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(71) Applicant: **Zorini, Luigi Omodeo**
27024 Cilavegna (PV) (IT)

(72) Inventor: **Zorini, Luigi Omodeo**
27024 Cilavegna (PV) (IT)

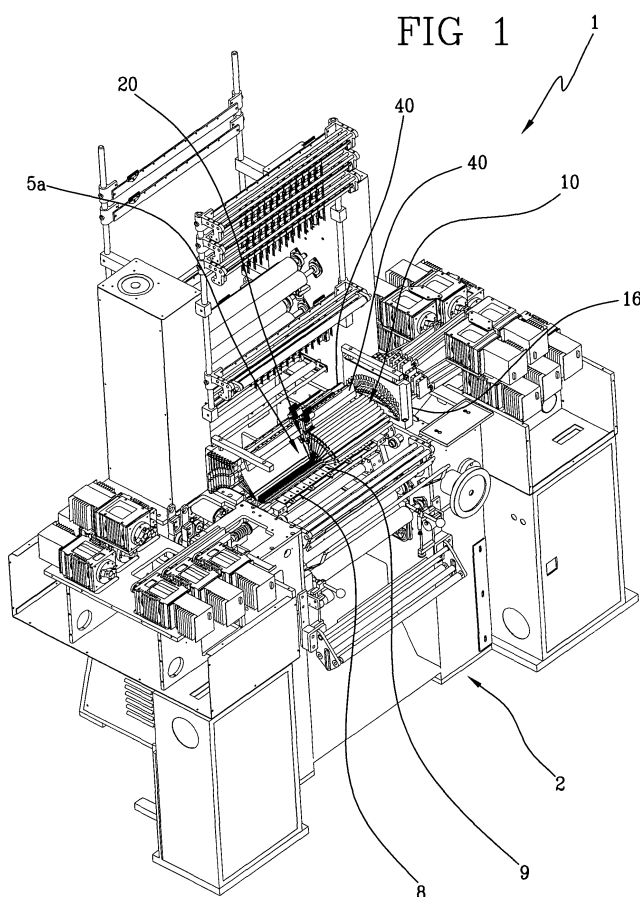
(74) Representative: **Baroni, Matteo**
Bugnion S.p.A.
Viale Lancetti, 17
20158 Milano (IT)

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(54) **Crochet machine**

(57) A crochet machine comprising weaving members (12) for manufacturing a textile product; at least one main bar (40); at least one weaving element (20) designed to obtain ornaments in said textile product; at least

one actuator (30) mounted on said main bar (40) and uniquely dedicated to said weaving element (20), said actuator (30) being active on said weaving element (20) to move the latter along a direction transverse to a longitudinal extension of said main bar (40).



Description

[0001] The present invention relates to a crochet machine.

[0002] It is known that in textile machines, such as crochet machines for warp knitting for example, also referred to as crochet galloon machines, formation of the textile product takes place by mutual intertwining, following predetermined patterns, of a plurality of warp threads and weft threads, suitably engaged by respective weaving members; said members are for example needles mounted on a needle bar, eye-pointed needles supported by a guide bar, and threading tubes mounted on one or more carrier slide bars.

[0003] These weaving members are driven, through suitable actuators, in synchronised cyclic movements to cause mutual intertwining of the warp threads and weft threads following the desired weaving pattern.

[0004] The weft threads and warp threads are fed to the respective weaving members from a plurality of bobbins mounted on a rack-shaped structure termed "creel" or they are unwound from a drum called "beam".

[0005] Take-down rollers are also provided in order to cause sliding of the textile product and progressive supply of same to the machine exit.

[0006] In addition to the above, the crochet machines can also be provided with one or more Jacquard devices designed to move further threading tubes in a direction transverse to the needle lying plane, in order to obtain additional ornaments in the manufactured textile product. This movement of the Jacquard type is generally obtained following two modes.

[0007] A first solution consists in mounting a driving head over the machine at a position substantially corresponding to the area where the product is made, which head through a plurality of actuators and/or a series of engagement elements mechanically interlocked with the main shaft of the machine, cause selective movement of the different Jacquard tubes, by exerting a suitable mechanical action on connecting wires linked to the upper ends of said tubes.

[0008] A second solution consists in positioning an electromagnetic actuator alongside the machine loom, which actuator essentially consists of a plate of metal material drivable in an electromechanical manner.

[0009] Each tube is selectively interlocked with the plate through a respective connecting wire, preferably housed in an elastomeric protection sheath, so that concurrently with movement of the plate, the tubes can be lifted or lowered as required by the ornament to be made.

[0010] The crochet machine can also be provided with a further member called "picker" which consists of a movable retaining element adapted to hold the weft thread in a position externally spaced apart from a side edge of the fabric so as to form a sort of loop on said side edge.

[0011] The picker is generally interlocked with the main shaft of the machine and connected thereto by means of a series of intermediate control linkages; in this way, the

picker is moved and driven with suitable synchronism relative to the other weaving members present on the machine and retains the weft thread when required (then releasing it after few instants).

[0012] A first drawback, that can be found with reference to all the different solutions briefly described above concerns the overall bulkiness of the structures used for support and movement of the Jacquard devices and the picker/s.

[0013] It is also to be pointed out that, for operation and displacement of these weaving elements, a plurality of moving mechanical parts are employed that are subjected to wear in time, require a continuous servicing and have an almost negligible operating flexibility.

[0014] A further drawback particularly connected with the solution contemplating the presence of said driving head mounted over the machine, consists in that a gauging operation (called "equalisation") of the mechanical structure of this head is required to be performed, which operation needs some time and specific knowledge in the matter and achievement of which in a sufficiently precise and reliable manner is very difficult.

[0015] In addition, the presence of the different connecting wires between the actuators acting on the tubes and the driving head, gives rise to a great number of problems for passage of the weft threads and for access thereto by the operators when for example servicing is required or there are problems to be solved during operation of the machine.

[0016] The present invention aims at making available a crochet machine having a reduced bulkiness and a simple structure, particularly with reference to devices of the Jacquard type and pickers.

[0017] Another aim of the invention is to provide a crochet machine in which the number of moving mechanical parts is reduced, in spite of the presence of devices of the Jacquard type and pickers.

[0018] A further aim of the invention is to make available a crochet machine having an important operating flexibility, particularly with reference to devices of the Jacquard type and pickers.

[0019] A still further aim of the invention is to provide a crochet machine that can be set up, regulated and serviced in a shorter time and with reduced costs as compared with the machines of known type.

[0020] The foregoing and further aims are substantially achieved by a crochet machine having the features recited in the appended claims.

[0021] Further features and advantages will become more apparent from the detailed description of an embodiment of a crochet machine given by way of non-limiting example and illustrated in the accompanying drawings, in which:

- Fig. 1 is a perspective view of a crochet machine according to the present invention;
- Fig. 2a shows a detail of the machine seen in Fig. 1;
- Fig. 2b is a side view of the detail seen in Fig. 2a;

- Fig. 3a shows a detail of Fig. 2a;
- Fig. 3b is a side view of the detail seen in Fig. 3a, with some parts removed for a better view of others;
- Figs. 4 and 5 are diagrammatic side views of a machine in accordance with the invention, with some parts removed for a better view of others;
- Figs. 6, 8a-8d diagrammatically show possible embodiments of actuators employed in the machine in accordance with the invention;
- Figs. 7a-7c show possible connections between an actuator and a weaving element in accordance with the invention;
- Figs. 9 and 10 are diagrammatic side views of a machine according to the invention, with some parts removed for a better view of others;
- Figs. 11a and 11b diagrammatically show a front view and a side view of a machine according to the invention with some parts removed for a better view of others;
- Figs. 12a and 12b diagrammatically show a front view and a side view of a machine according to the invention with some parts removed for a better view of others;
- Fig. 13 diagrammatically shows a fabric and the weaving elements for manufacture of same.

[0022] With reference to the drawings, a crochet machine in accordance with the present invention has been generally identified with reference numeral 1.

[0023] In the present context, by crochet machine it is intended any textile machine in which a textile product is manufactured which consists of a ground warp formed with a series of chains made by means of respective warp threads and obtained through suitable mutual movements of needles and eye-pointed needles, and of one or more weft threads guided by respective threading tubes so as to be transversely looped with said warp threads following predetermined patterns.

[0024] A possible embodiment of a crochet machine is disclosed in document EP99860 where a machine is shown in which the needles are oriented and moved along a direction oblique to the ground, and the eye-pointed needles are in a position facing the needles; in this type of machines the carrier slide bars are aligned on each other above the needles and are operatively associated with feeding elements designed to carry out movements in a vertical direction (or, more generally, along a trajectory having at least one vertical component) so as to engage the weft threads and bring them into the weaving area to enable the weft threads to be looped with the warp formed by needles and eye-pointed needles.

[0025] A further embodiment of a crochet machine is described hereinafter with reference to the accompanying drawings; it is to be noted that the present invention, referring particularly to use of one or more bars supporting Jacquard devices to be better described in the following, can apply both to the type of crochet machine briefly described above and to the crochet machine dis-

closed hereinafter.

[0026] With reference to the drawings, the crochet machine 1 comprises a base or framing 2 provided with two side posts to which at least one front bar 4 is horizontally engaged, at which sequential intertwining of the weaving threads for manufacture of a textile product takes place.

[0027] Also arranged between the side posts is a needle bar 6 carrying a plurality of needles 7. The needle bar 6 moves needles 7 along a direction substantially parallel to the longitudinal extension of said needles and perpendicular to the extension of the front bar 4.

[0028] Also mounted between the side posts is a guide bar 8 carrying a plurality of eye-pointed needles 9 and moving the latter along arched trajectories, astride needles 7, to obtain warp chains of said textile product.

[0029] The warp threads, each of which is engaged by a respective eye-pointed needle 9, are wound on a beam from which they are progressively unrolled during manufacture of the textile product.

[0030] The machine 1 further comprises one or more carrier slide bars 10 on which a plurality of threading tubes 11 are mounted; each carrier slide bar 10 is submitted both to a reciprocating motion in a vertical direction through suitable plates 16 engaging the ends of said carrier slide bar 10, and to a horizontal movement in a direction substantially parallel to a longitudinal extension thereof.

[0031] Alternatively, plates 16 can be stationary (i.e. rigidly connected to the machine base 2), while the front bar 4 is moved vertically with a reciprocating motion.

[0032] In this manner, the weft threads guided by said tubes 11 interlace with the warp chains obtained by the mutual movement of needles 7 and eye-pointed needles 9, forming the textile product.

[0033] Movement of said bars 6, 8 and 10, being of known type, is not herein further described.

[0034] Each weft thread is wound on a corresponding bobbin mounted on a creel and is progressively fed to a corresponding tube 11 for manufacture of the textile product; the weft threads can also be unwound from a beam.

[0035] Needles 7, eye-pointed needles 9 and tubes 11 can be generally identified as the textile members 12 of the machine 1.

[0036] The crochet machine 1 further comprises a main shaft (not shown) driven in rotation by suitable actuating means, preferably comprising an electric motor.

[0037] The main shaft is used to provide a reference to the synchronised movement of the different members of which the machine 1 is made up; in fact, the needle bar 6, guide bar 8 and carrier slide bar 10 directly or indirectly get their position and movement speed from the angular position and rotation speed of the main shaft.

[0038] In addition to the above, the crochet machine 1 further comprises at least one weaving element 20. This weaving element 20 may comprise a Jacquard device 21 and in particular a threading tube.

[0039] As better specified in the following, the Jacquard device 21 acts in such a manner as to preferably

provide further ornaments within the textile product being made, in addition to those usually obtained through the above mentioned tubes 11, needles 7 and eye-pointed needles 9.

[0040] The machine 1 also comprises at least one actuator 30 uniquely dedicated to said weaving element 20. This means that actuator 30 has the only function of moving the weaving element 20; practically there are no other weaving members or elements interlocked with actuator 30.

[0041] Actuator 30 is preferably mounted on a main bar 40 of the machine 1. Actuator 30 acts on the respective weaving element 20 to move the latter along a transverse direction preferably perpendicular to the longitudinal extension of the main bar 40.

[0042] In the case of the Jacquard device 21, this main bar 40 is preferably substantially parallel to the carrier slide bars 10 of the machine 1 (Fig. 2a) and the movement direction of the weaving element 20 due to actuator 30 can be the vertical direction relative to the ground.

[0043] Preferably, the main bar 40 is interposed between plates 16 to which the ends of the carrier slide bars 10 are connected; in more detail, the main bar 40 is supported by said plates 16.

[0044] In the embodiment in which the carrier slide bars 10 are moved in a vertical direction by plates 16, the main bar 40 too follows this reciprocating vertical movement, due to engagement between the main bar 40 and plates 16.

[0045] In addition, the main bar 40 is preferably interlocked with a longitudinal movement mechanism (not shown) that can be either of the mechanical type, comprising a cam connected through a suitable intermediate control linkage to the main shaft of the machine 1, or of the electromechanical type, comprising a suitable actuator such as an electric motor for example, acting on the main bar 40 itself.

[0046] In particular, the main bar 40 can be moved through a connecting-rod-crank coupling interlocked with the main shaft or with said actuator.

[0047] As shown in Figs. 2a, 2b, 3a, 3c, the weaving element 20 through which a movement of the Jacquard type is carried out is a threading tube 21; alternatively, the weaving element 20 can be provided with an eyelet 21a adapted to guide the thread according to said Jacquard movement (Fig. 7c).

[0048] This threading tube 21 is adapted to guide a thread supplied in the same manner as the weft threads are supplied to the respective tubes 11 mounted on the carrier slide bars 10, and to loop it in a selective manner into the fabric being manufactured, depending on the position taken by actuator 30.

[0049] Due to the action of actuator 30, the weaving element 20 can be shifted between a lower position at which it causes the thread guided by the weaving element 20 itself to be looped into the textile product, and an upper position at which this thread is not looped in the textile product.

[0050] As diagrammatically shown in Figs. 3a and 3b, the main bar 40 on which actuator 30 is mounted preferably has a housing seat 41 defined by a step 42 and by one or more plates 43 mounted on the upper edge 40a of the main bar 40 and projecting therefrom on the same side as the side from which step 42 projects.

[0051] Step 42 and plates 43 therefore define a groove or housing seat 41 with which actuator 30 is in engagement, through a respective connecting element 44.

[0052] The connecting element 44 has an expansion 45 suitable for engagement with said housing seat 41 and one or more support and guide portions 46a, 46b to which actuator 30 is engaged.

[0053] In particular, a fixed portion 31 of actuator 30 (rigidly connected to the main bar 40) is housed in a respective support portion 46a of the connecting element 44, while a movable portion 32 of actuator 30 (movable relative to the main bar 40 and acting on the weaving element 20) is slidably housed in a respective guide portion 46b of the connecting element 44.

[0054] In this manner, depending on the commands received by actuator 30, the weaving element 20 can be moved as above described.

[0055] Preferably, the threading tube 21 comprises a first portion 22 and a second portion 23. The first portion 22 is preferably substantially cylindrical and has a through hole 22a for engagement of the thread to be used for manufacture of the textile product. In particular, the through hole 22a is directed along the longitudinal extension of tube 21. The second portion is rigidly connected to the first portion 22 and is removably in engagement with actuator 30.

[0056] Removability of the weaving element 20 (in particular of tube 21), is particularly advantageous should replacement or servicing of same be required.

[0057] By way of example, Figs. 7a-7c show two possible embodiments of the connection between actuator 30 and weaving element 20 (in particular the threading tube 21 or eyelet 21a for movements of the Jacquard type).

[0058] In the example in Fig. 7a, preferably applicable to actuators having a substantially cylindrical extension, the movable portion 32 of actuator 30 has an outer covering portion 33 movable, in a predetermined stroke, along the longitudinal extension of actuator 30. A deformable element 34, preferably an elastic element, in particular a spring, keeps the covering portion 33 in an active position at which tube 21 is maintained in engagement with actuator 30.

[0059] The covering portion 33, following an axial stress manually exerted by an operator for example, can be shifted to a non-active position at which tube 21 can be released from actuator 30.

[0060] The movable portion 32 of actuator 30 is provided with a cylindrical surface 37 defining a respective cylindrical cavity adapted to engage the weaving element 20.

[0061] Said cylindrical surface 37 has one or more ax-

ial cuts 37a enabling radial deformation (i.e. an increase in the area of the opening mouth) of surface 37, to facilitate axial separation between tube 21 and actuator 30.

[0062] In said active position, the covering portion 33 radially covers said surface 37 at least partly so as to inhibit deformation of same and keep the tube linked to actuator 30. In said non-active position, the covering portion 33 covers surface 37 to a smaller degree and preferably does not cover it at all, so that it can become deformed and enable removal of tube 21.

[0063] In the example in Fig. 7b preferably applicable to actuators having a substantially parallelepiped shape, the distal end 32a of the movable portion 32 of actuator 30 has two elongated portions 38a, 38b axially spaced apart from each other; one of said elongated portions 38b has a tooth 38c extending externally in a radial direction.

[0064] The elongated portion 38b carrying tooth 38c preferably has a transverse section decreasing away from the fixed portion of actuator 30. Preferably, a weakening hollow 38d is present at the upper end of the two elongated portions 38a, 38b to facilitate movement of the portion 38b carrying tooth 38c.

[0065] The weaving element 20 has a covering portion 26 at least partly defining a cavity 26a into which the movable portion 32 of actuator 30 can be inserted. The covering portion 26 has a through side opening 27 adapted to house said tooth 38c. When actuator 30 engages the weaving element 20, the movable portion 32 is inserted into cavity 26a defined by the covering portion 26; to maintain said condition, tooth 38c is inserted into the side opening 27 of the covering portion 26 itself.

[0066] When the weaving element 20 is required to be removed for servicing, due to a failure, or also because a different weaving element (i.e. having different shape and/or sizes) is to be used, it is sufficient to apply an internally directed radial force to the tooth 38c and, by exploiting the deformable character of the elongated portion 38b carrying the tooth 38c itself, to release said tooth from the side opening 27 of the covering portion 26.

[0067] It is then possible to axially remove the movable portion 32 of actuator 30 from the covering portion 26 and thus complete disengagement between actuator 30 and weaving element 20.

[0068] Fig. 7c is quite similar to Fig. 7b, the only difference being replacement of tube 22 with an eyelet 21a.

[0069] As an alternative to the above, the movable portion 32 of actuator 30 is provided to be made of one piece construction with the weaving element 20; in this case an engagement of the removable type is preferably employed between actuator 30 and main bar 40.

[0070] Generally, actuator 30 and weaving element 20 define a weaving device for the machine 1.

[0071] Preferably, several actuators 30 disposed in side by side relationship can be mounted on the machine 1, each of them acting on a respective weaving element 20 and being uniquely dedicated thereto.

[0072] In particular, the distance between the weaving

elements 20 interlocked with said actuators 30 can be less than 4 mm, preferably less than 3 mm and equal to 2.5 mm, for example.

[0073] Advantageously, the size of actuators 30 evaluated along the longitudinal extension of the main bar 40 is smaller than 3 mm, preferably smaller than 2.5 mm and equal to 2.4 mm, for example.

[0074] As diagrammatically shown in Figs. 1, 2a and 3b, the machine 1 can comprise several main bars 40, each of which carries a plurality of actuators 30; each actuator 30 acts on a respective weaving element 20, such as a respective threading tube 21, for example. Preferably, the weaving elements 20 associated with a predetermined main bar 40 are alternated with the weaving elements associated with another main bar.

[0075] As diagrammatically shown in Figs. 2a, 2b, the threading tubes 11 being part of said weaving members 12 and the threading tubes 21 interlocked with actuators 30 are disposed in respective directions converging towards a weaving region or area 5a where said textile product is manufactured.

[0076] In other words, the threading tubes 11, 21 are such disposed as to define a sort of fan converging on the area 5a where needles 7, eye-pointed needles 9 and tubes 11 co-operate so as to obtain the textile product.

[0077] It will be appreciated that actuators 30 can be regulated individually, i.e. independently of each other. In particular, actuators 30 mounted on different main bars 40 can be operated separately, preferably according to predetermined phase displacements and/or synchronisms relative to the actuators mounted on the other main bars 40.

[0078] The weaving element 20 may comprise a picker device 25 (Figs. 4, 5, 9 and 13). The picker device 25 is provided with a grip element the function of which is to retain the weft thread for a predetermined period of time, while one or more textile members go on in their movement, and then release it enabling the weft thread itself to go on being looped.

[0079] Due to the picker device it is possible to obtain effects of the loop type, along the side edges of the textile product for example, or also over or under the textile product itself.

[0080] In more detail, the picker device 25 is movable between an operating position at which it is close to the weaving area 5a and retains a predetermined weft thread, and a non-operating position at which it is farther from the weaving area 5a and does not retain said weft thread.

[0081] The picker device 25 is preferably mounted on a respective main bar 40 that can be in particular defined by the front bar 4 of the machine 1 or by a bar rigidly associated with said front bar 4.

[0082] In this embodiment actuator 30 and the related picker device 25 operate in a direction substantially parallel to the longitudinal extension of needles 7.

[0083] Preferably, actuator 30 and/or the picker device 25 are guided by a respective groove formed in a surface

of the front bar 4.

[0084] The main bar 40 can also be a bar different from the front bar 4 and preferably disposed parallel to the front bar 4 itself.

[0085] Advantageously the machine 1 may comprise a pair of picker devices 25, each interlocked with a respective actuator 30, preferably mounted in the main bar 40 of the machine 1. Two pickers 25 are disposed on opposite sides of the weaving area 5a, so as to form loops or similar ornamental effects on both sides of the textile product (as diagrammatically shown, by way of example, in Fig. 13).

[0086] The machine 1 can also comprise a greater number of pickers, mounted to different positions depending on requirements and on the effects that are wished to be obtained on the textile product being manufactured.

[0087] Advantageously, as diagrammatically shown in Fig. 13, the picker device 25 (or picker devices 25) can be removably mounted on the main bar 40 for example, by a vice adjustable by means of respective screws. In this way, each picker device 25 can be freely shifted along the longitudinal extension of the main bar 40, so as to adapt the machine 1 to the requirements dictated by different embodiments.

[0088] Also actuator 30 dedicated to movement of picker 25 between its operating position and its non-operating position, can be removably engaged to the main bar 40 so as to enable it to be moved together with the picker 25 itself.

[0089] Preferably, the main bar 40 is interlocked with a respective actuator (not shown) for a longitudinal movement of same during operation of the machine 1, in particular according to a predetermined synchronism with the weaving members of the machine 1. In this manner the position at which picker 25 acts for manufacture of the textile product can vary during manufacture of the product itself.

[0090] The picker device (or devices) 25 can be also mounted to other positions of the machine 1; for instance it can be positioned at locations facing needles 7.

[0091] The picker device (or devices) 25 can also be mounted over or under the weaving area 5a; in these cases, movement of the device will preferably be along a substantially vertical direction. A technical solution of this type can be used for manufacture of such a product as Velcro® for example, having a series of projecting loops in a direction substantially perpendicular to the extension plane of the textile product.

[0092] According to another aspect of the invention (Fig. 5) the crochet machine 1 comprises a plurality of weaving members 12 for manufacture of a textile product in a predetermined weaving region 5a. The weaving members 12 can comprise needles 7, eye-pointed needles 9 and tubes 11 supported by respective bars 6, 8, 10.

[0093] The machine 1 further comprises a weaving element 20 consisting of a picker device 25 for co-operating in the manufacture of said textile product.

[0094] The machine 1 also comprises an actuator 30 uniquely dedicated to said picker device 25 and acting thereon to move it with a reciprocating motion close to and away from the weaving region 5a. Actuator 30 is rigidly mounted on the machine base 2 at a position facing the front bar 4 of said machine 1.

[0095] According to another aspect of the invention (Fig. 10), the crochet machine 1 comprises a plurality of weaving members for manufacture of a textile product in a predetermined weaving region 5a. The weaving members can comprise needles, eye-pointed needles and tubes supported by respective bars.

[0096] The machine 1 further comprises a weaving element 20 consisting of a retaining device 100 acting on the textile product 5 to hold it against the front bar 40 of the machine 1.

[0097] The machine 1 also comprises an actuator 30 uniquely dedicated to the retaining device 100 and active on the retaining device 100 itself to impart a reciprocating motion to the latter close to and away from the front bar 4.

[0098] In this manner the retaining device 100 is moved between an active position at which it pushes the textile product 5 against the front bar 40 so as to retain it, and a rest position at which it does not push the textile product 5, therefore letting it free to slide towards a possible taking-down member and/or a member for collecting the finished product.

[0099] Preferably, actuator 30 is rigidly mounted on the machine base, in particular at a position facing the front bar 4.

[0100] According to another aspect of the invention (Fig. 9), the crochet machine 1 comprises a plurality of weaving members for manufacturing a textile product in a predetermined weaving region 5a. The weaving members can comprise needles, eye-pointed needles and tubes supported by respective bars.

[0101] The machine 1 further comprises a weaving element 20 consisting of a cutting device 110 to laterally cut the textile product along a direction substantially parallel to the warp rows of said textile product.

[0102] Practically, the side acted upon by the cutting device 110 is a side parallel to the direction along which the product moves forward during its manufacture.

[0103] The machine 1 also comprises an actuator 30 uniquely dedicated to the cutting device 110 so as to start it at predetermined time instants; these instants are preferably defined according to a given synchronisation with the weaving members 12.

[0104] In more detail, the cutting device 110 comprises a first fixed portion 111, rigidly mounted on the machine base 2, and a movable portion 112 moved by actuator 30.

[0105] Each of the two portions 111, 112 is provided with a respective blade 111a, 112a, so that when actuator 30 acts on the second portion 112 and brings it close to the first one, the desired cutting action is obtained.

[0106] Preferably, the second portion 112 is pivotally mounted with respect to the first portion 111, so that actuator 30 causes an alternate rotary movement of same

around said fulcrum. Preferably actuator 30 is rigidly mounted on the machine base 2.

[0107] The machine can also comprise more than one cutting device, each of them being preferably associated with a respective dedicated actuator.

[0108] It will be noted that the above mentioned actuators 30 can be of the fluid-operated (pneumatic or oil-operated) type, of the electromagnetic type, or linear motors.

[0109] By way of example, Figs. 8a-8d diagrammatically show possible embodiments of an actuator 30 of the pneumatic type, while Fig. 6 diagrammatically shows the structure of an electromechanical actuator.

[0110] Each actuator 30 has a first inlet 35 so as to be fed by a feeding unit 50 associated with the machine 1.

[0111] When the actuator is of the pneumatic type, the feeding unit 50 may comprise a compressor connected to actuator 30 through an air duct to keep the actuator under pressure, preferably in the non-operating condition.

[0112] For an actuator 30 acting on a respective threading tube 21, the non-operating condition is that in which the thread supported by tube 21 is not looped into the product; for an actuator 30 acting on a picker device 25 the non-operating condition is that in which picker 25 does not retain any weft thread. For an actuator 30 acting on the retaining device 100, the non-operating condition is that in which the device does not retain the fabric against the front bar 40; for an actuator 30 acting on the cutting device 110, the non-operating condition is that in which the first and second portions 111, 112 are moved apart so that no cutting operation is carried out.

Advantageously, if the actuator is of the pneumatic type the feeding unit 50 can be also positioned far from the machine 1, so that possible recycling/recirculation operations of the compressed air can be carried out without any problem.

[0113] If the actuator is of the fluid-operated type, the feeding unit can consist of a pump adapted to keep the actuator under pressure by means of a suitable fluid reaching actuator 30 through a respective duct.

[0114] If the actuator is an electromagnetic actuator or a linear motor, the feeding unit 50 can consist of an electric power unit.

[0115] Preferably, the first inlet 35 is at an end of actuator 30 opposite to the end with which the textile element 20 is in engagement. For instance, in the case of the Jacquard device 21, the first inlet 35 is at the end 30a of actuator 30 opposite to that substantially facing the weaving area 5a.

[0116] For said actuators 30 use of a duct 150 is provided for connection between the feeding unit 50 and actuator 30; duct 150 has an end portion 150a in engagement with the first inlet 35 of actuator 30 which extends along a direction substantially parallel to the longitudinal extension of actuator 30.

[0117] Practically, as far as Jacquard devices 21 are for example concerned, the duct can be in engagement

with the upper end of actuator 30 and the end portion of this duct is oriented in a substantially vertical direction.

[0118] Figs. 8a-8d in particular show possible shapes of the connection between duct 150 and actuator 30. In Figs. 8a, 8b the end portion 150a substantially has an L-shaped conformation and is in engagement with the first inlet 35 of actuator 30 according to a direction transverse and preferably perpendicular to the longitudinal extension of the actuator 30 itself. In Figs. 8c, 8d the end portion 150a is in engagement with the first inlet 35 in a direction parallel to the longitudinal extension of actuator 30.

[0119] The machine 1 further comprises a control unit 60 to regulate and control operation of the different actuators 30.

[0120] Where actuator 30 is of the fluid-operated type, it is associated with a respective solenoid valve having an input for receiving a command signal from the control unit 60. In a first embodiment, the solenoid valve is mounted on actuator 30 and is substantially in contact therewith. In another embodiment, the solenoid valve is separated from the respective actuator 30 and is preferably positioned close to the control unit 60, alongside the machine base 2, for example.

[0121] Where an actuator of the electromagnetic type or linear motor is concerned, actuator 30 has a second input 36 for receiving a command signal from the control unit 60 so as to regulate movement of said weaving element 20.

[0122] Generally, the command signal causes movement of actuator 30 from its non-operating condition to its operating condition, so that the weaving element 20 can perform its function.

[0123] In one embodiment, actuator 30 has return means 160 (Figs. 8b, 8d) to bring actuator 30 and the related weaving element 20 back to the non-operating condition after the command signal has been received and the weaving element 20 has accomplished its task.

[0124] By way of example, the return means 160 can consist of a resilient element such as a spring for example, adapted to be resiliently deformed when actuator 30 reaches its operating condition so as to bring the latter back to the non-operating condition at the end of the action of the command signal.

[0125] Alternatively, actuator 30 can be a double-acting actuator (Figs. 8a, 8c) designed to receive a first command signal for moving from the non-operating condition to the operating condition, and a second command signal for going back to the non-operating condition.

[0126] Advantageously, in case of electromechanical actuator comprising a cylinder and a piston slidably movable within the cylinder, the latter contemplates the presence of a magnet at each of its axial ends so that the piston is maintained in its end-of-stroke positions (defining the non-operating and operating conditions of the actuator, respectively) until a further command causes generation of a field sufficiently strong to overcome the attraction between magnet and piston and move the piston to the opposite position.

[0127] According to an embodiment of the electromagnetic actuator, the piston, i.e. the actuator core, is provided to be made of magnetic material, in particular by means of a succession of magnets 170 surrounded by a plurality of coils 180 to increase the force generated per unit volume.

[0128] According to another aspect of the invention (Figs. 11a, 11b), the crochet machine 1 comprises a plurality of weaving members for manufacture of a textile product in a predetermined weaving region 5a; the weaving members 12 comprise at least one carrier slide bar 10 carrying a predetermined number of threading tubes 11.

[0129] The machine 1 further comprises a fluid-operated actuator 130, preferably of the pneumatic type, acting on the carrier slide bar 10 to rotate the same around its longitudinal axis.

[0130] In this manner the so-called "turning-over" movement is obtained which enables the position, at the inside of the fabric, where one or more weft rows can be inserted to be defined in a dynamic manner.

[0131] According to another aspect of the invention (Figs. 12a, 12b), the machine 1 comprises a plurality of weaving members for manufacture of a textile product in a predetermined weaving region.

[0132] The machine 1 further comprises at least one "figure 8" bar 120 provided with one or more threading tubes 121 and designed to carry out movements according to a "figure 8" trajectory with each of said tubes 121.

[0133] The machine 1 further comprises one or more actuators 140a of the fluid-operated (and preferably pneumatic) type, acting on the "figure 8" bar 120 to move the same around its longitudinal axis preferably through a kinematic mechanism 122.

[0134] To make the tubes 121 follow the "figure 8" trajectory, the machine 1 further comprises one or more actuators 140b preferably consisting of electric motors.

[0135] The invention achieves important advantages.

[0136] First of all the crochet machine in accordance with the invention has a reduced bulkiness and a simple structure, in particular with reference to the Jacquard and picker devices.

[0137] Another advantage resides in that, in spite of the presence of devices of the Jacquard and picker type, the number of moving mechanical parts is reduced, so that it is possible to minimise the machine wear and the necessity of carrying out servicing.

[0138] Another advantage is the great operating flexibility of the machine in accordance with the invention, particularly with reference to the Jacquard and picker devices mounted thereon.

[0139] Referring particularly to the different Jacquard devices that can be mounted on the same bar it is to be pointed out that, exactly due to the fact that each textile element is interlocked with a single respective actuator, it is possible to define the ornaments that will be obtained on the product by virtue of the positioning of the individual actuators.

[0140] In addition it is possible to also position Jacquard devices on the same bar so as to obtain different effects on different products made "in parallel" on the same machine.

[0141] A further advantage of the invention resides in that through mounting of several weaving elements on one bar and use of several bars mutually disposed in a suitable manner, the fineness of the effect to be obtained on the fabric can be defined by merely adding or removing some bars, the system thus acquiring a sort of modular character.

Claims

1. A crochet machine comprising:

- weaving members (12) for manufacturing a textile product;
- at least one main bar (40);
- at least one weaving element (20) designed to co-operate in manufacturing said textile product;
- at least one actuator (30) mounted on said main bar (40) and uniquely dedicated to said weaving element (20), said actuator (30) being active on said weaving element (20) to move the latter along a direction transverse to a longitudinal extension of said main bar (40).

2. A machine as claimed in claim 1, wherein said main bar (40) is substantially parallel to one or more carrier slide bars (10) of said machine (1).

3. A machine as claimed in anyone of the preceding claims, wherein said weaving element (20) is a threading tube (21).

4. A machine as claimed in the preceding claim wherein said main bar (40) is interposed between a pair of plates (16) between which one or more carrier slide bars (10) of said machine (1) are positioned.

5. A machine as claimed in claim 3 or 4, wherein said threading tube (21) comprises:

- a first portion (22), preferably substantially cylindrical, having a through hole (22a) for engagement of a thread to form said textile product;
- a second portion (23) rigidly connected to said first portion (22) and removably in engagement with said actuator (30).

6. A machine as claimed in anyone of claims 3 to 5, wherein a plurality of actuators (30) disposed in mutual side by side relationship are mounted on said main bar (40), each actuator acting on a respective weaving element (20).

7. A machine as claimed in claim 6, wherein the distance between the weaving elements (20) interlocked with said actuators (30) is less than 4 mm, and preferably less than 3 mm.
8. A machine as claimed in claim 6 or 7, wherein the size of said actuators (30) evaluated along the longitudinal extension of said main bar (40) is smaller than 3 mm and preferably smaller than 2.5 mm.
9. A machine as claimed in anyone of claims 6 to 8, comprising a plurality of main bars (40), each carrying a plurality of actuators (30), each actuator (30) acting on a respective weaving element (20).
10. A machine as claimed in the preceding claim, wherein the weaving elements (20) mounted on a predetermined main bar (40) are alternated with the weaving elements (20) mounted on another main bar (40).
11. A machine as claimed in anyone of claims 6 to 10, wherein threading tubes (11) being part of said weaving members (12) and threading tubes (21) interlocked with said actuators (30) are disposed along respective directions converging towards a weaving region (5a) where said textile product is manufactured.
12. A machine as claimed in claim 1 or 2, wherein said weaving element (20) is a picker device (25).
13. A machine as claimed in the preceding claim, wherein said main bar (40) is a front bar (4) of said machine (1).
14. A machine as claimed in claim 12, wherein said main bar (40) is parallel to said front bar (4) and is mounted on the opposite side from the latter with respect to said weaving area (5a).
15. A crochet machine comprising:
- weaving members (12) for manufacturing a textile product in a predetermined weaving region (5a);
 - one weaving element (20) consisting of a picker device (25) for co-operating in manufacturing said textile product;
 - an actuator (30) uniquely dedicated to said picker device (25) and acting on said picker device (25) for an alternate movement of same close to and away from said weaving region (5a).
16. A machine as claimed in the preceding claim, wherein said actuator (30) is rigidly mounted to a base (20) of said machine (1) at a position facing a front bar (4) of said machine (1).

17. A crochet machine comprising:

- weaving members (12) for manufacturing a textile product in a predetermined weaving region (5a);
- a weaving element (20) consisting of a retaining device (100) acting on said textile product to retain it against a front bar (40) of said machine (1);
- an actuator (30) uniquely dedicated to said retaining device (100) and active on said retaining device (100) for an alternate movement of same close to and away from said front bar (40) so as to move said retaining device (100) between an active position at which it pushes said textile product against said front bar (40), and a rest position at which it does not push said textile product.

18. A machine as claimed in the preceding claim, wherein said actuator (30) is rigidly mounted on a base (2) of said machine (1) preferably at a position facing said front bar (4).

19. A crochet machine comprising:

- weaving members (12) for manufacturing a textile product in a predetermined weaving region (5a);
- a weaving element (20) made up of a cutting device (110) to laterally cut said textile product along a direction substantially parallel to the warp rows of said textile product;
- an actuator (30) uniquely dedicated to said cutting device (110) to start the latter at predetermined time instants.

20. A machine as claimed in the preceding claim, wherein said cutting device (110) comprises a first fixed portion (111) rigidly mounted to a base (2) of the machine (1), and a movable portion (112) operated by said actuator (30).

21. A machine as claimed in the preceding claim wherein said actuator (30) is rigidly mounted to a base (2) of said machine (1).

22. A machine as claimed in anyone of the preceding claims, wherein said actuator (30) is a fluid-operated actuator, an electromagnetic actuator or a linear motor.

23. A machine as claimed in anyone of the preceding claims, wherein said actuator (30) has a first inlet (35) to be fed by a feeding unit (50) associated with said machine (1).

24. A machine as claimed in the preceding claim, where-

in said first inlet (35) is at an end of said actuator (30) opposite to the end with which said textile element (20) is in engagement.

- 25.** A machine as claimed in the preceding claim, further comprising a duct (150) for connection between said feeding unit (50) and actuator (30), said duct (150) having an end portion (150a) in engagement with said first inlet (35) of said actuator (30), said end portion extending along a direction substantially parallel to the longitudinal extension of said actuator (30). 5
- 26.** A machine as claimed in anyone of the preceding claims, wherein said actuator (30) is a fluid-operated actuator, associated with a respective solenoid valve, having an input for receiving a command signal from a control unit (60) to regulate movement of said actuator (30). 10
- 27.** A machine as claimed in the preceding claim, wherein said solenoid valve is mounted on said actuator (30). 15
- 28.** A machine as claimed in claim 26, wherein said solenoid valve is separated from said actuator and preferably positioned close to said control unit (50). 20
- 29.** A machine as claimed in anyone of the preceding claims, wherein said actuator (30) has a second input (36) for receiving a command signal from a control unit (60) of said machine (1), to regulate movement of said weaving element (20). 25
- 30.** A crochet machine comprising: 30
- weaving members (12) for manufacturing a textile product in a predetermined weaving region (5a);
 - said weaving members (12) comprising at least one carrier slide bar (10) carrying a predetermined number of threading tubes (11); 35
 - a fluid-operated actuator (130), preferably of the pneumatic type, acting on said carrier slide bar (10) to rotate the same around its longitudinal axis. 40
- 31.** A crochet machine comprising: 45
- weaving members (12) for manufacturing a textile product in a predetermined weaving region (5a); 50
 - at least one "figure 8" bar (120), provided with one or more threading tubes (121) and designed to carry out movements according to a "figure 8" trajectory with each of said tubes (121); 55
 - a fluid-operated actuator (140a) preferably of the pneumatic type, acting on said "figure 8" bar

(120) to move the latter around its longitudinal axis;

- an actuator (140b), preferably consisting of an electric motor to move said "figure 8" bar along its longitudinal axis to cause said tubes (121) to follow said "figure 8" trajectory.

- 32.** A weaving device for textile machines, in particular crochet machines, comprising:

- a weaving element (20) for manufacturing a textile product;
- an actuator (30) operatively dedicated in a unique manner to said weaving element (20) and acting on said weaving element (20) for movement of same;

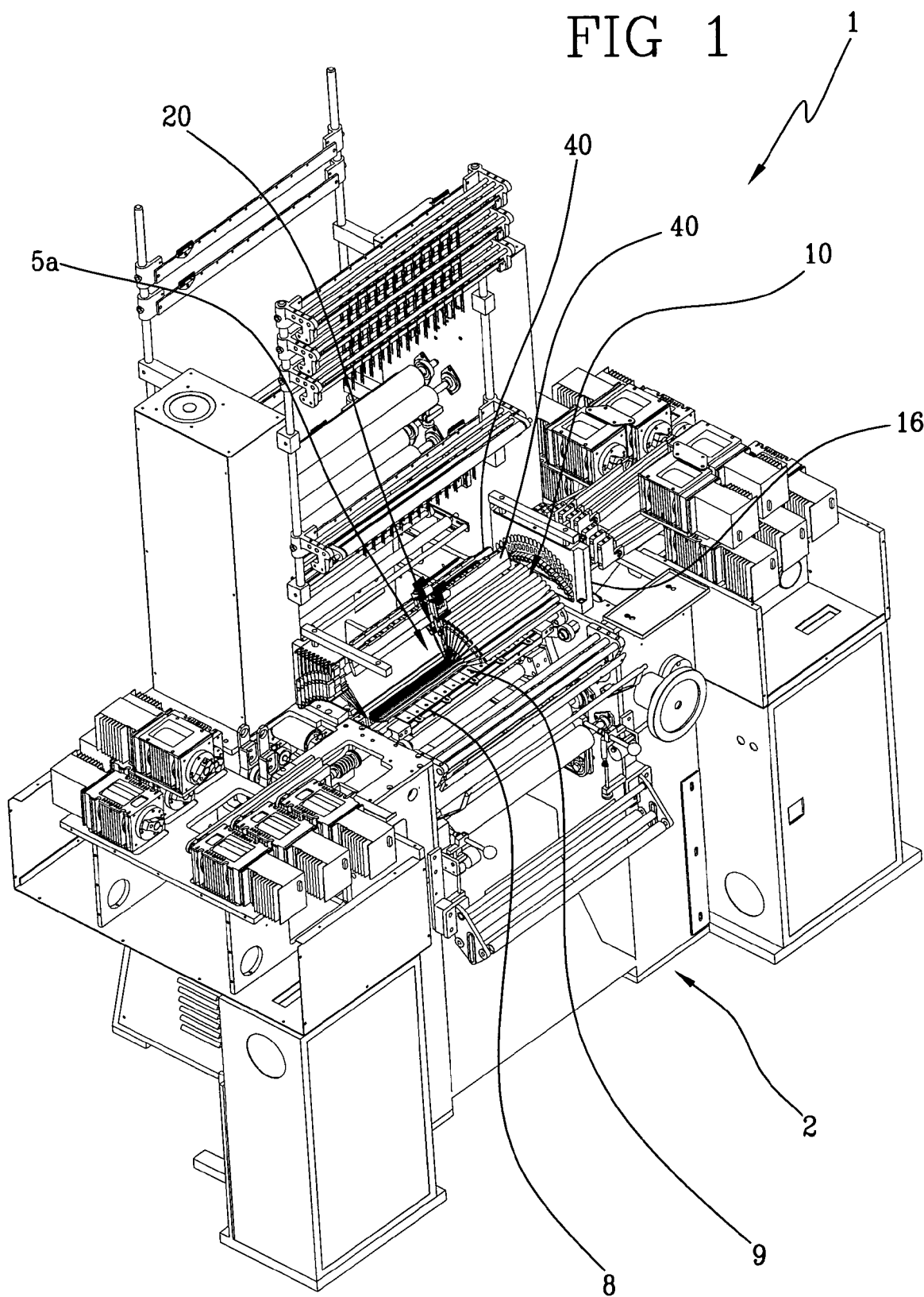
said weaving element (20) being removably linked to said actuator (30).

- 33.** A device as claimed in the preceding claim, wherein said weaving element (20) is a threading tube (21) or an eyelet (21a).

- 34.** A device as claimed in claim 32 or 33, wherein said actuator (30) and/or weaving element (20) is deformable, preferably in a reversible manner and in particular in an elastic manner.

- 35.** A device as claimed in the preceding claim, wherein said actuator (30) and/or textile element (20) is deformable so as to define an engagement condition at which the actuator (30) and weaving element (20) are mutually linked, and a release condition at which the actuator (30) and weaving element (20) are mutually disengaged.

FIG 1



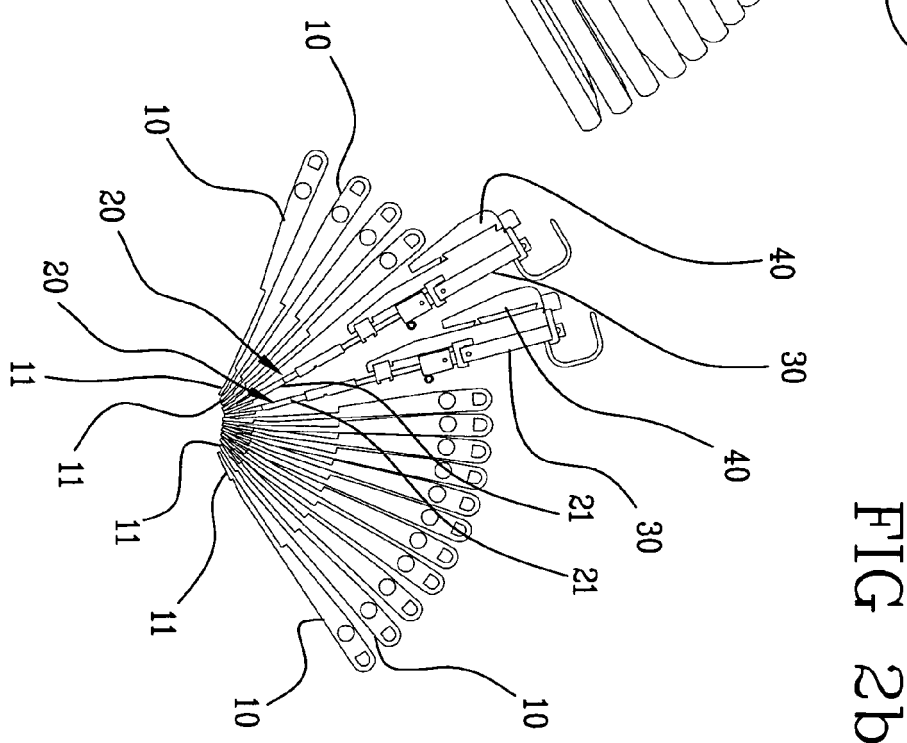
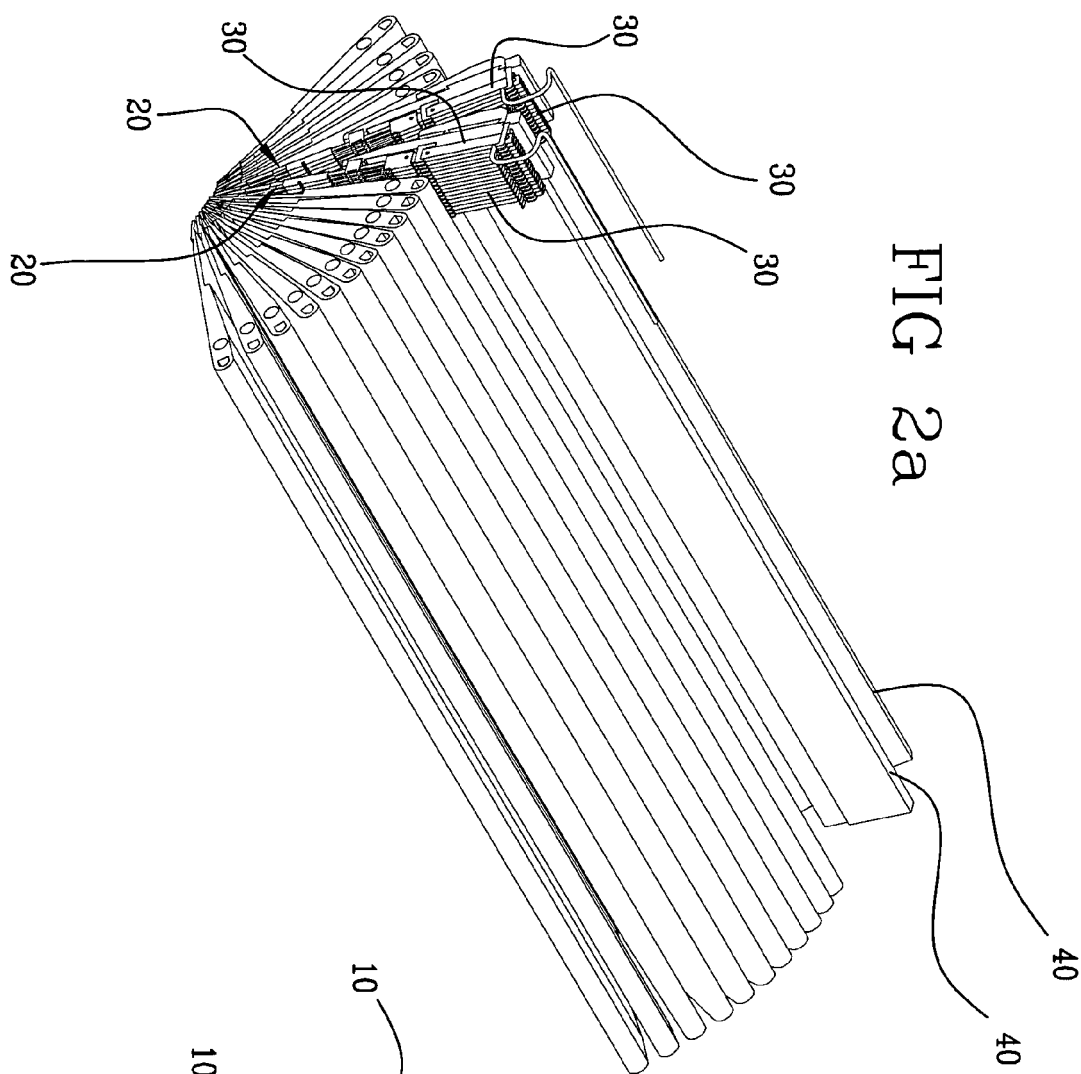


FIG 3a

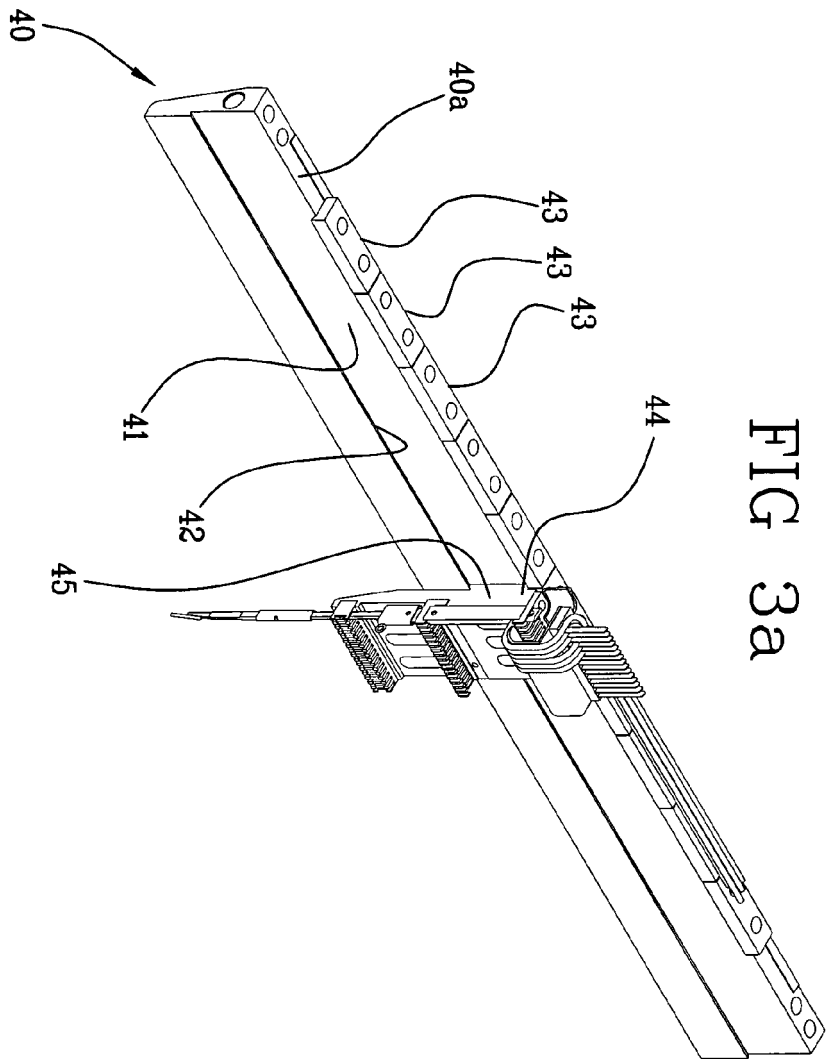


FIG 3b

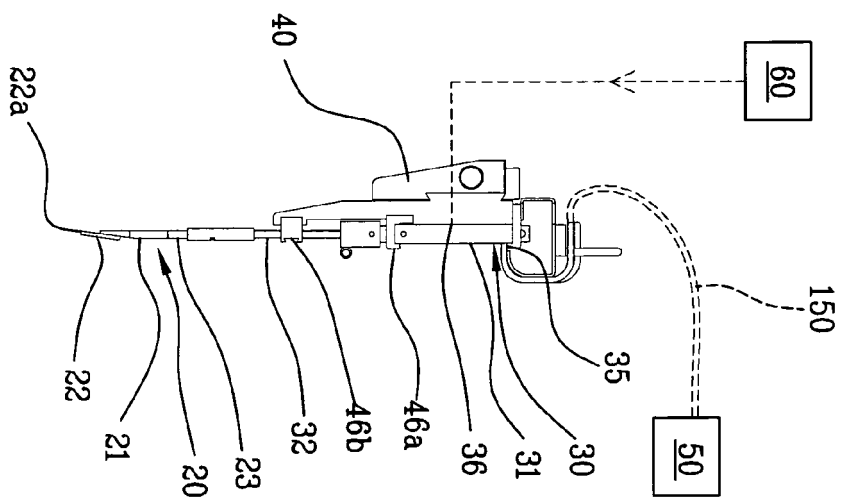


FIG 4

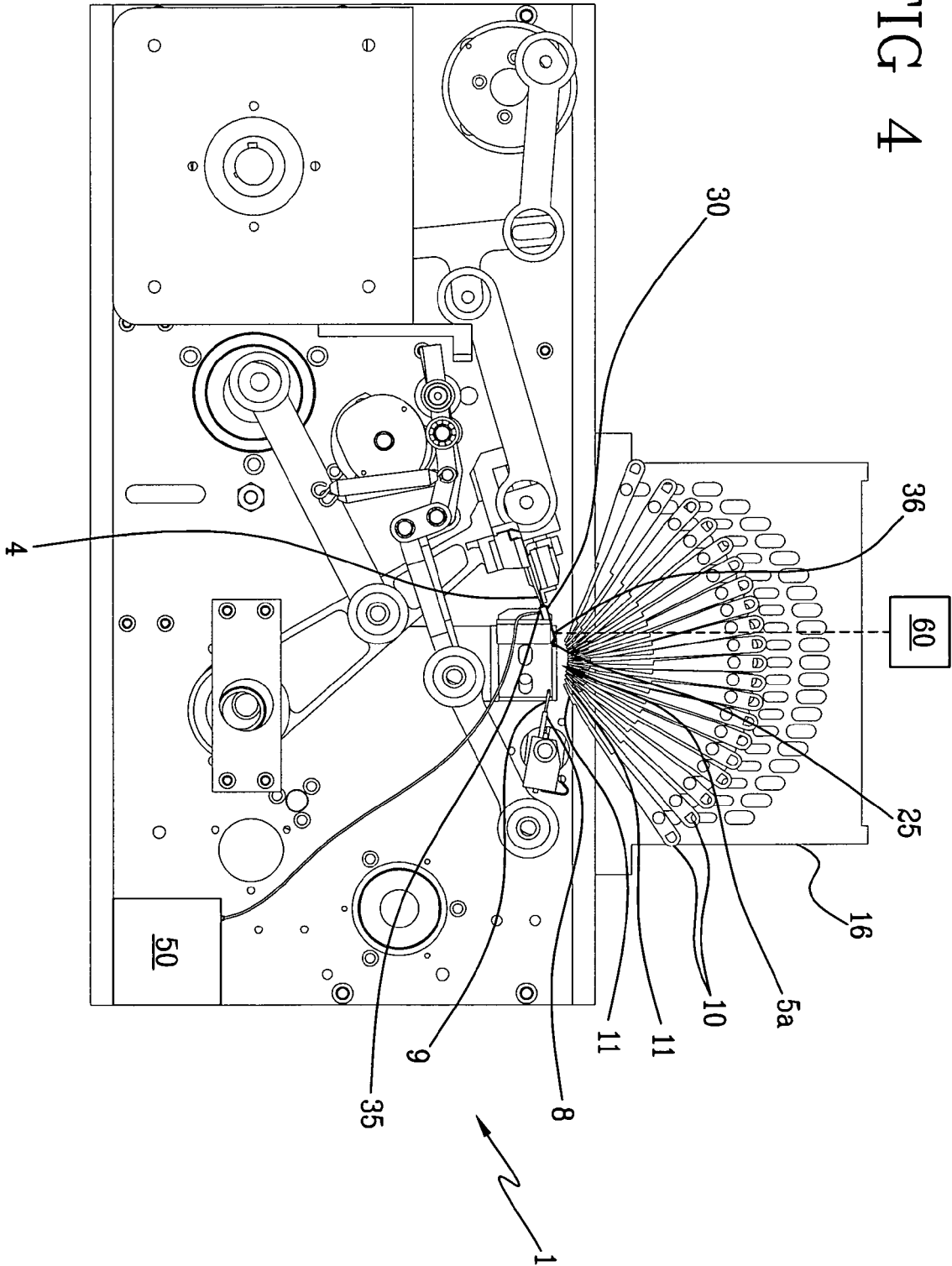


FIG 5

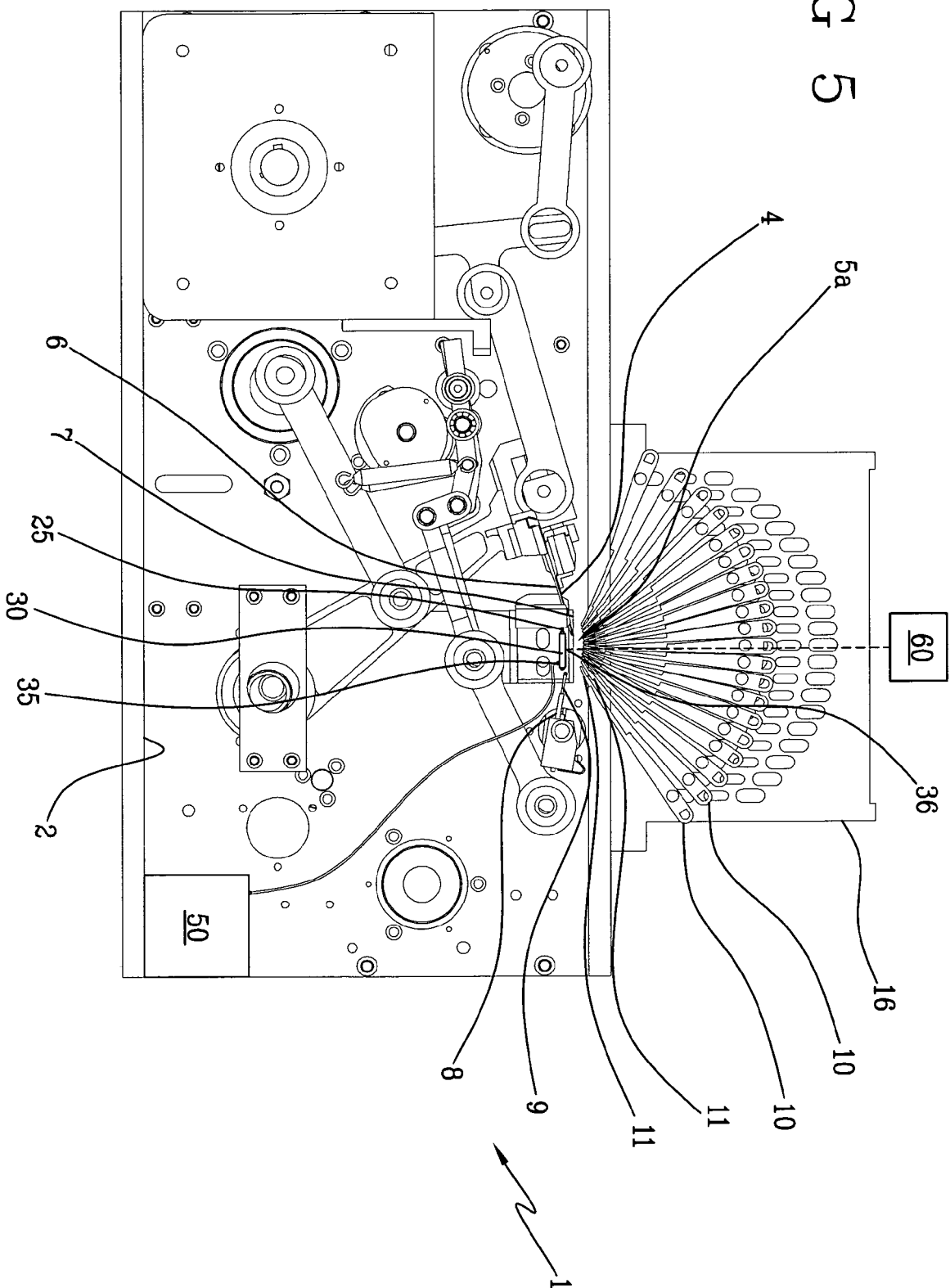


FIG 6

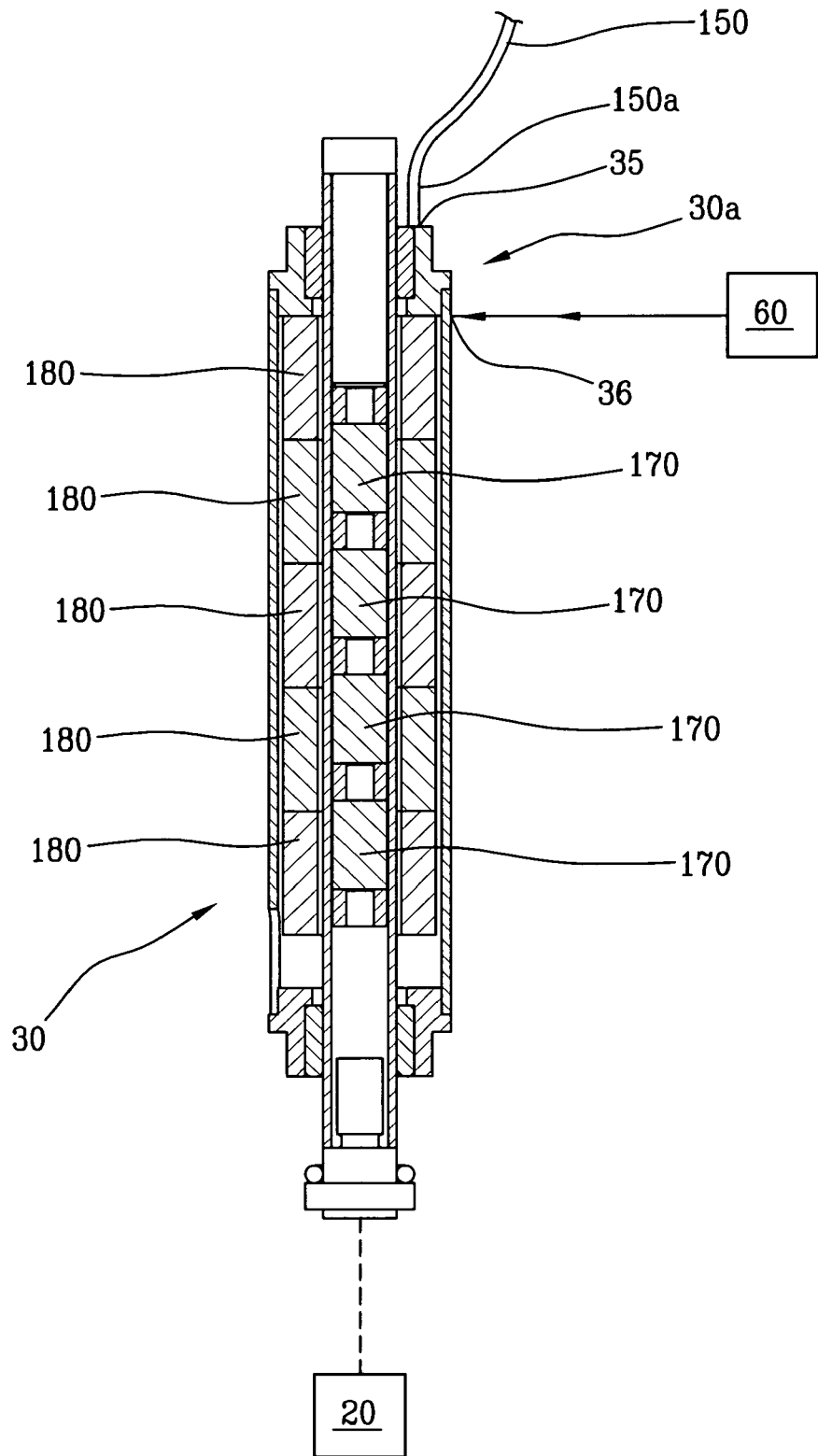


FIG 7a

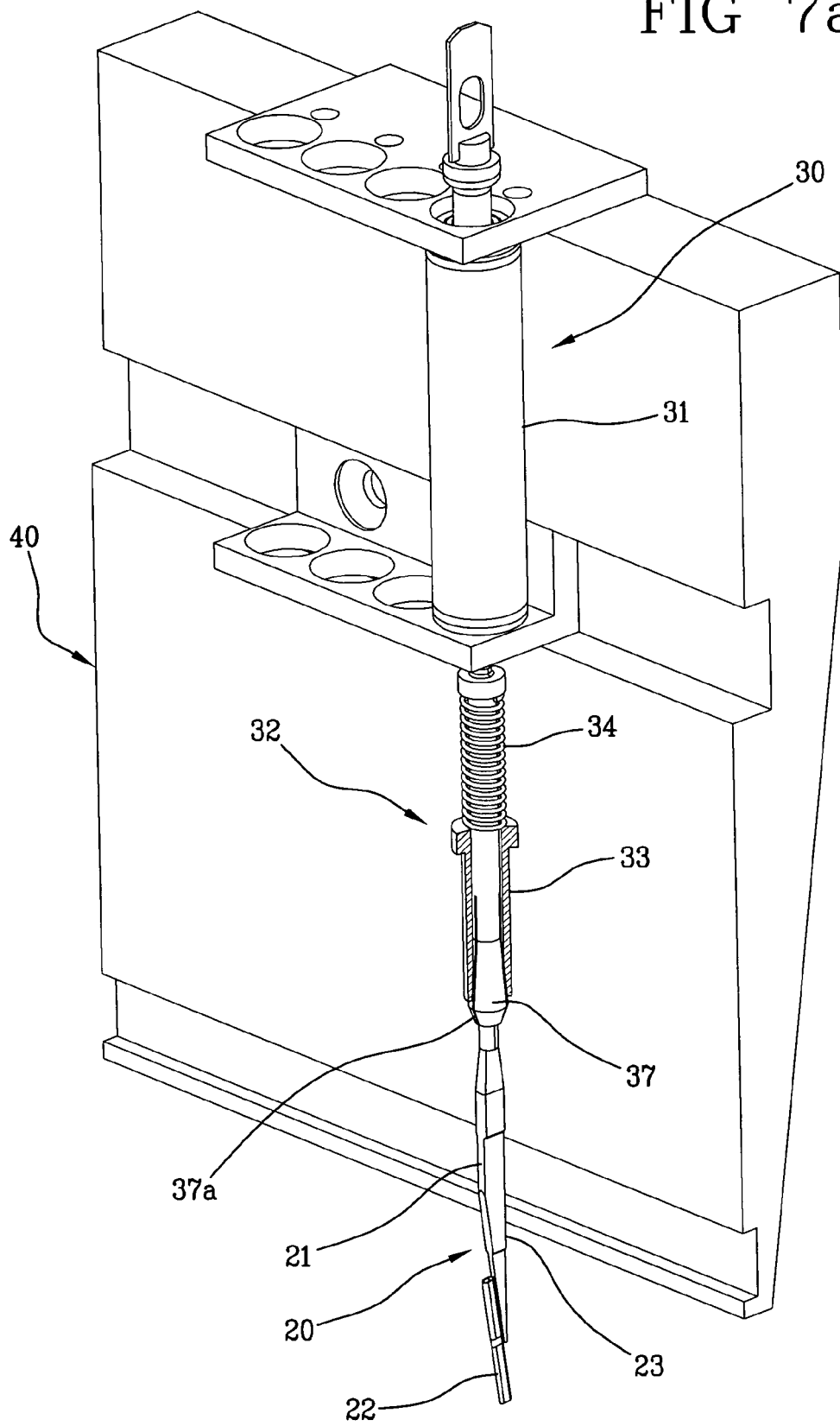


FIG 7b

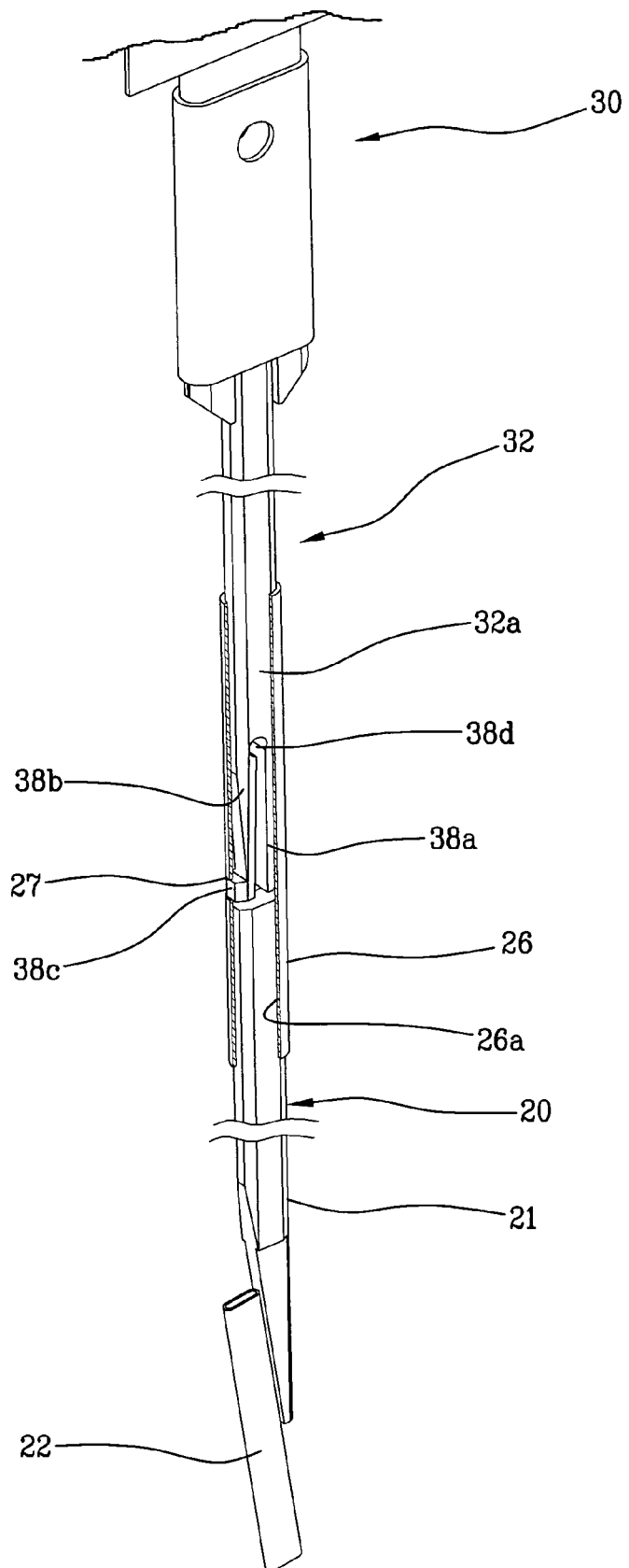
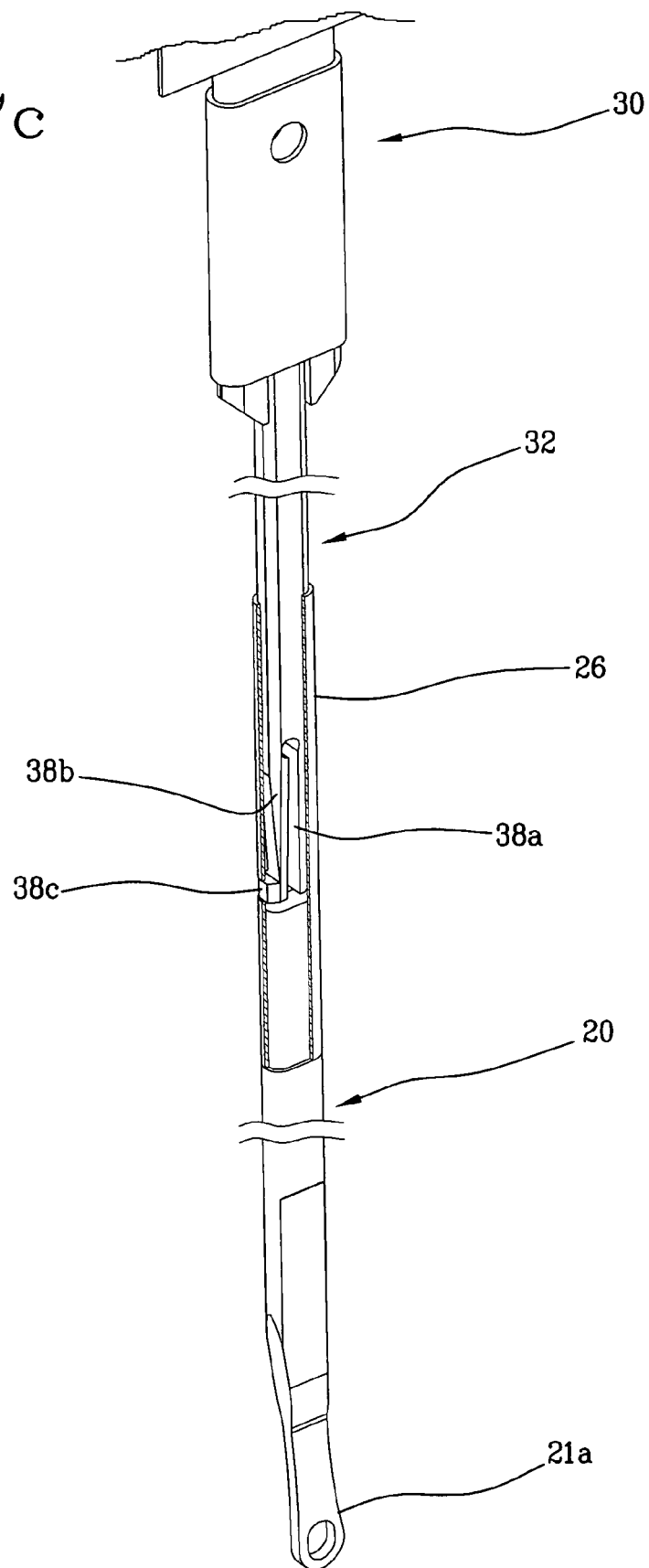
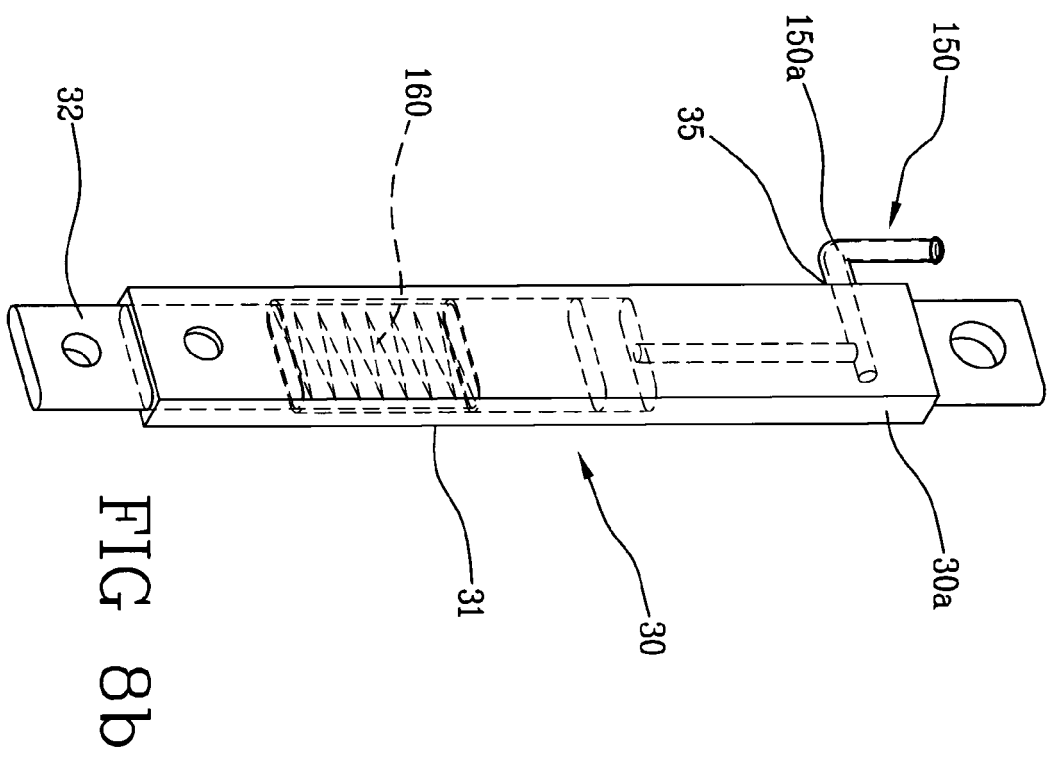
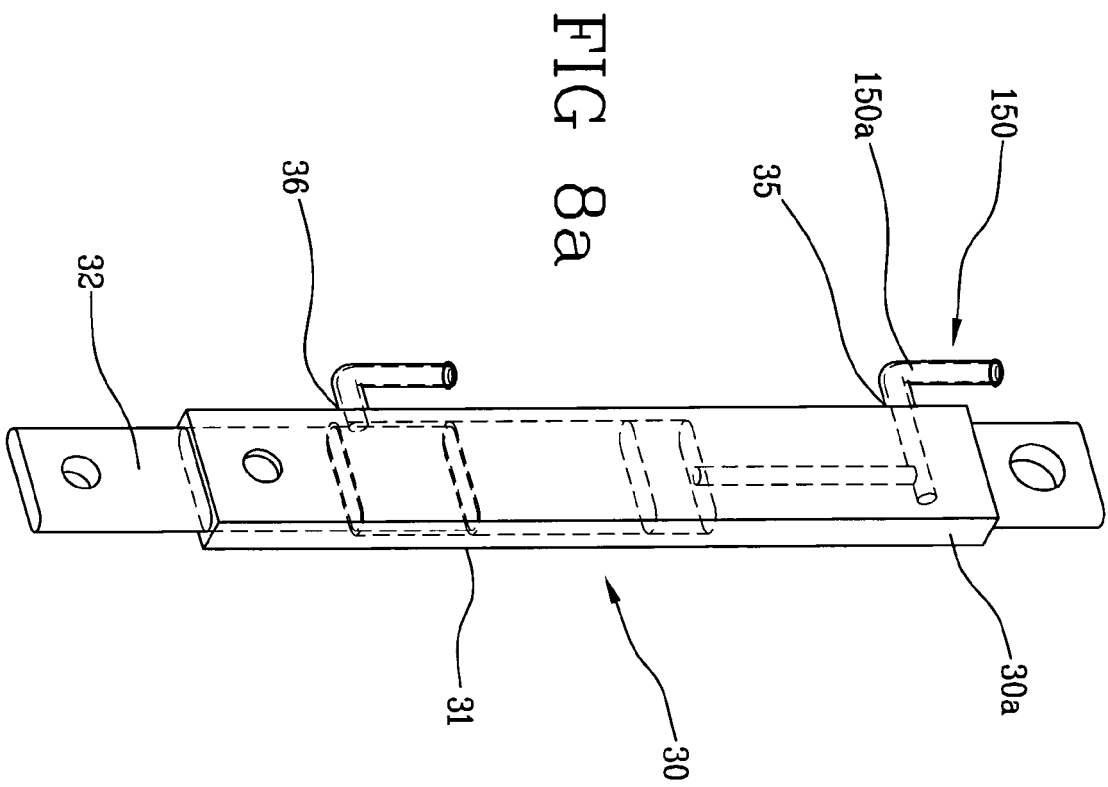
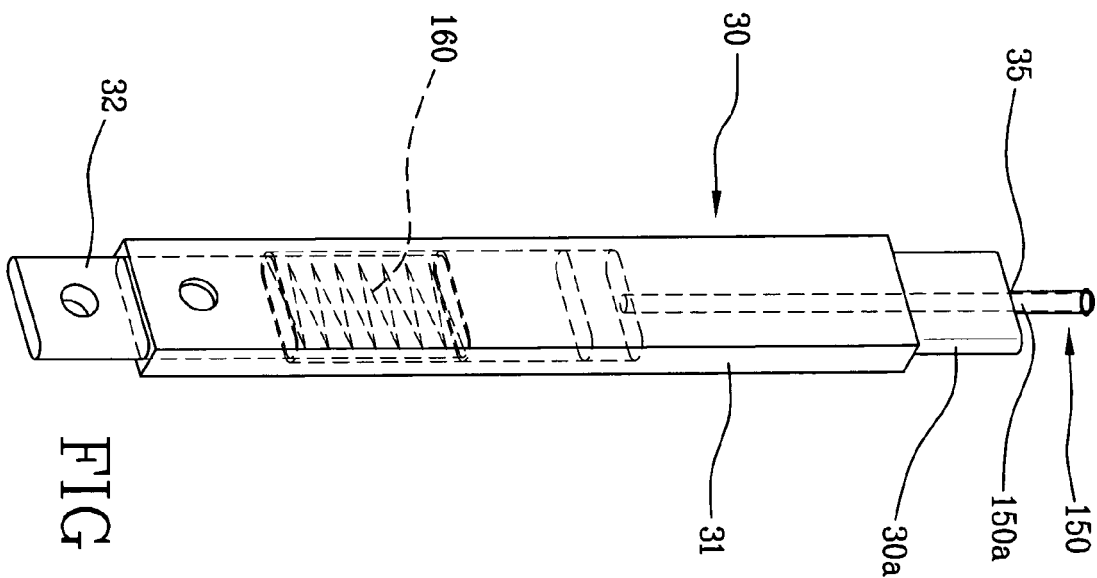
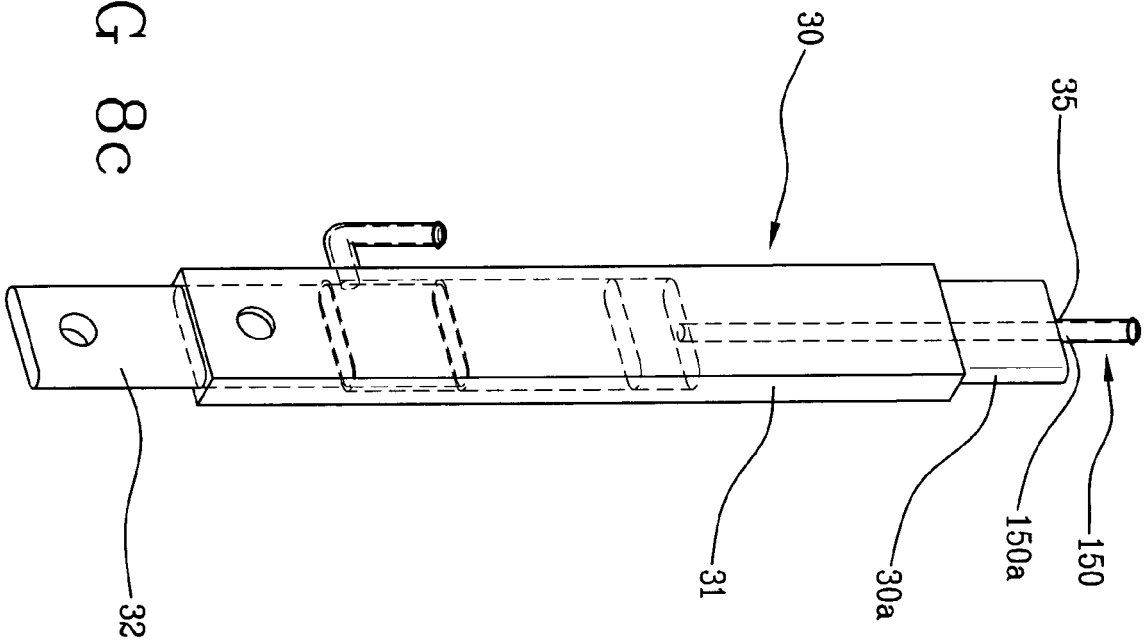


FIG 7c







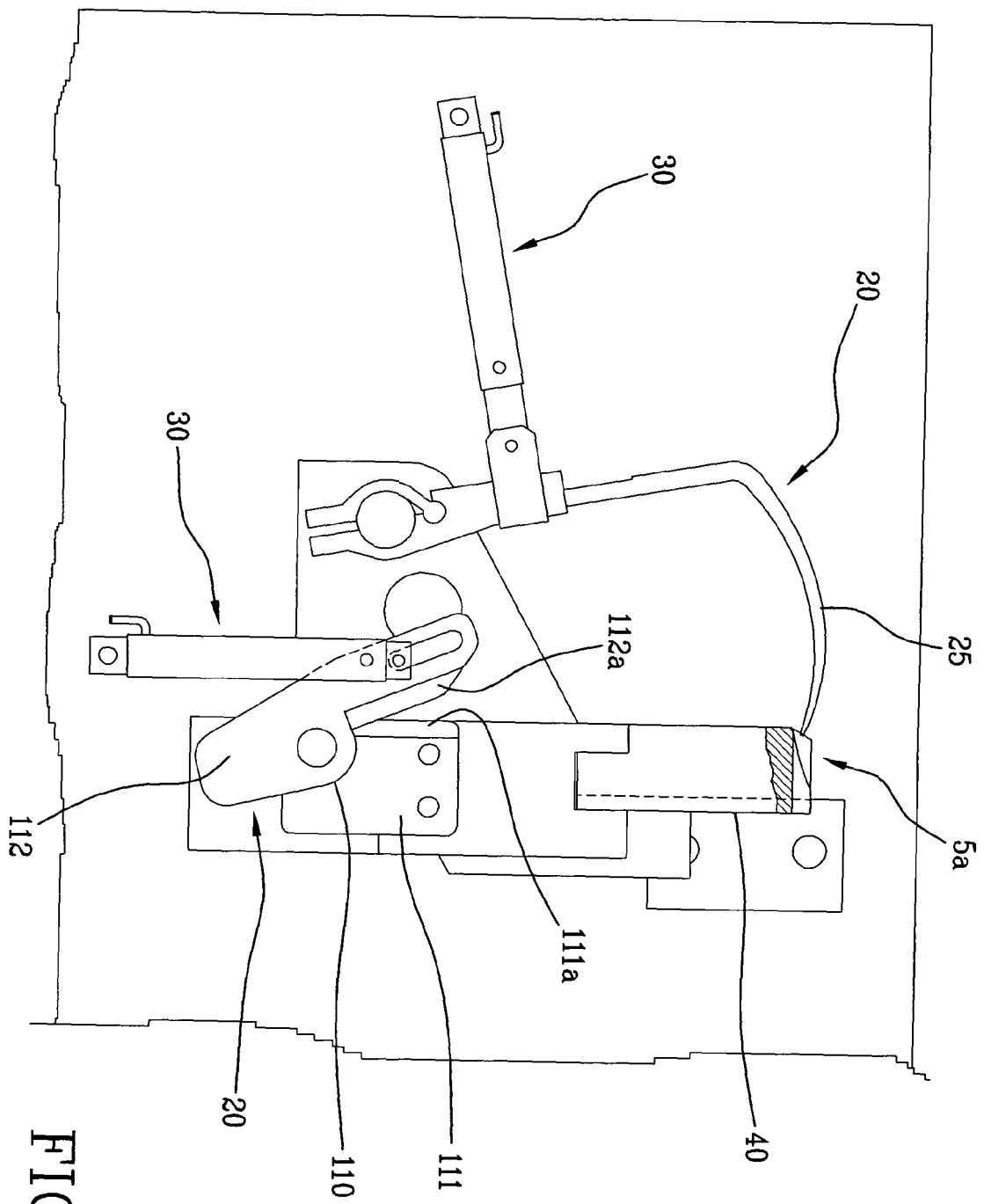


FIG 9

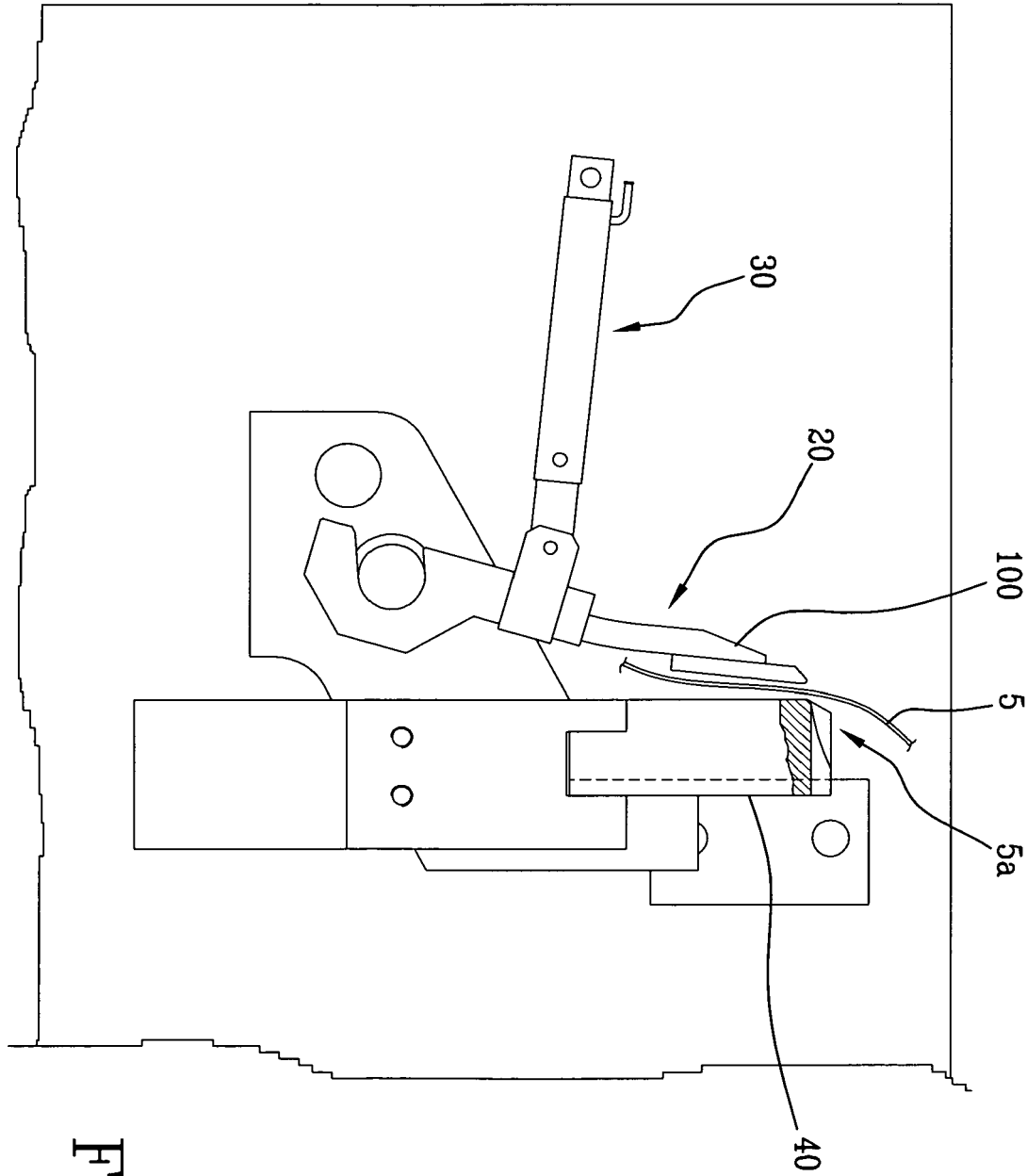
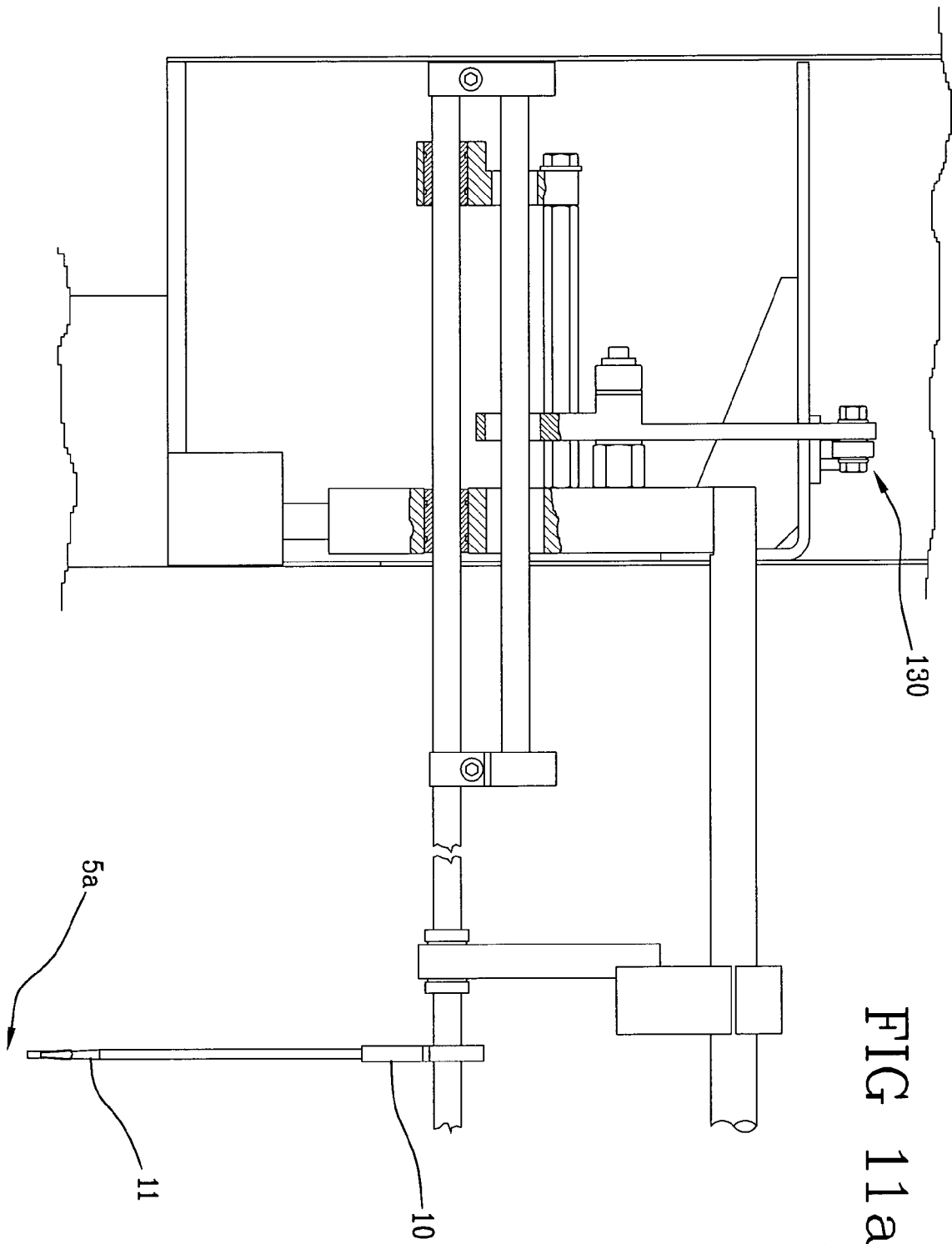


FIG 10



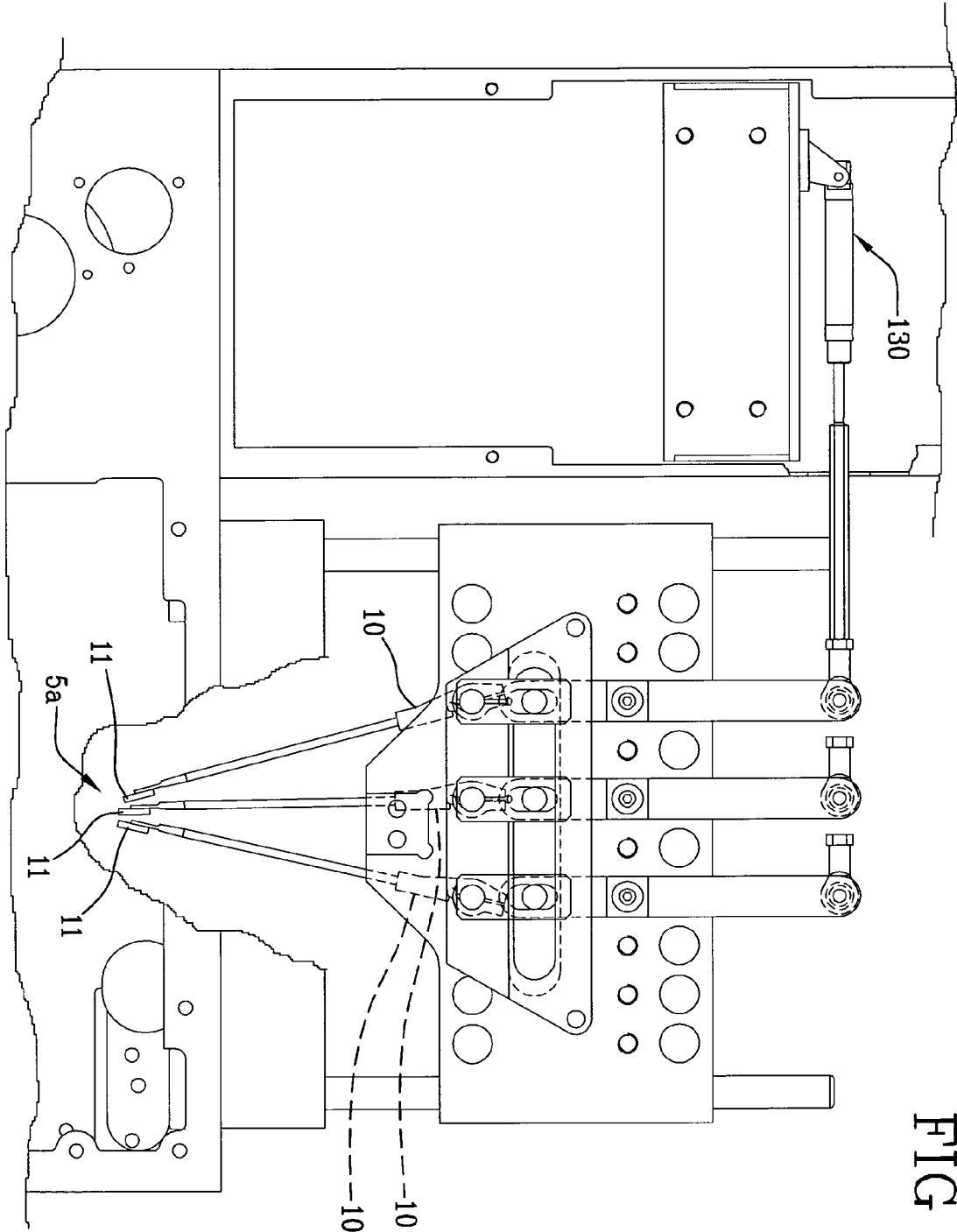


FIG 11b

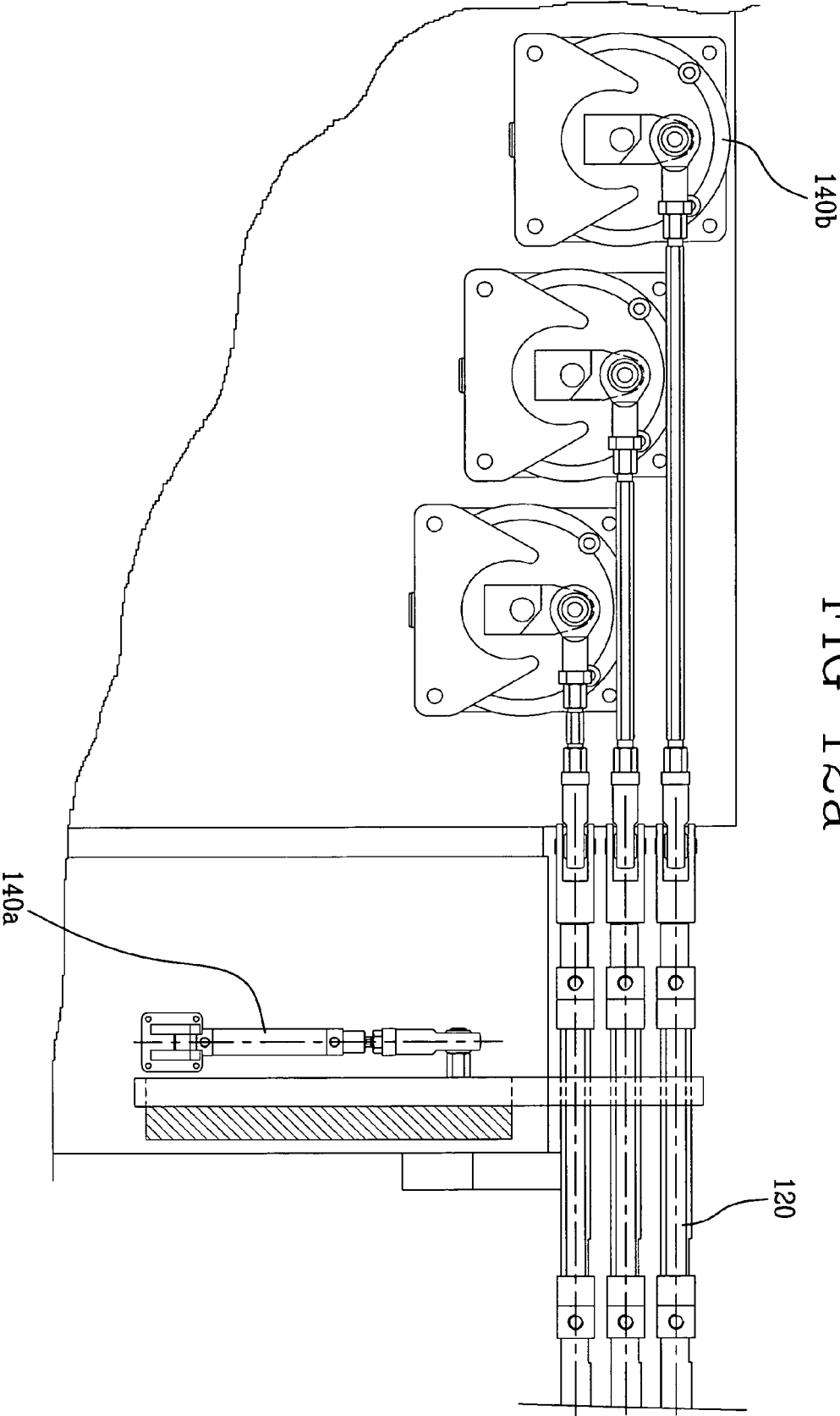


FIG 12b

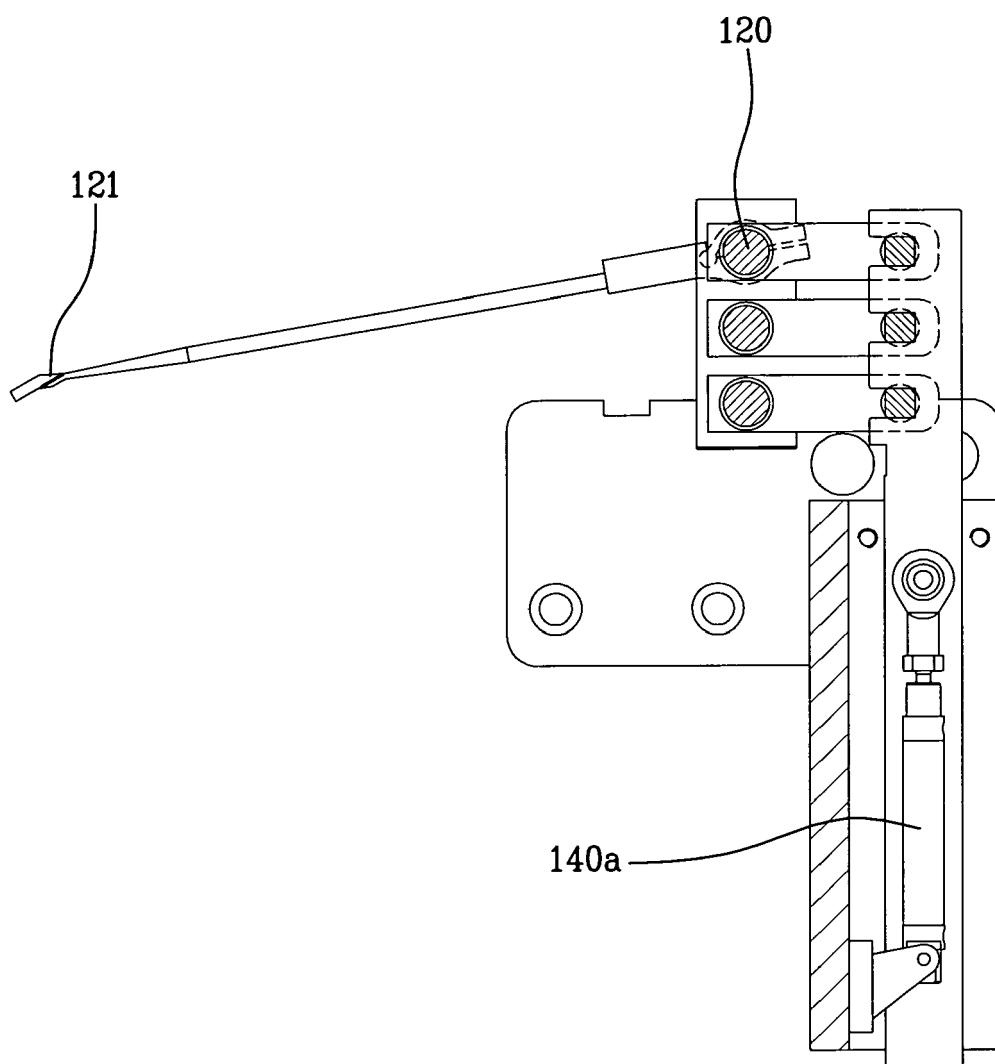
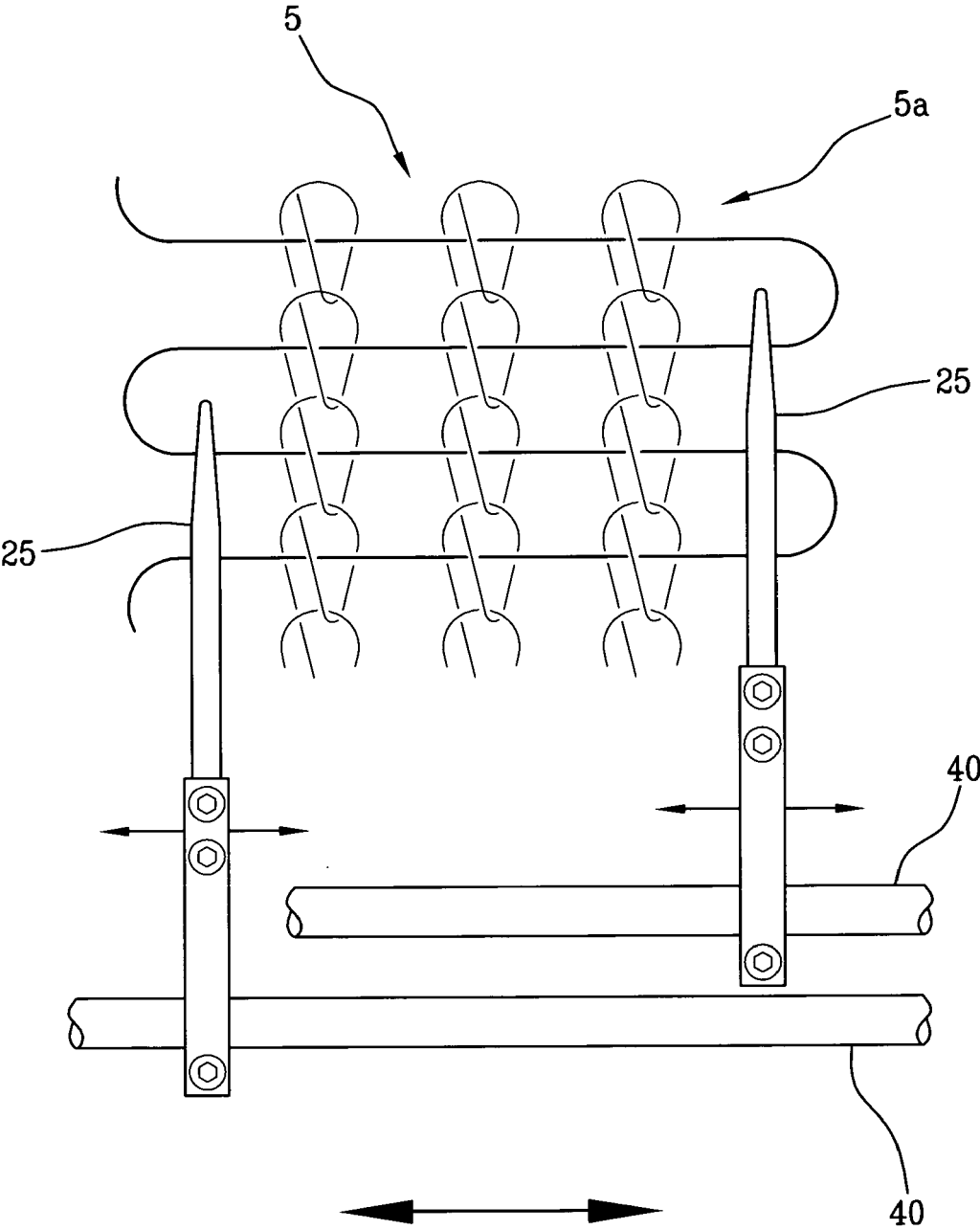


FIG 13



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 99860 A [0024]