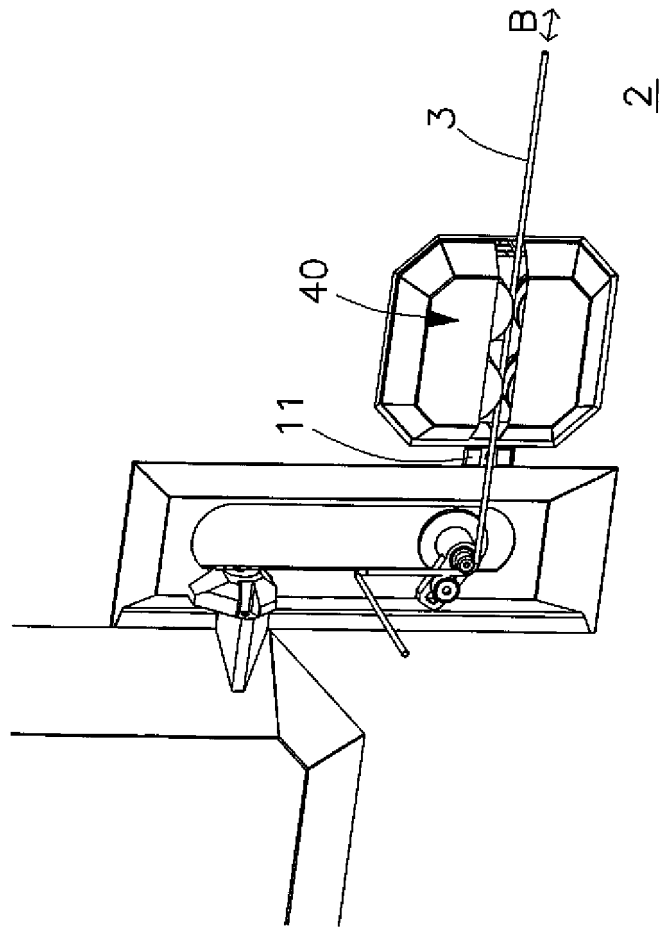


Fig. 22

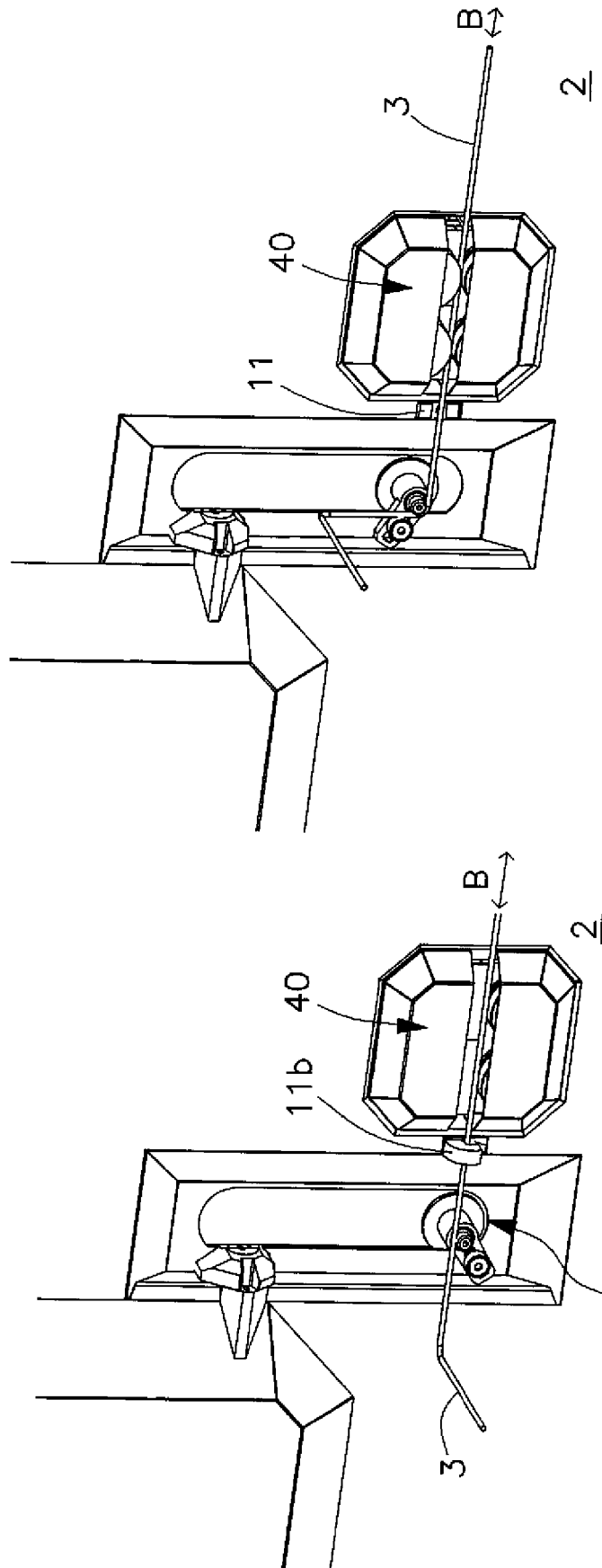


Fig. 23

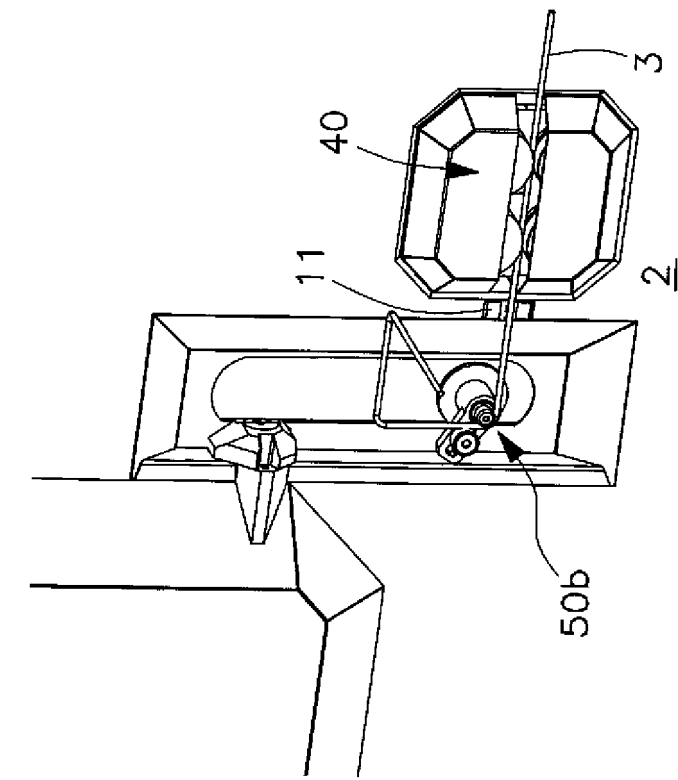


Fig.25

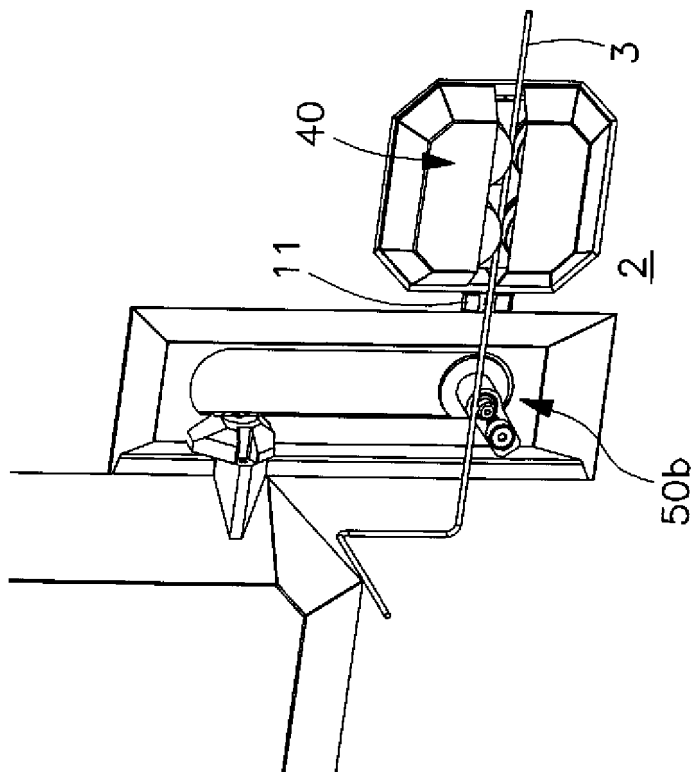


Fig.24

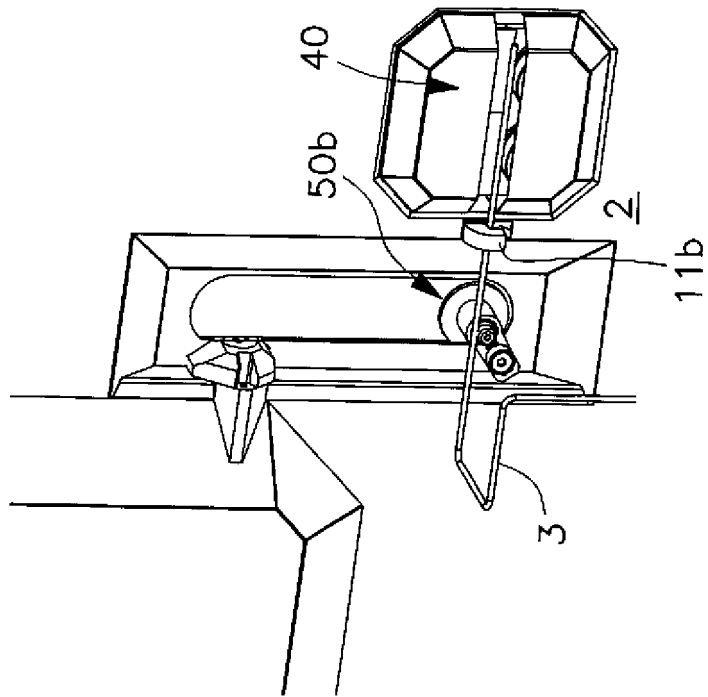


Fig. 27

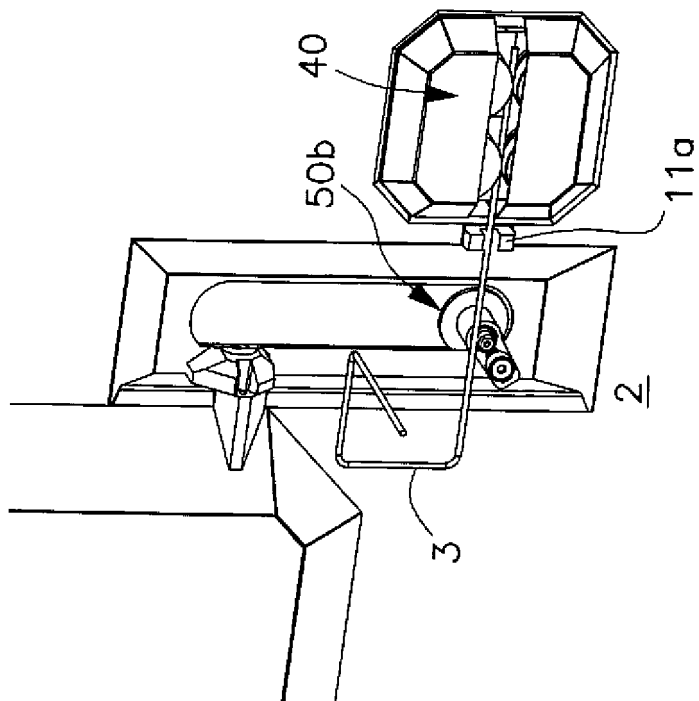


Fig. 26

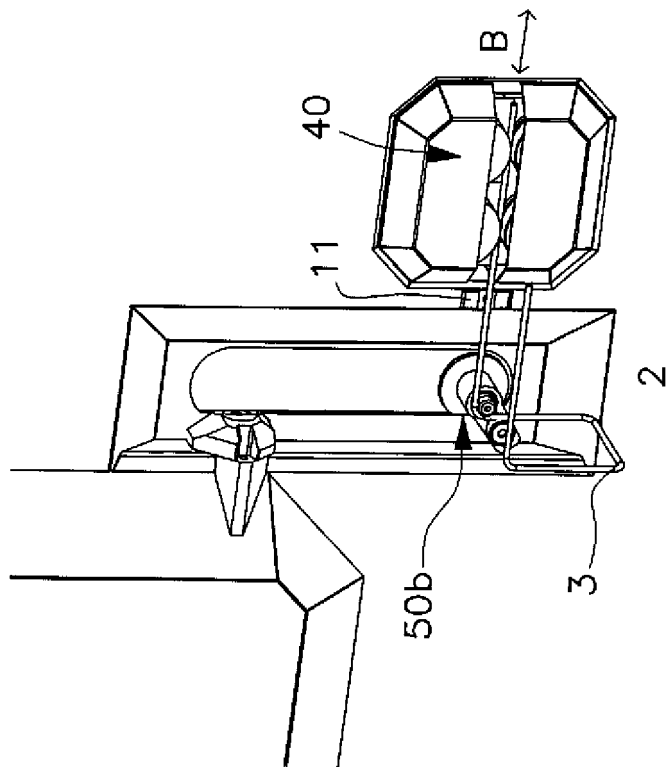


Fig. 28b

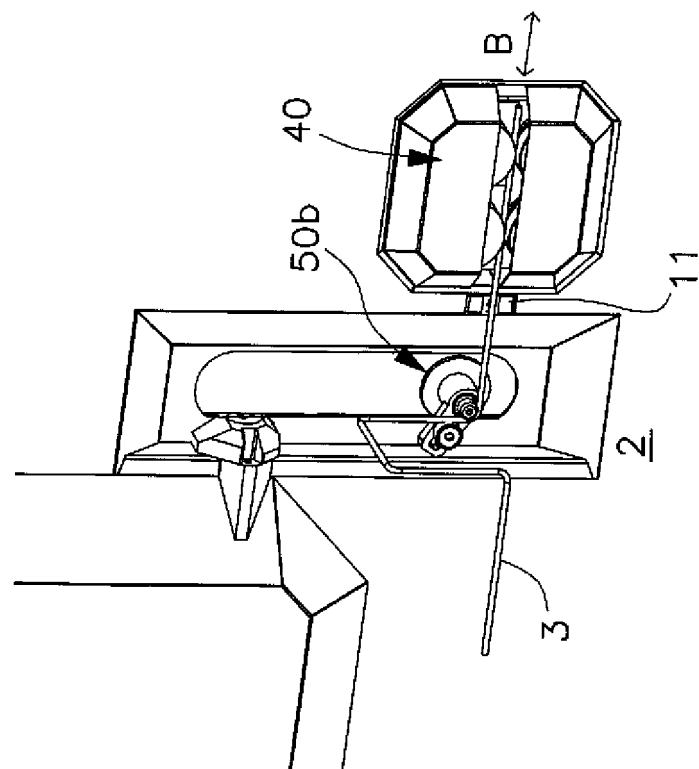


Fig. 28a

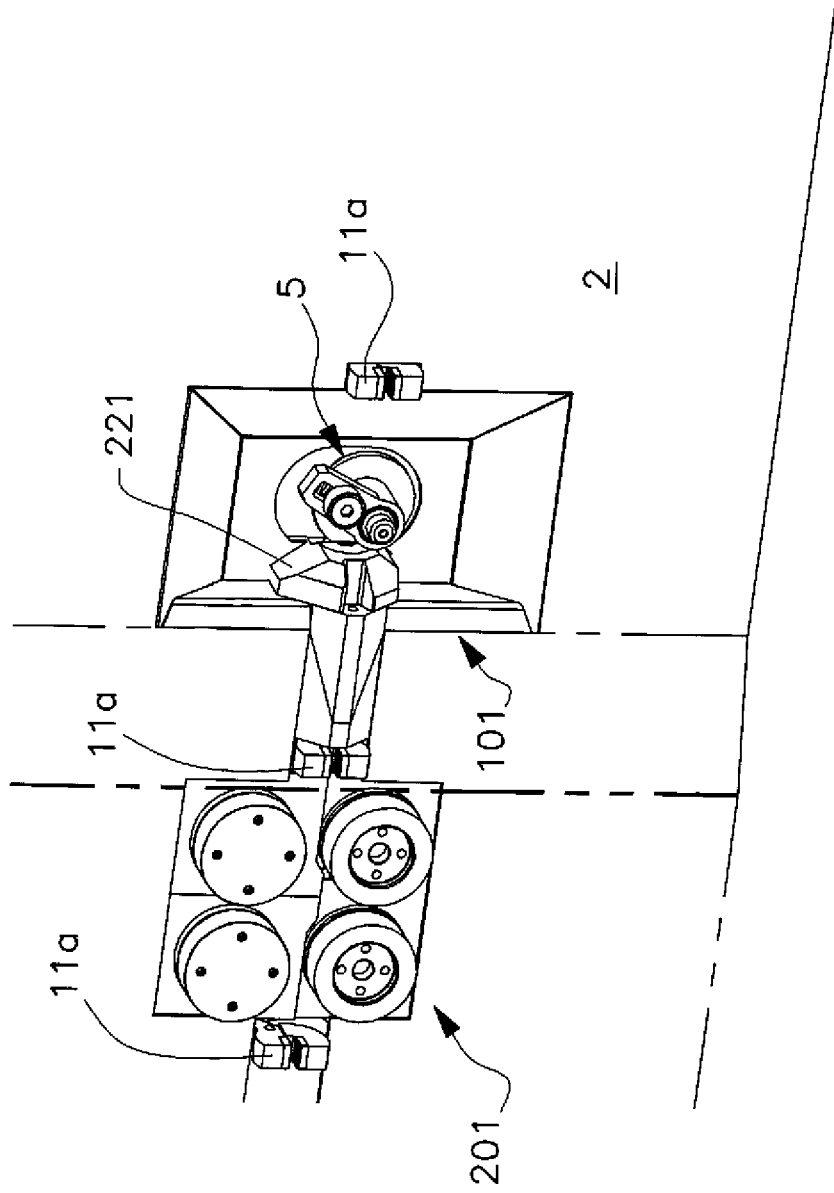
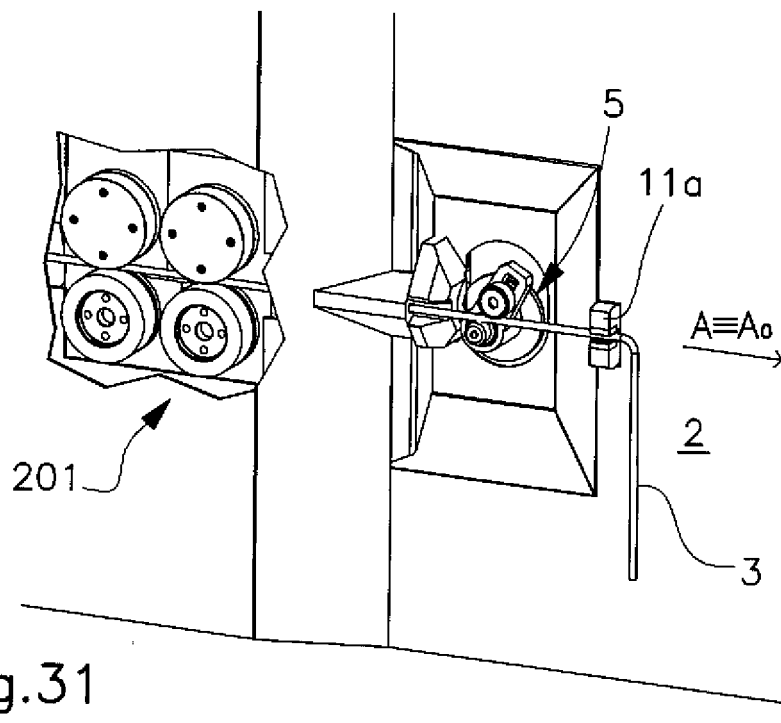
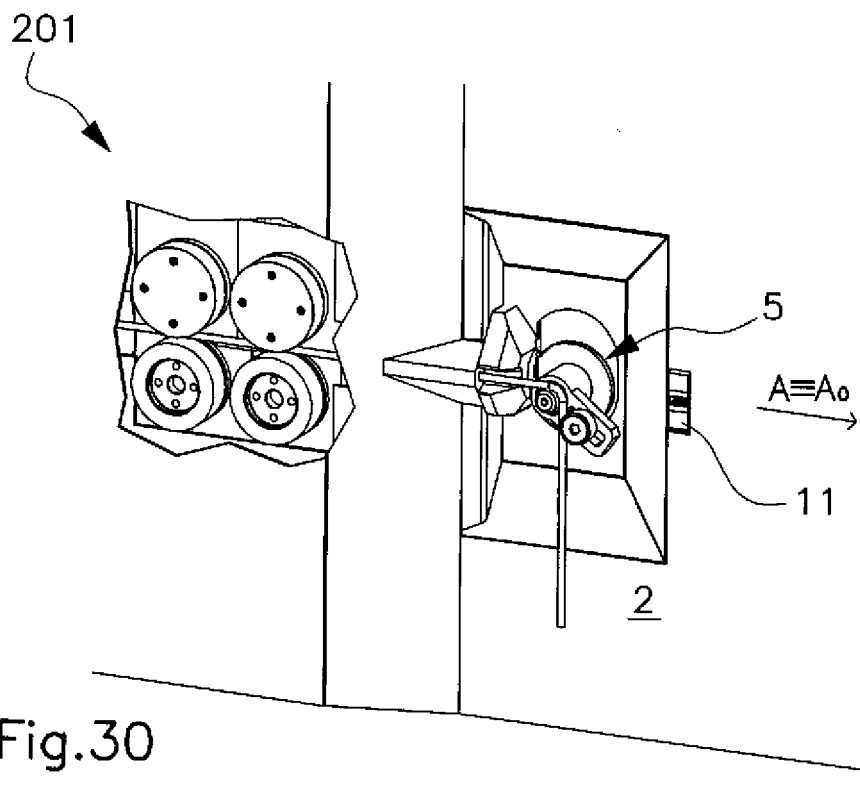


Fig. 29



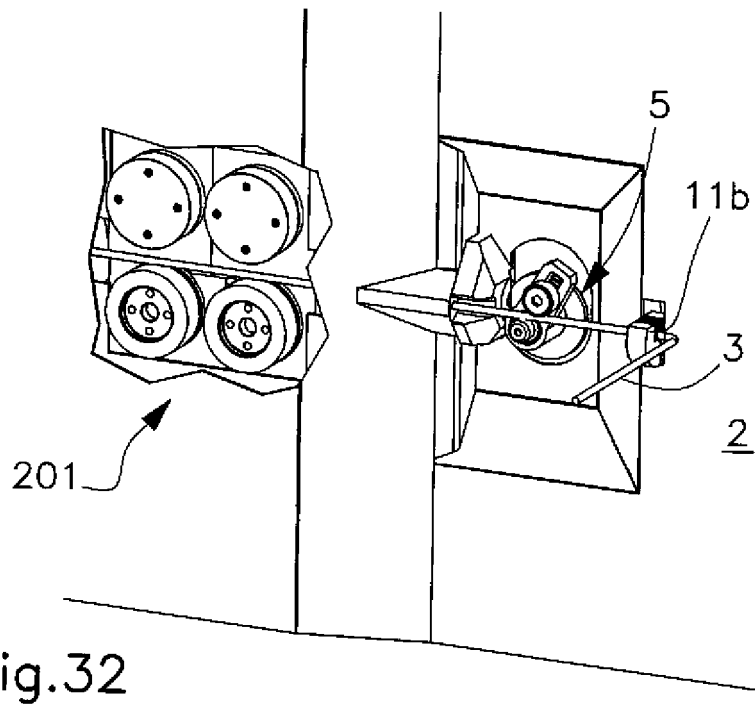


Fig.32

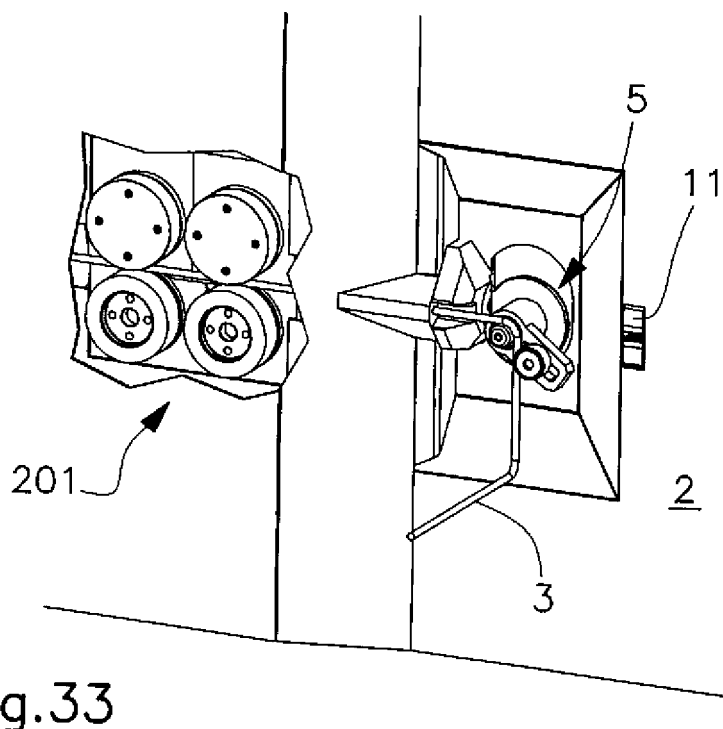


Fig.33

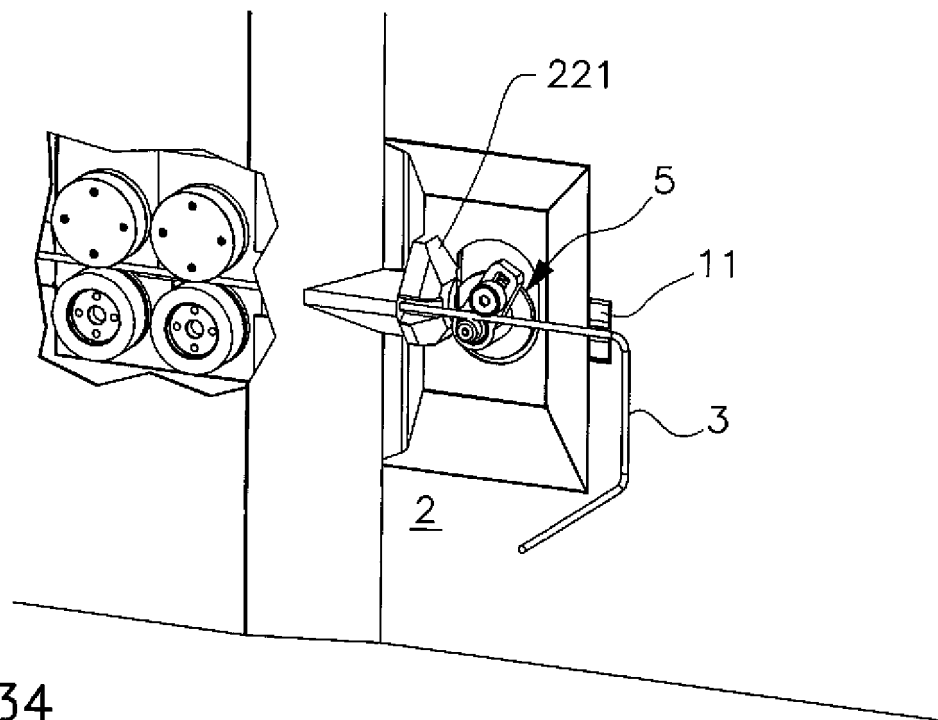


Fig.34

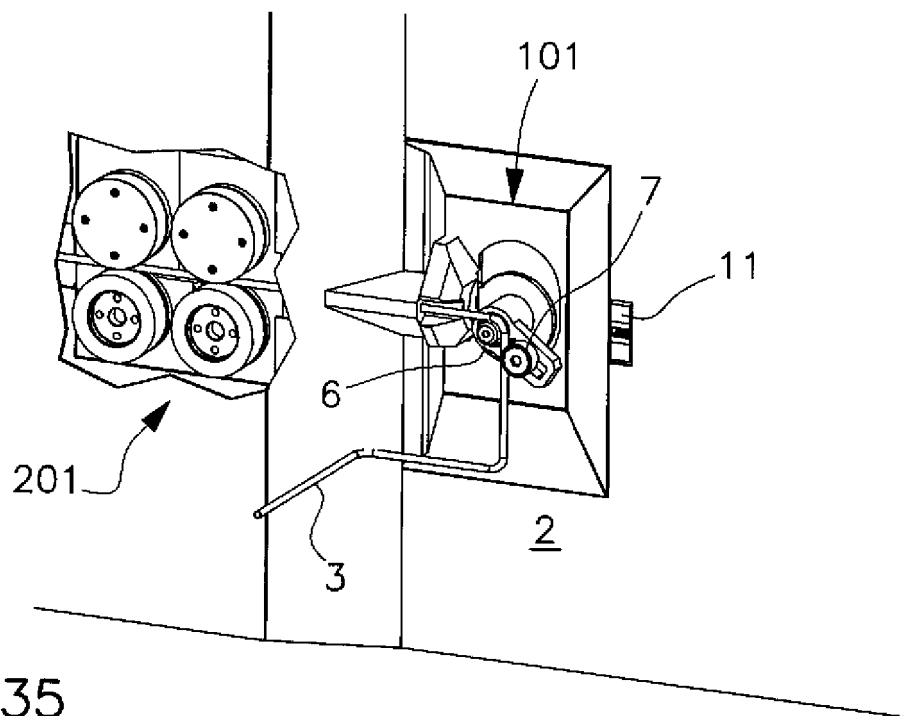


Fig.35

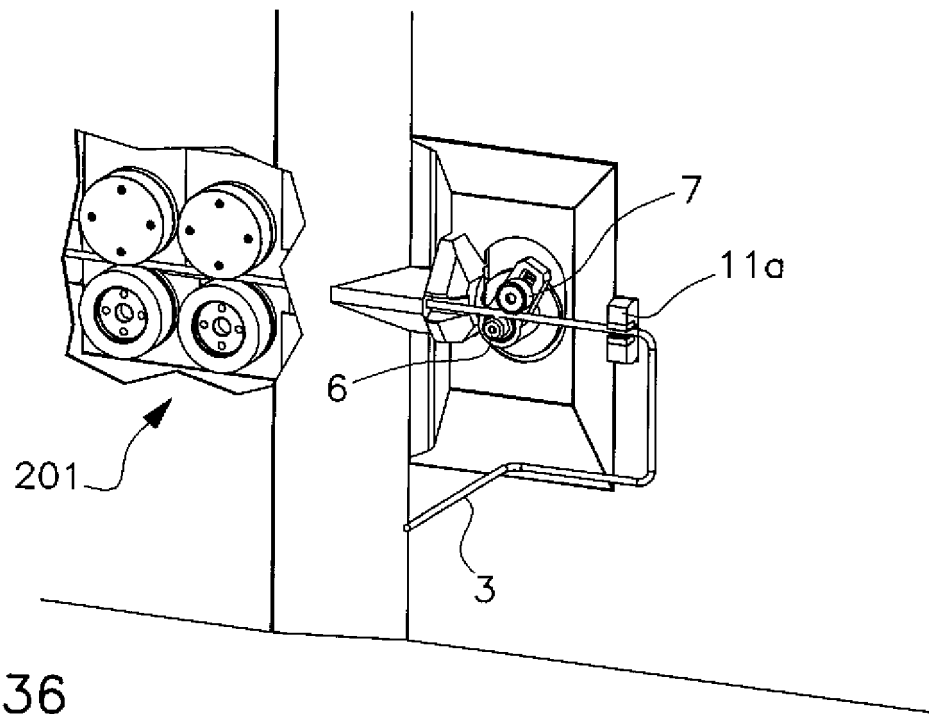


Fig.36

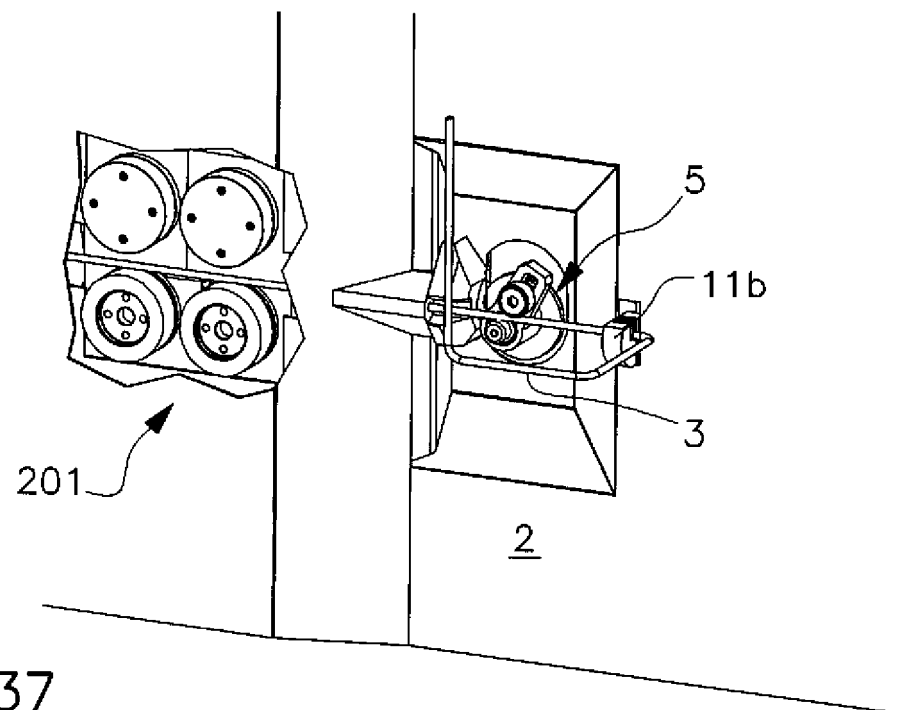


Fig.37

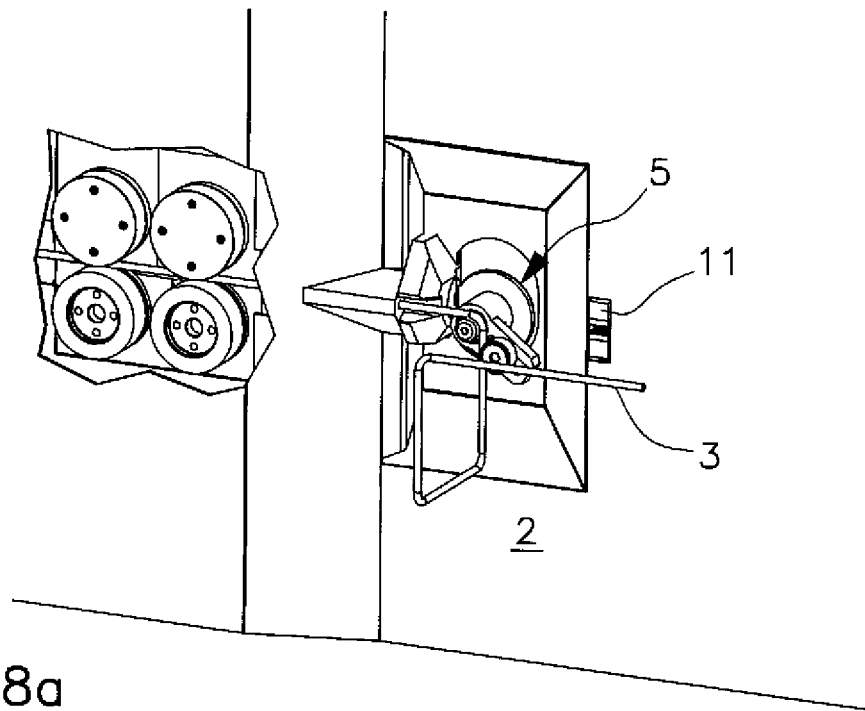


Fig.38a

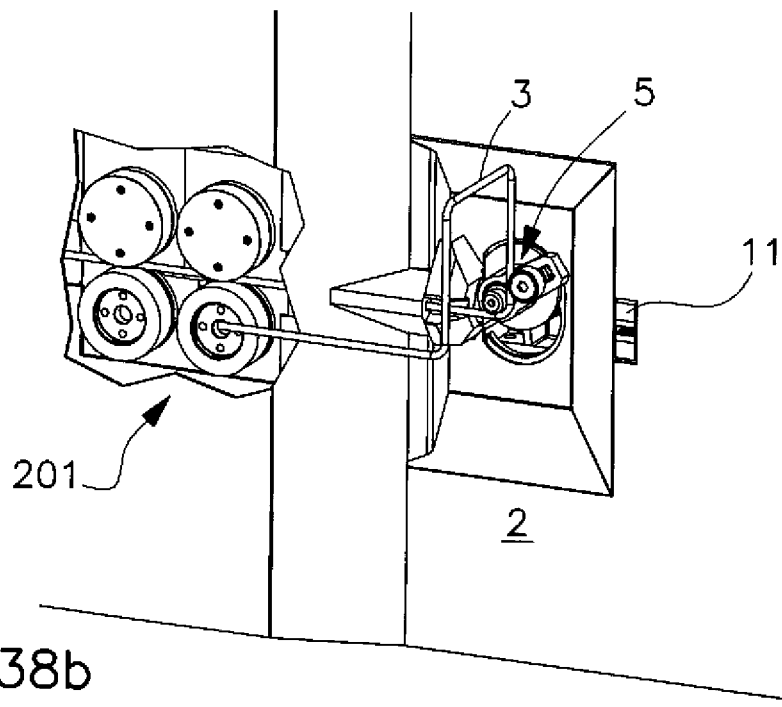


Fig.38b

REFERENCES CITED IN THE DESCRIPTION

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