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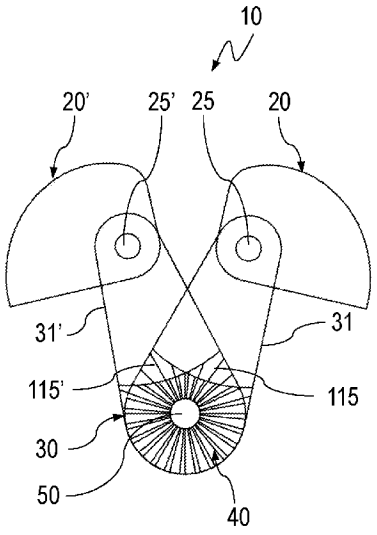
(54) Title: ANCHORING AND SUPPORT CLIMBING DEVICE

(57) Abstract: An anchoring and support climbing device (10) comprises: - a central body (15) suitable for being connected at one end to a wire; - at least one cam (20, 20') rotatably arranged with respect to said body (15) by means of a; - rotation pin (25, 25') which can be positioned or dislocated with respect to said body (15) between a minimum overall dimensions position and a maximum overall dimensions position of said rotation pin (25, 25') by; - movement means (30); - and locking means (40) of the same rotation pin (25, 25'); where said movement means (30) comprise at least two rockers (31, 31') opposed to each other, and said locking means (40) comprise a ratchet locking mechanism suitable for allowing the single direction rotation with respect to the second rotation pin (50), so as to prevent the rotational movement of the rockers (31, 31').

Fig. 31c



ANCHORING AND SUPPORT CLIMBING DEVICE

DESCRIPTION

TECHNICAL FIELD

The present invention relates to an anchoring and support climbing device.

More particularly, the present invention relates to a rock anchoring and support device for the passive safety of mountaineers and climbers during wall or slope climbing.

PRIOR ART BACKGROUND

Portable and removable spring loaded cam mechanical safety devices, commonly known as friends, are widely known and used in the field of climbing and mountaineering, which are suitable for being inserted in a stable manner in cracks or crevices of the rock walls in such a way as to guarantee anchoring and stable and secure support to the wall for the mountaineer or climber and to be subsequently and easily removed.

During climbing progression, the mountaineer or climber must always be properly secured to the vertical wall by means of ropes or wires, typically dynamic safety ropes, which must be fixed to the rock support at regular intervals so as to limit the same climber's fall in case of loss of wall adhesion or anchoring. Said dynamic safety ropes are typically connected and secured in a sliding manner to the rock walls by means of traditional anchoring means or devices, including said removable cam devices such as friends, for example.

A great advantage of the removable type anchoring devices is that they can be reused several times by the climber during the ascent, compared to the classic rock pressure nails or bolts.

Said traditional anchoring and support cam devices or friends typically comprise a body

or a central bearing structure, able to be connected at one of its ends with a typical dynamic mountaineering rope. On said central body or structure a plurality of movable cams are rotatably hinged, symmetrically opposed and defining generally on their outer contact surface facing the rock, a typically logarithmic spiral or round involute shaped profile. This particular spiral conformation allows to have an optimal working angle on each point of the contact profile, typically equal to about 14°, measured between a straight line perpendicular to the traction force and passing through the cam contact point and the straight line joining the rotation centre and the same contact point, as shown with preliminary reference to figure 22. This optimal working angle allows a secure anchoring of the device with the progressive unloading of the traction force on the opposite side walls. Said cams are generally held in a maximum open stable position by means of traditional spring loaded elastic elements and are brought into the closed position by acting on tie rods by means of a handle, so as to overcome the resistance of the elastic elements and bring the cams into closed position. In the closed position the cams have a minimum overall dimensions dimension that allows them to be easily inserted into the crack or crevice of the rock wall. To adapt to the various sizes and widths of the cracks in the rock said cam devices are generally made in series of proportionately standardized sizes in such a way as to cover a range of sizes traditionally extended from a few tens of millimetres to some tens of centimetres. Each cam dimension suitable for covering a given size range is typically indicated with a specific colour so as to be immediately recognizable to the climber or user.

A typical example of these known anchoring and support cam devices is described in document US 4.184.657 (A) which refers to a climbing aid device with a support bar, a pin mounted on the same support bar, two pairs of cams rotatably mounted on the same pin and suitable for rotating in an opposite manner from a closed position to an open

position. Spring elements are mounted on the pin between each pair of cams and are suitable for applying a force to each cam so as to push it into its open position. An operating bar is slidably mounted on the support bar and is connected to each cam, while an attachment point for a climbing wire is formed on the opposite end to the pin of the support bar. Applying a downward force on the operating bar brings the cams into the closed position so that the device can be inserted into a crack formed in the rocks or the like. The operating bar is then released, and the spring elements push the cams into the open position, locking the device inside the crack. The document also describes a support bar which may also include means for holding the operating bar in a position where the cams are in the closed position.

However, said known anchoring and support climbing devices provided with cams have drawbacks and operating limits.

An important limit of said known anchoring cam devices is due to the fact that, since the cracks, openings or crevices in the rock have various sizes, in order to be able to cover a useful size range for its ascent, the climber must necessarily carry a considerable number of devices in such a way as to possess the appropriate size device depending on the size of cracks, openings or crevices that occur during the ascent. This limit requires the climber to have to carry with him on the wall a greater weight and a bulky volume, not being able to determine a priori which series of sizes are more useful than others.

A further drawback of other known solutions, relating to anchoring and support climbing devices, is due to the fact that in order to make them adaptable to larger size ranges, the characteristic spiral profile has been modified which gives the cams an optimal work angle of 13.75°, thus compromising optimal operation.

A further limit of these traditional anchoring devices are the costs necessary for the equipment due to the fact that a large number of anchoring devices or friends is needed

to cover a large size range of rock cracks or crevices, which the mountaineer and climber have to carry during the ascent.

A further limit of these traditional anchoring devices is due to the fact that if during the climber or mountaineer's progression on the wall a consecutive plurality of cracks or crevices of the same size or dimensional range occur, as it is frequent, the use of all the anchoring devices or friends of the same size is necessary, leaving the climber or mountaineer without them and thus considerably limiting his ability to secure to the wall.

OBJECTS OF THE INVENTION

The object of this invention is to overcome and resolve, at least in part, the above-mentioned drawbacks and operating limits.

More specifically, the object of the present invention is to provide an anchoring and support climbing device capable of adapting to a greater size range of rock cracks, openings or crevices.

A further object of the present invention is to provide the user with an anchoring and support climbing device that can be made in different size series while maintaining the ideal spiral profile and the ideal cam working angle.

A further object of the present invention is to provide an anchoring and support climbing device able to guarantee a high level of resistance and reliability over time, such as to be produced easily and inexpensively.

According to an example and some embodiments, these and other objects are achieved by the anchoring and support climbing device object of the present invention in accordance with the independent claim.

According to another example, the anchoring and support climbing device comprises:

- a central body suitable for being connected at one end to a wire;
- at least one cam rotatably arranged relative to said body by means of a rotation

pin and suitable for anchoring to a rock wall, said cam being suitable for being arranged between a closed limit position on said body and an open limit position projecting and protruding from said central body;

- at least one portion of said rotation pin of the cam can be positioned or dislocated with respect to said body, between a minimum overall dimensions position and a maximum overall dimensions position of said rotation pin by means of movement means and locking means of the same rotation pin, so as to increase the extension or opening distance of the cam.

The constructive and functional characteristics of the anchoring and support climbing device can be better understood from the following detailed description, in which reference is made to the attached drawings which represent some preferred and non-limiting embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The following figures shown in the drawins are schematic and simplified, different crosshatched and fillings style of the areas can highlight, in addition to a particular sectioned part, different elements and for greater clarity the element lines or hidden features or to which other elements are overlapped are also made visible.

Figures 1a and 1b are schematic representations of two front views of the anchoring and support climbing device object of the present invention in the maximum open position of the cams and in the minimum and maximum overall dimensions configuration, respectively;

figure 2a is a schematic representation of a front view of the anchoring and support climbing device object of the present invention in a limit configuration with the rotation pins in the minimum overall dimensions position and the cams in the minimum extension or closed position;

figure 2b is a schematic representation of a front view of the anchoring and support climbing device object of the present invention in an intermediate configuration with the rotation pins in the minimum overall dimensions position and the cams in the maximum extension or open position;

figure 2c is a schematic representation of a front view of the anchoring and support climbing device object of the present invention in an intermediate configuration with the rotation pins in the maximum overall dimensions position and the cams in the minimum extension or closed position;

figure 2d is a schematic representation of a front view of the anchoring and support climbing device object of the present invention in a limit configuration with the rotation pins in the maximum overall dimensions position and the cams in the maximum extension or open position;

figures 2e, 2f, 2g, 2h are schematic front view representations of the corresponding figures 2a, 2b, 2c, 2d, respectively, of the anchoring and support device object of the present invention, with the different dimension cams and with the rotation pin centres not arranged on a horizontal axis with respect to the body of the device;

figure 3a is a schematic representation of an axonometric view of the anchoring and support climbing device object of the present invention in the maximum overall dimensions configuration and in the maximum open position of the cams;

figure 3b is a schematic representation of another axonometric view of the anchoring and support climbing device object of the present invention in the minimum overall dimensions configuration and in the closed position of the cams;

figure 4 is a schematic representation of an exploded axonometric view of the anchoring and support climbing device object of the present invention;

figure 5a is a schematic representation of a side view of the anchoring and support

climbing device object of the present invention in the minimum overall dimensions configuration and in the closed position of the cams;

figure 5b is a schematic representation of a front view of the anchoring and support climbing device object of the present invention in the minimum overall dimensions configuration and in the closed position of the cams and with the maximum overall dimensions configuration and the maximum open position of the cams indicated as a reference with colon-dashed line;

figure 6a is a schematic representation of a side view of the anchoring and support climbing device object of the present invention in the maximum overall dimensions configuration and in the maximum open position of the cams;

figure 6b is a schematic representation of a front view of the anchoring and support climbing device object of the present invention in the maximum overall dimensions configuration and in the maximum open position of the cams;

figures 7a and 7b are schematic representations of a sectional view of an embodiment of the anchoring and support climbing device in the transition operation from the minimum overall dimensions configuration and closed position of the cams to the maximum overall dimensions and maximum open position of the cams, respectively;

figure 8a is a schematic front view representation of a further embodiment of the anchoring and support climbing device object of the present invention in the minimum overall dimensions configuration and in the closed position of the cams;

figure 8b is a schematic front view representation of a further embodiment of the anchoring and support climbing device object of the present invention in the maximum overall dimensions configuration and in the maximum open position of the cams;

figures 9a, 9b, 9c and 9d are a schematic representation of front views of a further embodiment of the anchoring and support climbing device object of the present

invention in the transition operation from a minimum overall dimensions configuration and in the minimum open position of the cams to a maximum overall dimensions and maximum open configuration of the cam, through two generic intermediate sliding steps, respectively;

figures 10a, 10b, 10c and 10d are a schematic representation of front views of a further variant form of the anchoring and support climbing device object of the present invention in the cam transition operation from a maximum overall dimensions configuration to a minimum overall dimensions configuration and in the maximum open position of the cam, through two generic intermediate sliding steps, respectively;

figure 11a is a schematic representation of a side view of a further embodiment of the anchoring and support climbing device object of the present invention in the maximum overall dimensions configuration and in the maximum open position of the cams;

figures 11b, 11c, 11d and 11e are a schematic representation of front views of the further embodiment of figure 11a of the anchoring and support climbing device object of the present invention in the transition from the minimum overall dimensions and minimum open limit position of figure 11b to the maximum overall dimensions and maximum open position of the cams of figure 11e passing through the intermediate positions of figures 11c and 11d;

figures 11f, 11g and 11h are a schematic representation of front views of the same embodiment of figures 11 of the anchoring and support climbing device object of the present invention, in the exemplary transition operating steps of a rotation pin and a cam from the minimum overall dimensions configuration of figure 11f to the maximum overall dimensions configuration of figure 11h, passing through a generic intermediate step of figure 11g;

figures 12a, 12b, 12c and 12d are a schematic representation of plan views of a further

embodiment of the anchoring and support climbing device object of the present invention with the rotation pins of the cams formed on a crankshaft and in the transition operation from a minimum overall dimensions and minimum opening configuration of the cams to a maximum overall dimensions configuration and in the maximum open position of the cams, through two generic intermediate positions, respectively;

figures 13a, 13b, 13c and 13d are a schematic representation of front views of the previous further embodiment of the anchoring and support climbing device object of the present invention with the rotation pins of the cams formed on a crankshaft and in the transition operation from a minimum overall dimensions and minimum opening configuration of the cams to a maximum overall dimensions configuration and in the maximum open position of the cams, through two generic intermediate positions, respectively;

figures 14a, 14b, 14c and 14d are a schematic representation of front views of a further embodiment of the anchoring and support climbing device object of the present invention in the transition operation from a minimum overall dimensions and minimum opening configuration of the cams to a maximum overall dimensions configuration and in the maximum open position of the cams, through two generic intermediate positions, respectively;

figures 15a, 15b, 15c and 15d are a schematic representation of front views of a further variant form of the anchoring and support climbing device object of the present invention in the transition operation from a minimum overall dimensions configuration to a maximum overall dimensions configuration in the maximum open position of the cams, through two generic intermediate positions, respectively;

figures 16a and 16b are schematic representations of a side view and a front view of a further variant form of the embodiment of figures 11 of the anchoring and support climbing device object of the present invention provided with snap locking means of the

rotation pin in the closed position and with the same rotation pin in the locked position;

figures 16c and 16d are schematic representations of a side view and a front view of the same further variant form of the embodiment of figures 11 of the anchoring and support climbing device object of the present invention in the transition of the snap locking means of the rotation pin in the open position and with the same rotation pin in a sliding position;

figures 17a and 17b are schematic representations of front views of a further embodiment of the anchoring and support climbing device object of the present invention with movement means for the rocker pin and snap locking means for the rotation pin in the minimum overall dimensions and maximum overall dimensions position in the closed position, respectively, and with the same rotation pin in the locked position;

figures 17c and 17d are schematic representations of side views of the further embodiment of figures 17a and 17b of the anchoring and support climbing device object of the present invention with movement means for the rocker pin and snap locking means of the rotation pin in the position with the snap locking means of the pin in the retracted position of figure 17c and in the extended locked position of figure 17d, respectively;

figure 18a is a schematic representation of a side view of a further embodiment of the anchoring and support climbing device object of the present invention with strap movement means and locking means for the rotation pin with a slider pin locking hook;

figures 18b, 18c and 18d are a schematic representation of front views of the same embodiment of figure 18a of the anchoring and support climbing device object of the present invention with strap movement means and locking means for the rotation pin with slider pin locking hook, in the transition operating steps of a cam rotation pin from a minimum overall dimensions limit configuration of figure 18b to a maximum overall dimensions limit configuration of figure 18d, passing through a generic intermediate step

of figure 18c;

figure 19a is a schematic representation of a side view of a further embodiment of the anchoring and support climbing device object of the present invention provided with movement means for rocker rotation pins and with locking means for the same fork locking rotation pins;

figures 19b and 19c are schematic representations of front views of the same embodiment of figure 19a of the anchoring and support climbing device object of the present invention in the transition steps of the locking means from the locking position of the rotation pins to the unlocking position of the same rotation pins;

figures 19b and 19c are schematic representations of front views of the same embodiment of figure 19a of the anchoring and support climbing device object of the present invention in the transition steps of the fork locking means from the locking position of the rotation pins to the unlocking position of the same rotation pins, in the minimum overall dimensions configuration of the rotation pins;

figures 19d and 19e are schematic representations of front views of the same embodiment of figure 19a of the anchoring and support climbing device object of the present invention in the transition steps of the rocker movement means in the transition steps from the minimum overall dimensions limit position of figure 19d to the maximum overall dimensions limit position of figure 19e;

figures 19f and 19g are schematic representations of front views of the same embodiment of figure 19a of the anchoring and support climbing device object of the present invention in the transition steps of the fork locking means from the free unlocking position of the rotation pins to the locking position of the same rotation pins and in the maximum overall dimensions configuration of the rotation pins;

figure 20a is a schematic representation of a side view of a further embodiment of the

anchoring and support climbing device object of the present invention provided with movement means for the rotation pins and locking means for the same rotation pins with slotted arms and slider pins;

figures 20b, and 20d are partial schematic representations of front views of the same embodiment of figure 20a of the anchoring and support climbing device object of the present invention with the single slotted arms highlighted and provided with the rotation pins and cams;

figure 20c is a partial schematic representation of a front view of the same embodiment of figure 20a of the anchoring and support climbing device object of the present invention with the slotted arms provided with the rotation pins and the cams arranged in cooperation with the overlapping slots;

figures 20e, 20f, 20g and 20h are schematic representations of front views of the same embodiment of figure 20a of the anchoring and support climbing device object of the present invention in the transition steps from the minimum overall dimensions limit position of figure 20e to the maximum overall dimensions limit position of figure 20h passing through two generic intermediate steps of figures 20f and 20g;

figure 21a is a schematic representation of a side view of a further embodiment of the anchoring and support climbing device object of the present invention in the maximum overall dimensions configuration and in the maximum open position of the cams;

figure 21b is a schematic representation of a front view of a further variant form of the anchoring and support climbing device object of the present invention in the maximum overall dimensions configuration and in the maximum open position of the cams;

figure 21c is a schematic representation of a side view of a further variant of the anchoring and support climbing device object of the present invention in the minimum overall dimensions configuration and in the closed position of the cams;

figure 21d is a schematic representation of a front view of a further variant of the anchoring and support climbing device object of the present invention in the minimum overall dimensions configuration and in the closed position of the cams;

figures 21e, 21f and 21g are schematic representations of front views of a further variant of the anchoring and support climbing device in the transition operation from the maximum overall dimensions configuration and open position of the cams of figures 21e and 21f to the minimum overall dimensions and closed position of the cams of figure 21h, passing through the intermediate configurations of figure 21g, respectively;

figure 22 is a schematic representation of the working angle of a generic cam according to the prior art, in different points of the contact profile corresponding to different open or extending positions of the cam itself;

figures 23a and 23b are a partial schematic representation of a partially sectioned front and side view respectively of a further embodiment of an anchoring and support climbing device part object of the present invention with a rocker formed by two plate elements connected by a connecting pin and with two cams arranged on the same rocker;

figures 24a and 24b are a partial schematic representation of a partially sectioned side view and front view of the embodiment of figures 23a and 23b, respectively, of the remaining part of the anchoring and support climbing device object of the present invention with the opposite rocker formed by two plate elements with the opposite cam arranged on the same rocker side;

figures 25a and 25c are a schematic representation of two partially sectioned side views of the embodiment of figures 23a and 23b of the anchoring and support climbing device object of the present invention, with a locking plug in the inserted position and with the same locking plug during extraction step and partially extended, respectively;

figure 25b is a schematic representation of a partially sectioned front view of the

embodiment of figures 23a and 23b of the anchoring and support climbing device object of the present invention in the maximum overall dimensions limit configuration with the locking plug in the inserted position;

figure 26a is a schematic representation of a partially sectioned side view of the embodiment of figures 23a and 23b of the anchoring and support climbing device object of the present invention with the locking plug in a completely extended position;

figures 26b and 26c are a schematic representation of two front views of the embodiment of figures 23a and 23b of the anchoring and support climbing device object of the present invention free from the locking plug and in the rockers closing operation in the minimum overall dimensions limit configuration, respectively;

figures 27a and 27b are a schematic representation of a front view and a lateral view, respectively, of a further possible embodiment of the anchoring and support climbing device object of the present invention with locking means provided with a ratchet mechanism with rack and pawl;

figures 28a, 28b, 28c and 28d are schematic representations of front views of the assembled elements of the anchoring and support climbing device object of the present invention with the locking means provided with a ratchet mechanism in the transition steps from the minimum overall dimensions limit position of figure 28a to the maximum overall dimensions limit position of figure 28d passing through two intermediate positions of figures 28b and 28c;

figures 29a, 29b, 29c and 29d are schematic representations of front views of the anchoring and support climbing device operation object of the present invention with the locking means provided with a ratchet mechanism in the transition steps from the minimum overall dimensions limit position of figure 28a to the maximum overall dimensions limit position of figure 28d passing through two intermediate positions of

figures 28b and 28c;

figures 30a, 30b, 30c and 30d are schematic representations of a side view and three front views of a variant form of the anchoring and support climbing device object of the present invention with locking means provided with a ratchet mechanism with rack and pawl;

figures 31a, 31b and 31c are schematic representations of front views of the constructive elements of an embodiment of the anchoring and support climbing device object of the present invention with the locking means provided with a further ratchet mechanism in the transition steps from the minimum overall dimensions limit position of the pins and the cam maximum opening of figure 31a to the maximum overall dimensions limit position of the rotation pins and the cam maximum opening of figure 31c, passing through a generic intermediate position of figure 31b;

figures 32a, 32b and 32c are schematic representations of front views of the same embodiment of figures 31 of the anchoring and support climbing device in the movement operation of the movement means only in the various transition steps from the minimum overall dimensions limit position of the pins of figure 32a to the maximum overall dimensions limit position of the rotation pins of figure 32c, passing through a generic intermediate position of figure 32b;

figures 33a, 33b and 33c are schematic representations of front and side views of the same embodiment of figures 31 of the anchoring and support climbing device depicting the conformation of the conjugated toothed crowns of the ratchet locking means formed on the rockers;

figures 34a, 34b and 34c are schematic representations of side views of the same embodiment of the figures 31 of the anchoring and support climbing device in the engagement steps of the conjugated toothed crowns arrangement of the rocker locking means in the different engagement of the figure 34a, disengagement of figure 34b and

engagement configurations with safety locking of figure 34c.

DETAILED DESCRIPTION OF THE INVENTION

Various preferred embodiments of the anchoring and support climbing device object of the present invention are described below with reference to the attached figures. In the description the terms of "maximum overall dimensions" and "minimum overall dimensions", opening and extension or closing dimensions of the cams, refer to an operating working dimension of the anchoring and support device that is to the horizontal dimension perpendicular to the crack, opening or crevices development in the rock which is the width or work dimension to which the device must adapt. The other sizes of the crack itself, such as height and depth, are generally much greater than the width.

Although the following description is for the sake of simplicity of disclosure, in many examples, with only two opposed cams, it will be evident to the person skilled in the art that it can be extended in an obvious manner to a configuration with multiple cams or pairs of cams in series, as for the traditional devices of the prior art mentioned above. The embodiment according to which there is a single contrast cam suitable for operating on one side of a wall only is further understood to be comprised in the discussion of the present invention, where the only body of the device is in a cooperative contrast on the opposite wall.

With initial reference to figures 1a to 2h, the anchoring and support climbing device object of the present invention is schematically represented, indicated by reference number 10, said device comprising:

- a central body 15 preferably provided at one end thereof with connection means 17 such as a slotted stem or an opening formed in the same body 15, said connection means 17 being suitable for fixing and connecting a wire;
- at least one cam 20, 20' rotatably arranged relative to said body 15 by means of a

rotation pin 25, 25', said cam 20, 20' generally defining a contact profile 21 generally having a logarithmic spiral or evolving development for anchoring to a rock wall, said cam 20, 20' being suitable for being arranged between a reduced overall dimensions closed limit position on said body 15 and a maximum open limit position projecting and protruding from said body 15.

Said anchoring and support device 10, with reference to the same figures 1a to 2h, has the innovative feature according to which said rotation pin 25, 25' of the cam 20, 20', or a portion of the pin itself can be positioned or dislocated with respect to said body 15, within or external thereto, between a minimum overall dimensions position and a maximum overall dimensions position, or in any intermediate position to the extreme two of said rotation pin 25, 25' by means of movement means 30 and locking means 40 of the same rotation pin 25, 25', so as to increase the extension distance of the cam 20, 20'. Said movement means 30 are suitable for moving the rotation pin 25, 25' making it translate or rotate with respect to the body 15 while said locking means 40 are suitable for stabilizing said rotation pin 25, 25' in a stable manner with respect to the same body 15, allowing the same pin 25, 25' to allow the rotation of the cam 20, 20' with respect to its own axis.

With particular reference to the generalized forms of figures 1a to 2h, and to the constructive and exemplary embodiments of figures 3a to 20h, the main characteristic of the present invention is that of being able to position or displace the rotation pin 25, 25' of the cams 20, 20' with respect to the body 15, from a minimum overall dimensions position of the rotation pins 25, 25', indicated in the figure with the letter A, and a maximum overall dimensions position of the rotation pins 25, 25', indicated in the figures with the letter B, moving or reversing the relative position of both the rotation pins 25, 25' with each other as shown in figure 1, or moving and displacing a single rotation pin

25 with respect to or inside the body 15, passing through multiple intermediate positions, as shown in the embodiments of figures 7a to 20h, for example. In this way it is possible to adapt the anchoring and support device 10 to cracks or minimum openings of the rock, in the limit configuration with the rotation pins 25, 25' in a minimum overall dimensions position, marked with the letter A, and at the same time to adapt the anchoring and support device 10 to larger and more extended cracks or openings of the rock in the limit configuration with the rotation pins 25, 25' moved or displaced in a maximum overall dimensions position, marked with the letter B, and with a maximum opening or extension of the cams 20, 20', with respect to the configuration with the rotation pins 25, 25' in a minimum overall dimensions position.

Each cam 20, 20' can be movable and is generally of the monostable type and is kept in a maximum extension or open resting position of the cam 20, 20' with respect to the body 15 by means of an elastic element, not shown, such as for example a twist helical spring coaxially arranged with respect to the rotation pin 25, 25'.

In order to bring the cam 20, 20' into the closed position collected on said body 15, traditional tie rods (not shown) like wires or cables made of a metallic or polymeric material are used, generally constrained to one end of the cam 20, 20', such as to create a force moment with respect to the rotation pin 25, 25' and overcome the resistance of the elastic element. Said tie rods are preferably fixed to a handle which is slidingly arranged relative to said body 15.

In the embodiments described below and shown in the accompanying drawing tables, given only by way of non-limiting example, the opposite cams 20, 20' are of equal dimension and with the rotation pin 25, 25' centres joined by a horizontal line; however, it will be apparent to the person skilled in the art that the invention can also be implemented with cams 20, 20' of different dimensions and with the rotation pin 25, 25'

centres not arranged on a perfectly horizontal line, as shown in figures 2e to 2h, for example.

In a first advantageous embodiment of the anchoring and support device 10, with reference in particular to figures 15a to 15d, said movement means 30 of the rotation pin 25, 25' may comprise a simple rod 29, rotatably arranged relative to the body 15 around a second rotation pin 50, said rod 29 comprising preferably an oblong body wherein the rotation pin 25 of the cam 20 is rotatably arranged. The rotation of the rod 29, manually operated by the tie rod 55, leads said rotation pin 25 to orbit about said second rotation pin 50 and relative to the body 15.

After a rotation of about 180° the rotation pin 25 and the relative cam 20 hinged thereto move from the minimum overall dimensions limit configuration A of figure 15a, with the cams 20, 20' closed and gathered on the body 15, to the maximum overall dimensions limit configuration B of figure 15d, with the cams 20, 20' completely opened and extended, passing through the generic intermediate configurations shown by way of example in figures 15b and 15c.

In this embodiment, the rotation pin 25' of the cam 20' is depicted, for simplicity, as fixed and coaxially positioned or coinciding with said second rotation pin 50, however also said rotation pin 25' can be moved and arranged on a further rod symmetrically positioned with respect to said rod 29.

Said movement means 30 of the pin 25, again with reference to figures 15a to 15d, may comprise one or more traditional tie rods 55, like wires or cables made of a metal or polymeric material, generally stabilized at one end of said rotation pin 25 and from the other end on the connecting means 17, said tie rods 55 being suitable for manual movement of the same rotation pin 25 between the two stable minimum and maximum overall dimensions limit configurations of the anchoring and support device 10, marked

in the figures by the letters A and B, respectively. Said locking means 40 can also comprise a traditional return elastic element 60 placed in cooperation in linear traction with said rotation pin 25 and said body 15, so as to return the pin 25, after it is led in an intermediate position around the second rotation pin 50, which is stable in the nearest limit position.

The rod 29 is moved from the minimum overall dimensions limit position A, illustrated in figure 15a, manually acting on the tie rod 55 in the arrow F direction of the figures, overcoming the force of the elastic element 60, in a similar way to stretching the rope of an arc in the act of nocking an arrow, thus bringing the pin 25 into the position of figure 15b. Continuing to stretch the tie rod 55, according to the arrow F of the figures, the rod 29 with the rotation pin 25 is driven in rotation according to the arrow R of the figures to beyond the lowest minimum point, where the conjunction axis of the second rotation pin 50 and the rotation pin 25 is in a vertical position and the elastic element 60 is in the maximum elongation position. Subsequently the return force of the elastic element 60 completes the rotation of the rod 29 according to the arrow R of the figures, leading the rotation pin 25 to the maximum overall dimensions limit configuration B of figure 15d.

A particularly advantageous characteristic of this embodiment described above is the construction simplicity and the low number of components of the anchoring and support device 10 which guarantee a reduced weight and overall dimensions together with an increased practicality and ergonomics of use.

In a further variant form of said first embodiment of the anchoring and support device 10, with reference also to figures 18a to 18d, said movement means 30 may also comprise at least one strap 70, preferably having a laminar shape, rotatably arranged at one of its ends with respect to the same rotation pin 25, 25', said strap 70 being provided at the opposite end with a slider pin 71 suitable for being slidably arranged in a slot 72 longitudinally obtained in the body 15. With reference to the same figures, said locking

means 40 may also comprise at least one locking hook 75 of the slider pin 71, generally having a half-moon shape, said locking hook 75 being rotatably stabilized to said body 15 and suitable for locking in surface cooperation the sliding of said slider pin 71 inside the slot 72, in such a way as to prevent the rotation of the rod 29 and keep it together with the rotation pin 25 in the minimum overall dimensions position of figure 18b or in the maximum overall dimensions position of figure 18d, also in cooperation with the elastic return element 60.

With reference now to figures 19a to 19g in a further embodiment of the anchoring and support device 10, said movement means 30 comprise at least one rocker 31 rotatably stabilized and hinged by one end thereof to the body 15, said rocker 31 being including or forming the same body 15, by means of a second rotation pin 50 inserted in a hole not shown. On one end of said rocker 31, a second hole 35 is formed wherein said rotation pin 25 is housed so that, as the rotation of said rocker 31 varies in one of the directions of the arrow marked by the letter R, of figure 19d, the position of the rotation pin 25, 25' varies, according to the direction of the arrows marked by the letters P, P' of figure 19d, to which the cam 20, 20' is rotatably stabilized, which expands projecting externally up to the maximum overall dimensions limit configuration of figure 19e.

Said rocker 31 can be further provided with an elastic element (not shown), such as an elastic torsion spring, suitable for keeping it rotated in a stable position in one of the limit configurations.

With reference to the same figures, said locking means 40 of the pin 25, 25' can advantageously comprise a locking fork 80, provided with a plurality of prongs 81, 81' defining a plurality of recesses 82, said locking fork 80 being slidingly stabilized in a vertical direction with respect to said rocker 31 or to said body 15 and suitable for slidingly arrange so as to house the rotation pins 25, 25' in the recesses 82 of the locking fork 80

in such a way as to prevent rotation of the rocker 31 from the minimum or maximum overall dimensions limit position, as shown in figures 19b, 19c.

Said locking means 40 can advantageously comprise at least one third return elastic element 85, suitable for keeping the locking fork 80 in a monostable position engaged on the rotation pins 25, 25'. In order to unlock the rotation pins 25, 25' and bring the anchoring and support device 10 from the minimum overall dimensions configuration A of figure 19b, 19c and 19d, to the maximum overall dimensions configuration B of figure 19e, 19f and 19g, the user acts manually on the second tie rod 84 so as to slide the locking fork 80 in the direction of the arrow F of figures 19, overcoming the resistance force of the third return elastic elements 85 and releasing the rotation pins 25, 25', allowing the same rotation pins to pass from one limit configuration to another, as shown in figures 19d and 19e. Each rocker 31 can also be advantageously provided at the second rotation pin 50 of an elastic element, not shown, of the torsion spring type, suitable for maintaining said rocker 31 in a monostable position, preferably in the minimum overall dimensions limit position A, in such a way that following the rotation pins 25, 25' release (figure 19c), the rockers 31 move automatically and simultaneously to the maximum overall dimensions limit position B (figures 19f and 19g). Releasing the second tie rod 84, the force of the third elastic elements 85 causes the locking fork 80 to slide returning it towards the arrows F' of figure 19f, again bringing the recesses 82 to engage with the rotation pins 25, 25' locking them in the new limit position (figure 19g). The prongs 81, formed laterally on said locking fork 80, preferably have a greater length than the prongs 81' formed in a central position, so as to prevent the rotation pins 25, 25' movement beyond the maximum and minimum overall dimensions limit positions.

In a further variant form, not shown, the prong or prongs 81' formed centrally with said locking fork 80 can also have different lengths or have a step so as to preferentially unlock

one of the two rotation pins 25, 25' at different times.

With reference now to figures 8a to 9d, in a further embodiment of the anchoring and support device 10, said movement means 30 can comprise an oblong slotted opening 36, formed in the body 15 inside which the rotation pin 25, 25' of the cam 20, 20' is slidably and the rotatably arranged. Said slotted opening 36 defines two opposite ends 37, 37' having a generally circular or semi-circular shape and suitable for rotatably housing the rotation pin 25, 25' in the minimum and maximum overall dimensions limit positions A and B. Still with reference to said figures in a possible constructive variant of said second embodiment, said locking means 40 of the rotation pin 25, 25' comprise a restricted portion 38 of said slotted opening 36 connecting said ends 37, 37', said portion having a limited transition section with respect to said ends 37, 37' and suitable for being arranged in movement cooperation with a flattening 26 obtained on the outer surface of the rotation pin 25, as shown in detail in figure 9a to 9b relative to the sole cam 20 and the sole rotation pin 25. In correspondence of said flattening 26, said rotation pin 25, 25' has a reduced diametrical section suitable for locating rotating in alignment with the restricted portion 38 of said slotted opening 36, so that in said alignment position the pin 25, 25' can slide freely without rotating inside said slotted opening 36 between the ends 37, 37' defining the limit positions of the configurations A and B.

Said rotation pin 25, 25' is advantageously called in a stable position inside one of the ends 37, 37', by means of traditional spring or equivalent elastic elements 60 (figures 8a and 8b). When the cam 20, 20' rotates in the position such as to bring the diametral section of the rotation pin 25, 25' with the flattening 26 aligned with said restricted portion 38 of the slotted opening 36, the same rotation pin 25, 25' can be moved manually towards the opposite end 37, 37', in a different overall dimensions configuration, overcoming the elastic element 60 force. By subsequently rotating the pin in the destination end 37, 37'

and disaligning the flattening 26, the rotation pin 25, 25' shows a diametral section greater than the restricted portion 38 such as to keep it in position and prevent the elastic element 60 from returning it in the position of the stable starting configuration through the restricted portion 38.

This embodiment can advantageously be applied to all the rotation pins 25, 25' of the anchoring and support device 10 or only to the rotation pin 25 of the cam 20 or, vice versa, to the rotation pin 25' of the cam 20'.

With reference also to figures 11a to 11h, in a further embodiment of the anchoring and support device 10, said locking means 40 comprise at least one locking element 45 slidably arranged, by means of a further second return elastic element 61, in a channel 46 formed in the body 15, said channel 46 being open and intersecting the slotted opening 36, so as to block and prevent the sliding of the pin 25, 25' between the two ends 37, 37' of the same slotted opening 36.

The user acting on a third tie rod 94 with a force in the direction of the arrow F of figures 11f and 11h and overcoming the second elastic element 61 force, moves the locking element 45 along the direction and the way of the arrow P of figure 11f freeing the sliding pin 25' allowing it to move from the position of figure 11g, defining a minimum overall dimensions configuration A, to the position of figure 11h defining a maximum overall dimensions configuration B. Releasing the third tie rod 94, the locking element 45 returns to its original position moving in the way of the arrow P' by means of the second elastic element 61, locking the rotation pin 25' permanently in the configuration of figure 11h.

With reference now to figures 7a and 7b and also to figures 3a to 6b, a further embodiment of the anchoring and support device 10 is shown, comprising, by way of example, an expansion cam 20 suitable for extending towards one side of the body 15 and a pair of fixed contrast cams 20' suitable for extending on its opposite side of the same

body 15, as shown in figures 3a, 3b, 5a and 6a.

In this embodiment the pin 25 of the expansion cam 20 is provided with said movement means 30 and locking means 40 while the pins 25' of the cams 20' are, for simplicity of construction, fixed with respect to the body 15.

With particular reference also to figure 4, said movement means 30 and locking means 40 of the pin 25 define a "ratchet" type mechanism wherein said movement means 30 comprise at least one rocker 31 rotatably stabilized in its central part to the body 15 by means of a second rotation pin 50 inserted in a first hole 33. On one end of said rocker 31, a second hole 35 is formed wherein said rotation pin 25 is housed so that, as the rotation of said rocker 31 varies in a direction concordant with the arrow marked by the letter R in figure 7a, the position of the rotation pin 25 varies, according to the direction of the arrow marked by the letter P of figure 7a, to which the cam 20 is rotatably stabilized, which expands and projecting externally from the body 15 up to the maximum overall dimensions limit configuration of figure 7b.

Said rocker 31 can also be further provided with an elastic element (not shown), such as an elastic torsion spring, suitable for keeping it rotated in a direction opposite to the arrow marked by the letter R of figure 7a.

Said locking means 40 of the pin 25 comprise a pawl 41 rotatably hinged at one end thereof to the body 15 by means of a third rotation pin 51, while the end 42 of the same pawl 41 is formed so as to house in a recess 32 formed in the same rocker 31 such as to lock it in position and prevent it from rotating in the opposite way to the arrow marked by the letter R, bringing the anchoring and support device 10 into the maximum overall dimensions configuration of figure 7b.

The pawl 41 is further provided with a second elastic element (not shown), such as an elastic torsion spring, suitable for maintaining a contact surface 43 of the same pawl 41

slidingly pressed against the rocker 31 during its rotation and carrying the end 42 of the same pawl 41 in the recess 32 of the rocker 31 when the latter is in the maximum overall dimensions position of figure 7b.

Said locking means 40 further comprise a locking pin 52 stabilized to the body 15 suitable for locking the rocker 31 at the recess 32, such as to prevent the second elastic element from driving the rocker 31 in rotation beyond the position of figure 7a, in the opposite way to the arrow marked by the letter R.

The switching of the rocker 31 and the pawl 41 between the minimum overall dimensions position A of figure 7a and the maximum overall dimensions position B of figure 7b, or vice versa, can be advantageously obtained by means of traditional cables or wires, not shown, which can be operated manually.

With reference now to figures 21a to 21h, in a variant of the previous embodiment, the anchoring and support device 10 comprises, again by way of example, an expansion cam 20 suitable for extending towards one side of the body 15 and a pair of fixed contrast cams 20', suitable for extending on its opposite side of the same body 15, as shown in the figures.

Also in this variant the pin 25 of the expansion cam 20 is provided with said movement means 30 and locking means 40 while the pins 25' of the cam 20' are fixed with respect to the body 15.

Said movement means 30 of the pin 25 comprise at least one rocker 31 rotatably stabilized on one of its ends to the body 15 by means of a second rotation pin 50. On the end of said rocker 31 the rotation pin 25 is still housed in such a way that, as the rotation of said rocker 31 varies according to the direction and in the same way or discordant with the arrow marked by the letter R of figures 21f and 21g, the position of the rotation pin 25 varies, according to the direction of the arrow marked by the letter P of figure 21g, to

which the cam 20 is rotatably stabilized.

The rocker 31 can also be further provided with an elastic element (not shown), such as an elastic torsion spring, which is suitable for keeping it rotated in a direction opposite to the arrow marked by the letter R of figures 21f and 21g in the minimum overall dimensions limit configuration.

Said locking means 40 of the pin 25 comprise a pawl 41 rotatably hinged at one end thereof to the body 15 by means of a third rotation pin 51, while the end 42 of the same pawl 41 is formed such as to be housed in cooperation with a recess 32 formed in the same rocker 31, such as to lock it in position and prevent its rotation and movement in the maximum overall dimensions configuration of figure 21e.

The pawl 41 can still be further provided with a second elastic element (not shown), such as an elastic torsion spring, suitable for maintaining the same pawl 41 pressed in a cooperative position in contact with the rocker 31 during its rotation, so that the end 42 of the same pawl 41 engages in the recess 32 of the rocker 31 when the latter reaches the maximum overall dimensions limit position of figure 21e.

To bring back the anchoring and support device to the minimum overall dimensions limit configuration of figure 21h, the user acts by rotating the pawl 41 along the way of the arrow F of figure 21e, unlocking the rocker 31 (figure 21f) and allowing the same to rotate through the intermediate positions (figure 21g) until the stable position of the minimum overall dimensions configuration of figure 21h.

The switching of the rocker 31 and the pawl 41 between the minimum overall dimensions position of figure 21h and the maximum overall dimensions position of figure 21e, or vice versa, can be advantageously obtained by means of traditional cables or wires, not shown, which can be operated manually.

In further variants not shown in this embodiment, said movement means 30 and said

locking means 40 of the pin 25 can also advantageously be applied to the pin 25' of the contrast cam 20'.

In a further possible embodiment of the anchoring and support device 10, with particular reference to figures 20a to 20h, said movement means 30 and said locking means 40 of the rotation pins 25, 25' can also comprise two shaped symmetrical plates 90, 90', preferably of a laminar shape, rotatably hinged at one end to the body 15 by at least one second rotation pin 50, 50'. On the opposite end of each said shaped plates 90, 90' the rotation pins 25, 25' of the cams 20, 20' are stabilized (partial figures 20b, 20d). On each of said shaped plates 90, 90' a groove 92, 92' is formed, passing tilted with respect to the vertical direction, said grooves 92, 92' being symmetrical and specular and with an incident and intersecting direction to each other (figure 20c).

On said body 15 a drive element 95 is furthermore slidably stabilized, on the end of which a second slider pin 96 is stabilized, suitable for slidingly engaging said through grooves 92, 92', as shown in figures 20 and 20h.

Acting on said drive element 95 with a force in the direction and in the way of the arrow F of figures 20e to 20h, said second slider pin 96 engages said grooves 92, 92' moving the intersection point from the position of figure 20e, corresponding to the minimum overall dimensions configuration A, to the position of figure 20h, corresponding to the maximum overall dimensions configuration B, passing through the generic intermediate positions of figures 20f and 20g.

Moving the drive element 95 along the way of the arrow F, the second slider pin 96 rotates the shaped plates 90, 90' in a direction opposite to each other by varying the position of the rotation pins 25, 25'.

This particular shape has the further advantage of allowing a gradual adjustment of the distance between the rotation pins 25, 25' in any intermediate position, since said second

sliding pin 96 can be stably arranged in an intermediate position with respect to the positions of the two minimum and maximum overall dimensions limit configurations A and B and preventing their movement.

With reference now to figures 10a to 10d, in a further embodiment of the anchoring and support device 10, said locking means 40 can comprise an "U"-shaped slotted opening 36 and formed in the body 15 with a material portion 36' placed so that the ends 37, 37' of the slotted opening 36 are not directly connected and facing to each other and define a diametral section substantially the same as that of the slotted opening 36.

Still with reference to the exemplary form of the same figures, referred for simplicity to the rotation pin 25 only and to the cam 20, the rotation pin 25 is moved manually by means of the tie rods 55 overcoming the force of the elastic element 60, so as to lead the same rotation pin 25 with the cam 20 from the maximum overall dimensions limit position B of figure 10a, to the minimum overall dimensions limit position A of figure 10d, passing through the intermediate configurations of figures 10b and 10c.

With reference also to figures 16a to 16d, in another further embodiment, said locking means 40 can advantageously comprise a retractable snap mechanism of said locking element 45, of the type also used in ballpoint pens, in such a way as to keep the same locking element 45 engaged intersecting the slotted opening 36 and locking the movement of the rotation pin 25, 25' or maintaining the same locking element 45 disengaged so as to allow the free sliding of the rotation pin 25, 25' inside the slotted opening 36, simply by pressing on the exposed end of the same locking element 45 until it snaps into the stable position.

With reference now to figures 12a to 13d, in yet another possible embodiment of the anchoring and support device 10, said movement means 30 comprise a crankshaft 27, rotatably arranged in the body 15 with respect to a rotation axis x by means of at least one

second rotation pin 50, as shown in figures 12a to 12d. The rotation pins 25, 25' are advantageously formed directly on said shaft and define the crank pins of said crankshaft 27. The second rotation pin 50 is also advantageously formed on said crankshaft 27 and defines one or more journal pins thereof. The rotation of the crankshaft 27 leads the rotation pins 25, 25', which correspond to the crank pins of the crankshaft 27 itself, to rotate relative to the body 15. After a rotation of 180°, the pins 25, 25' and the related cams 20, 20' hinged thereto move from the minimum overall dimensions limit configuration A of figures 12a and 13a, with the cams 20, 20' closed and gathered on the body 15, to the maximum overall dimensions limit configuration B of figures 12d and 13d, with the cams 20, 20' completely open and extended, passing through generic intermediate configurations represented by way of example in figures 12b, 13b and 12c, 13c.

With reference to figures 13a to 13d in particular, the locking means 40 of the pin 25, 25' comprise a locking pin 52, stabilized to the body 15 and suitable for engaging with said crankshaft 27 at a recess 32, so as to prevent the rotation of the same. Still with reference to the same figures, said locking means 40 can further comprise a preferably discoidal shape selector 53, integral with said crankshaft 27, where a plurality of recesses 32 are formed on said selector 53 so as to block said crankshaft 27 with the pins 25, 25' in a stable position, in the minimum overall dimensions limit configuration A (figures 13a and 13b) or in the maximum overall dimensions limit configuration (figure 13c, 13d). Moving the locking pin 52 in the way of the arrow F of figures 13c and 13d, it is possible to rotate the crankshaft 27 with the selector 53 in the direction of the arrow R of figure 13d, positioning it in the desired position corresponding to the desired configuration.

An advantage of this embodiment is that it is possible to move and reposition both pins 25, 25' with a single element at the same time and stably using a single locking element

40.

A further advantage of this embodiment described above is that of being able to lock the rotation pins 25, 25' in several intermediate positions in addition to the configuration A and B limit positions, increasing the number of recesses 32 formed on the selector 53.

With reference now to figures 14a to 14d, in a further possible embodiment of the anchoring and support device 10, said movement means 30 can comprise a parallelogram 28, rotatably arranged with respect to the body 15 around a second rotation pin 50, said parallelogram 28 preferably comprising two parallel sheets in the middle of which the rotation pin 25 of the cam 20 is positioned. The rotation of the parallelogram 28 leads said rotation pin 25 to orbit around said second rotation pin 50 with respect to the body 15. After a rotation of about 180°, the rotation pin 25 and the relative cam 20 hinged thereto move from the minimum overall dimensions limit configuration A of figure 14a, with the cams 20, 20' closed gathered on the body 15, to the maximum overall dimensions limit configuration B of figure 14d, with the cams 20, 20' completely open and extended, passing through the generic intermediate configurations shown by way of example in figures 14b and 14c.

Still with reference to the same figures, said locking means 40 of the pin 25 comprise at least one locking pin 52, stabilized to the body 15 and suitable for engaging with recesses 32, preferably formed on the greater diagonal ends of said parallelogram 28, so as to prevent the rotation of the same parallelogram 28 beyond the limit positions. In this embodiment the rotation pin 25' of the cam 20' is fixed and coincides with or is coaxially connected to the second rotation pin 50.

Said movement means 30 of the pin 25, again with reference to figures 14a to 14d, may further comprise one or more traditional tie rods 55, like wires or cables made of a metal or polymeric material, generally stabilized at one end of said rotation pin 25 and suitable

for manual movement of the same pin between the two stable minimum and maximum overall dimensions limit configurations of the anchoring and support device 10, marked in the figures by the letters A and B. Said locking means 40 can also comprise a traditional return elastic element 60 placed in cooperation in linear traction with said tie rods 55, so as to return the pin 25, after it is led in an intermediate position around the second rotation pin 50, which is stable in the nearest limit position.

With reference now to figures 17a to 17d, in a further possible combined embodiment of the anchoring and support device 10, said movement means 30 can comprise, by way of example, a slotted opening 36 for the pin 25' and a rocker 31 for the rotation pin 25. The locking means 40 of the rotation pin 25 can comprise a retractable pin 57, slidably arranged in the body 15 and defining a retractable snap mechanism, of the type also used in ballpoint pens, such as to keep the rocker 31 locked in the outer limit position defining the maximum overall dimensions configuration B of figure 17b, when the retractable pin 57 is in the extended position. When said retractable pin 57 is lead to the stable recessed position, in the direction of the arrows F of figure 17c, the rocker 31 is free to rotate in the opposite way to the arrow R of figures 17a and 17b, until the opposite extreme position defining the minimum overall dimensions configuration A. A locking pin 52 stabilized in said body 15 prevents the same rocker 31 from rotating beyond the limit position of the minimum overall dimensions configuration A.

With reference now to figures 23a to 26c in a still further embodiment of the anchoring and support device 10, said movement means 30 can comprise at least two rockers 31, 31' rotatably opposite to each other, stabilized and hinged at one of their ends to the body 15 by means of a second rotation pin 50 inserted in a first hole 33, where said body 15 can also comprise only said second rotation pin 50 stabilized directly with the connecting means 17.

The solution with two cams external to the device and a central antagonist cam is considered below, however it will be apparent to the person skilled in the art how the same solution can be applied to a greater number of cams.

With particular reference to the partial figures 23a to 23b, relating only to the cams 20' and to the left rocker 31', and to figures 24a and 24b, relating only to the central cam 20 and to the right rocker 31, on one end of said rocker 31, 31', a second hole 35 (figures 23a and 24b) is obtained wherein said rotation pin 25, 25' is housed so that, as the rotation of said rocker 31, 31' varies with respect to the axis of the same rotation pin 25, 25' in one of the directions of the arrows marked by the letters R, R', of figure 26b, the position of the rotation pin 25, 25' varies, to which the cam 20, 20' is rotatably stabilized, according to the direction of the arrows marked by the letters P, P' of figure 26b.

With particular reference to the figures 23a to 23b only, said movement means 30 comprise for the left cams 20' (two cams in the preferred embodiment shown in the figures) a rocker 31' formed by two plate-shaped elements parallel and stably joined by said second rotation pin 50 and a connecting pin 102 so as to form a rigid structure, while the cams 20' are rotatably arranged on the pins 25' stabilized at the rockers 31', as shown in figure 23b.

With particular reference instead only to figures 24a to 24b, said movement means 30 comprise for the right (single) cam 20 a rocker 31 formed by two plate-shaped elements parallel and stably joined again by said second rotation pin 50 and by the rotation pin 25 so as to form a rigid structure, while the cam 20 is again rotatably arranged on the same rotation pin 25 stabilized between the two elements of the rocker 31, as shown in figure 24a. However, it will still be evident to the person skilled in the art that these rockers 31, 31' can also be made in a completely equivalent manner by a single body rather than by two or more single plate-shaped elements arranged in a pack as in the examples of figure

23b and 24a.

Said rockers 31, 31' can be further advantageously provided with one or more elastic elements (not shown), such as an elastic torsion spring, said elastic element being suitable for keeping said rockers 31, 31' rotated in a stable position in the minimum overall dimensions limit configuration A of figure 26c.

With reference again to all the figures 23a to 26c, said locking means 40 of the pin 25, 25' can advantageously comprise at least one locking plug 100 which can be slidably inserted, according to the direction of the arrow F of figure 25a, in at least one plug hole 104 formed on at least one rocker 31, 31', said locking plug 100 being able to be housed in a recess 106 (figure 24b) formed on an inner side of an opposite rocker 31, 31', so as to lock the rotation of the rockers 31, 31' with each other and with respect to the second rotation pin 50, in a maximum overall dimensions position B, as shown in figure 25b.

When the user needs a reduced overall dimensions configuration, proceeding with the extraction and removal of the locking plug 100 in the direction of the arrow F of figure 25c, the rockers 31, 31' find themselves in the unconstrained configuration of figure 26a being free to rotate with respect to the second rotation pin 50 towards each other, under the action of the elastic element (not shown) and according to the directions of the arrows R, R' of figure 26b, until they overlap to each other in a limit position with the recess 106 housing the connecting pin 102 according to the direction of the arrow F of figure 26b, preventing a further rotation of the rockers 31, 31' beyond the minimum overall dimensions position A of the rotation pins 25, 25' of figure 26c.

Said locking plug 100 can further be provided with a fixing element (not shown) stabilized at its exposed end, such as cord or flexible twine, said fixing element being suitable for keeping it integral with the body 15 or with the connecting elements 17 of the anchoring and support device 10, so as to prevent it from dispersing and reuse it to return the rockers

31, 31' to the position of figure 25b, overcoming the resistance of the elastic return element, and reinserting said locking plug 100 in the plug hole 104 in the direction of the arrow F of figure 25a.

In other possible variants, not shown, said locking means 40 can comprise several locking plugs 100 which can be slidably inserted into a plurality of holes 104 formed on at least one of the rockers 31, 31', so as to select different opening angles between the same rockers in intermediate angular positions comprised between the limit positions of the maximum overall dimensions configuration B of figure 25b and minimum overall dimensions configuration A of figure 26c.

The movement and rotation of the cams 20, 20' is still obtained also in this embodiment by means of traditional tie rods, for simplicity not shown, generally positioned at the connecting means 17 of the anchoring and support device 10.

The closing and opening of the angle between the two rockers 31, 31' advantageously takes place on the opposite end with respect to the handle end of the connecting means 17 of the anchoring and support device, thus preventing the movement of the rockers themselves 31, 31' from obstructing or preventing the easy operation of the user's hand or hands.

With reference now to figures 27a to 34c, in further and possible embodiments of the anchoring and support climbing device 10, said locking means 40 of the rotation pin 25, 25' can comprise a ratchet locking mechanism (also said click) suitable for allowing, in operative conditions, the single direction rotation with respect to the second rotation pin 50, so as to prevent the rotation movement of the rockers 31, 31' in the rotation direction which leads to the closure of the same anchoring and support device 10 with consequent loss of contact between the rock surface walls.

In the cited figures, for the sake of simplicity of the disclosure, configurations with a pair

of cams 20' and a contrast cam 20 are considered, however, the extension of the following discussion to multiple equivalent configurations with a plurality of cams 20, 20' will be evident to the person skilled in the art.

With particular reference to figures 27a to 29d, said locking means 40 can comprise a rack element 108 rotatably hinged at one end thereof to a rocker 31, 31' by means of a hinge 109, said rack element 108 being provided on one side with a plurality of recesses 110 and protrusions or inclined teeth 110' formed on the same rack element 108, said recesses 110 and inclined teeth 110' being suitable for cooperatively engaging a second pawl 112 stabilized on the rocker 31, 31' opposite to the hinging one of the rack element 108.

Still with reference to the figures, said inclined teeth 110' can have an asymmetrical shape and are generally oriented and developed in the opposite direction to the opening direction of the rockers 31, 31' so as to define a sliding profile cooperating with said second pawl 112, said sliding profile being suitable for translating in a relative movement direction in accordance with the way of orientation of said inclined teeth 110' and suitable for locking the sliding of the rack element 108 by permanently housing said second pawl 112 in the recesses 110 in a direction of relative opposed movement. Said ratchet locking means 40 may also comprise an elastic element, not shown, such as a torsion spring coaxially arranged on said hinge 109 and suitable for maintaining the rack element 108 still in contact with said second pawl 112 during the relative translation movement between them.

Said rack element 108 can also be provided on the opposite side to said recesses 110 and inclined teeth 110' of a housing 113 suitable for being arranged in abutment with a said second rotation pin 50 or generally stabilized to the body of the anchoring and support climbing device 10 or of one of the rockers 31, 31' by means of a generic locking pin, so as to prevent the rotation of said rack element 108 beyond a limit position.

With particular reference also to figures 30a to 30b, in a variant form, said rack element is rotatably hinged with said hinge 109 on one end of a rocker 31, 31' opposite to that of the second rotation pin 25, 25', while said second pawl 112 is stabilized on the opposite end of the rocker 31, 31', opposite such as to provide a scissor arrangement of said rockers 31, 31' on the second rotation pin 50.

With particular reference to figures 31a to 34c a further embodiment of said locking means 40 of the anchoring and support climbing device 10 is shown, comprising a ratchet mechanism, wherein a plurality of recesses 110 and inclined teeth 110' can be alternatively arranged, according to a crown 115, 115' with a circular radial development formed on the facing surfaces of the respective rockers 31, 31', said crown 115, 115' can be centred at the housing hole of the second rotation pin 50.

The crown 115' formed on the rocker 31' is suitable for engaging in rotational cooperation at least one conjugated crown 115 of the rocker 31.

The asymmetric conformation and orientation of the inclined teeth 110' of the crowns 115 and 115', engaged in surface contact with each other, allows the relative rotation between said rockers 31, 31' in a rotation direction in accordance with the orientation direction of the inclined teeth 110' of the crown 115, 115' opposite to that considered, while it is prevented in the opposite direction where the inclined teeth 110' engage with the recesses 110. The relative rotation of the rockers 31, 31' is also associated with an axial translation of one of the rockers 31, 31' with respect to the second rotation pin 50, so as to allow disengagement of the inclined teeth 110' with the conjugated recesses 110 and the subsequent engagement of the same with subsequent counterparts in the rotation direction of the ratchet mechanism.

Said rockers 31, 31' are advantageously held with the surfaces of the respective crowns 115, 115' engaged and in contact by means of at least one elastic contrast element 117,

such as for example a spiral spring coaxially arranged on said second rotation pin 50 between the outer surface of the rocker 31, 31' and the inner abutment of a head 58 of the second rotation pin 50. In order to rotate with respect to one another, at least one of the rockers 31, 31' must translate axially to disengage the crowns 115, 115' to allow the inclined teeth 110' to snap in the subsequent engagement position.

Still referring to the figures, said locking means 40 can further comprise a safety mechanism comprising a movable bracket 120 provided with two slotted ends 122 suitable for sliding radially with respect to the second rotation pin 50 and with at least one inclined surface 124 formed on said slotted ends 122 such as to axially engage at least one rocker 31, 31' to prevent accidental axial translation of the same rocker with consequent disengagement of the crowns 115, 115'.

Still with reference to the same figures, said movable bracket 120 can be slidably stabilized or integrated with the connecting means 17 of the anchoring and support device 10, comprising for example a traditional handle.

With reference again to figures 27a to 34c, the operation of a generic locking and support climbing device 10 object of the present invention it is understood, provided with locking means 40 comprising a ratchet mechanism.

With particular reference to figures 29a to 29d the anchoring and support device 10 with the locking means 40 is generally, but not limited to, configured in a monostable rest position (as for example in figure 27a, 27b) with the cams 20, 20' maintained in the open position by means of the respective elastic elements (not shown) and with the rotation pins 25, 25' arranged in a minimum overall dimensions configuration A with the rockers 31, 31' held in a monostable limit position by means of further known elastic elements (not shown) arranged axially at the second rotation pin 50, said rockers 31, 31' forming a negative angle with each other with respect to the opposite limit position. For greater

clarity of exposition in figures 29a to 29d the rockers 31, 31' are schematized as line segments joining the first rotation pins 25, 25' with the second rotation pin 50.

As is generally the case in the operation of all the embodiments of the anchoring and support climbing device 10 described above, also in this case, acting on a handle 56 connected to tie rods 55, the resistance force of the elastic elements of the rotation pins 25, 25‘ is overcome, bringing the cams 20, 20' into the closed position and the anchoring and support device 10 in the minimum overall dimensions configuration A, as shown in figure 29a, i.e. in the configuration for inserting the same in a rock crack or crevice.

The elastic elements of the cams 20, 20', coaxially arranged on first rotation pins 25, 25', have a lower elastic stiffness than the possible elastic elements of the torsion spring type rockers 31, 31', coaxially arranged on the second rotation pin 50, so that the same rockers 31, 31' cannot be lead to rotate as long as the cams 20, 20' reach the closed position.

Once the closed limit position of the cams 20, 20' of figure 29 has been reached, continuing to apply a traction force F on the handle 56, the resistance force of the elastic elements of the rockers 31, 31' is overcome, causing them to rotate with respect to one another such as to vary the angle α identified between them and allow adjustment of the anchoring and support device 10 to larger size rock cracks or crevices. At the same time the rack element 108 tends to rotate, according to the direction of the arrow R of the figures 29a to 29d, with respect to its hinge 109 by means of the relative elastic element which leads the same rack element 108 to engage in surface contact with the second pawl 112.

Continuing to apply the traction force F on the handle 56, the rack element 108 reaches the intermediate position of figure 29b where the second pawl 112 engages with the recess 110 of the same rack element 108. Releasing the handle 56, the second pawl 112 remains in a stable position in the recess 110 in contact with the relative inclined tooth 110'

preventing the rockers 31, 31' from returning in the initial position of figure 29a making them stable in the position reached.

Continuing to apply the force F on the handle 56, a plurality of stable intermediate positions are reached in sequence, where the pawl progressively engages the subsequent recesses 110, for example as in figure 29c, until it reaches the limit position of maximum overall dimensions configuration B of the rotation pins 25, 25' where the second pawl 112 engages the last recess 110 available on the rack element 108, thus allowing a progressive adaptation of the anchoring and support device 10 in a plurality of intermediate positions so as to be able to adapt it easily and with one hand to different size cracks or crevices of the rock surface. To bring the device back to its initial position, the user must manually unlock the rack element 108. It is clear that the unstable opening interval of the angle α between the rockers 31, 31' corresponding to two progressive recesses 110 can be compensated by the opening of the cams 20, 20' which are brought into contact with the rock surface, thus carrying out the accurate final adjustment to the actual size of the rock crack or crevice. Subsequently, acting a traction force F on the connecting means 17 such as for example a handle or a grip, the anchoring and support device 10 is firmly stabilized on the rock support.

With particular reference to figures 31a to 32c and 34a to 34c, similarly to the second embodiment of the anchoring and support device 10 provided with locking means 40 with rack element, acting on tie rods (not shown in this case) the rockers 31, 31' are lead to rotate in such a way as to progressively vary the angle α formed between them until it inverts. Rotating the rockers 31, 31' with respect to each other, starting from a minimum overall dimensions configuration A of the rotation pins 25, 25' (figs. 31a, 32a and 34a), the respective crowns 115, 115' engaged in contact with each other disengage, at the same time overcoming the resistance force of the elastic elements (not shown) arranged on the

second rotation pin 50.

During the rotation of the rockers 31, 31' the inclined teeth 110' and the recesses 110 radially arranged on the respective crowns 115, 115' disengage while simultaneously making the external rocker 31 axially translate, overcoming the reaction of the elastic contrast element 117, as shown in figure 34b, until the successive inclined teeth 110' are progressively engaged with the conjugated recesses 110 of the respective crown 115, 115' in such a way as to bring the anchoring and support device 10 from the limit position of the minimum overall dimensions configuration A of figure 31a and 32a to the limit position of the maximum overall dimensions configuration B of figure 31c, 32c.

In the transition between the two limit configurations A and B the device can advantageously be arranged in a plurality of positions corresponding to intermediate and progressively increasing configurations, corresponding to each individual position between the recesses 110 and the inclined teeth 110' of the conjugated crowns 115 115 thus allowing, also in this embodiment, a progressive adaptation of the anchoring and support device 10 to a plurality of intermediate positions so as to be able to adapt it easily and with only one hand to different size cracks or crevices of the rock surface. Once the suitable adjustment has been reached, the cams 20, 20', while opening, are brought into contact with the rock support by carrying out the accurate final adjustment.

With particular reference to figure 34c alone, for greater safety, the user can act once the adjustment has been made applying a traction force in the direction of the arrow F on the connecting means 17 or a handle such as to bring the movable bracket 120 to translate vertically with the slotted ends 122, radially with respect to the second rotation pin 50, so as to lead the inclined surface 124 to engage with the external rockers 31', 31' preventing a possible accidental disengagement of the crowns 115, 115', otherwise kept in contact only by elastic contrast elements 117. In a variant form, said inclined surface 124 can also

be advantageously formed on a washer or rosette coaxially arranged on the second rotation pin 50 between its head 58 and the slotted end 122 of the movable bracket 120.

As it can be seen from the foregoing, the operation and advantages achieved by the anchoring and support device 10 object of the present invention are evident.

The anchoring and support climbing device 10 object of the present invention is particularly advantageous because it allows to provide the user with a device capable of adapting to a greater size range of cracks or crevices in the rock, allowing the climber to carry a smaller number and therefore a reduced weight, also allowing the same to reuse the same anchoring and support device 10 several times.

The anchoring and support climbing device 10 object of the present invention is also particularly advantageous because it allows to provide the user with an extremely simple device, with few assembled elements and with increased practicality and ergonomics of use.

Although the invention has been described above with particular reference to a series of preferred embodiments, given by way of non-limiting example, numerous modifications and further variations will be apparent to a person skilled in the art in the light of the above description. The present invention, therefore, intends to embrace all modifications and variations which fall within the scope of the following claims.

CLAIMS

1. Anchoring and support climbing device (10) comprising:
   - a central body (15) suitable for being connected at one end to a wire;
   - at least one cam (20, 20') rotatably arranged with respect to said body (15) by means of a;
   - rotation pin (25, 25') and suitable for anchoring to a rock wall, said cam (20, 20') being suitable for being arranged between a closed limit position on said body (15) and an open limit position projecting and protruding from said central body (15);

   wherein at least one portion of said rotation pin (25, 25') of the cam (20, 20') can be positioned or dislocated with respect to said body (15), between a minimum overall dimensions position and a maximum overall dimensions position of said rotation pin (25, 25') by;
   - movement means (30) and;
   - locking means (40) of the same rotation pin (25, 25'),

   so as to increase the extension or opening distance of the cam (20, 20');

   characterized in that said movement means (30) comprise at least two rockers (31, 31') opposed to each other, rotatably stabilized and hinged to the body (15) by means of a second rotation pin (50) and in that said locking means (40) comprise a ratchet locking mechanism suitable for allowing the single direction rotation with respect to the second rotation pin (50), so as to prevent the rotational movement of the rockers (31, 31').

2. Anchoring and support device (10) according to claim 1, where on one end of said rocker (31) said rotation pin (25, 25') to which the cam (20) is rotatably stabilized is housed, so that as the rotation of said rocker (31) varies, the position of the same

rotation pin (25, 25') varies.

3. Anchoring and support device (10) according to claim 1, wherein said locking means (40) comprise a rack element (108) rotatably hinged at one end thereof to a rocker (31, 31') by means of a hinge (109), said rack element (108) being provided on one side with a plurality of recesses (110) and inclined teeth (110') formed on the same rack element (108), said recesses (110) and inclined teeth (110') being able to cooperatively engage a second pawl (112) stabilized on a rocker (31, 31') opposite to the hinging one of the rack element (108).
4. Anchoring and support device (10) according to claim 3, wherein said locking means (40) comprise an elastic element such as a torsion spring coaxially arranged on said hinge (109) and suitable for maintaining the rack element (108) in contact with said second pawl (112) during the relative translation movement between them.
5. Anchoring and support device (10) according to claim 1, wherein said locking means (40) comprise a plurality of recesses (110) and inclined teeth (110') arranged according to a crown (115, 115') with a circular radial development formed on the facing surfaces of the respective rockers (31, 31'), said crown (115, 115') being centred at the housing hole of the second rotation pin (50).
6. Anchoring and support device (10) according to claim 5, wherein said crown (115') formed on the rocker (31') is suitable for engaging in rotational cooperation at least one conjugated crown (115) of the rocker (31).
7. Anchoring and support device (10) according to claim 5, wherein said rockers (31, 31') are held in contact with the respective crowns (115, 115') by means of at least one elastic contrast element (117), such as for example a spiral spring coaxially arranged on said second rotation pin (50).
8. Anchoring and support device (10) according to claim 5, wherein said locking means

(40) comprise a movable bracket (120) provided with two slotted ends (122) suitable for sliding radially with respect to the second rotation pin (50) and with at least one inclined surface (124) formed on said slotted ends (122) such as to axially engage at least one rocker (31, 31') to prevent the axial translation thereof with consequent crowns (115, 115') disengagement.

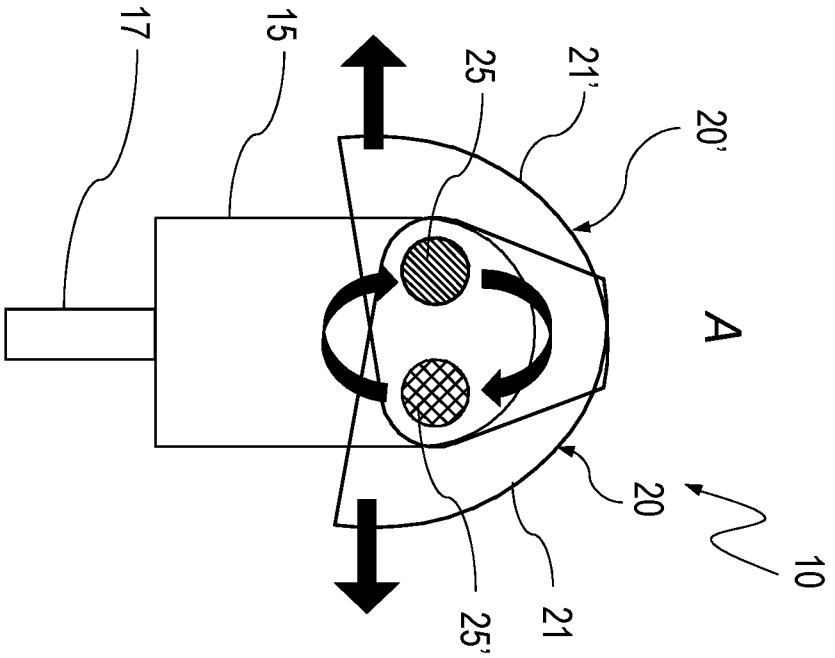


Fig. 1a

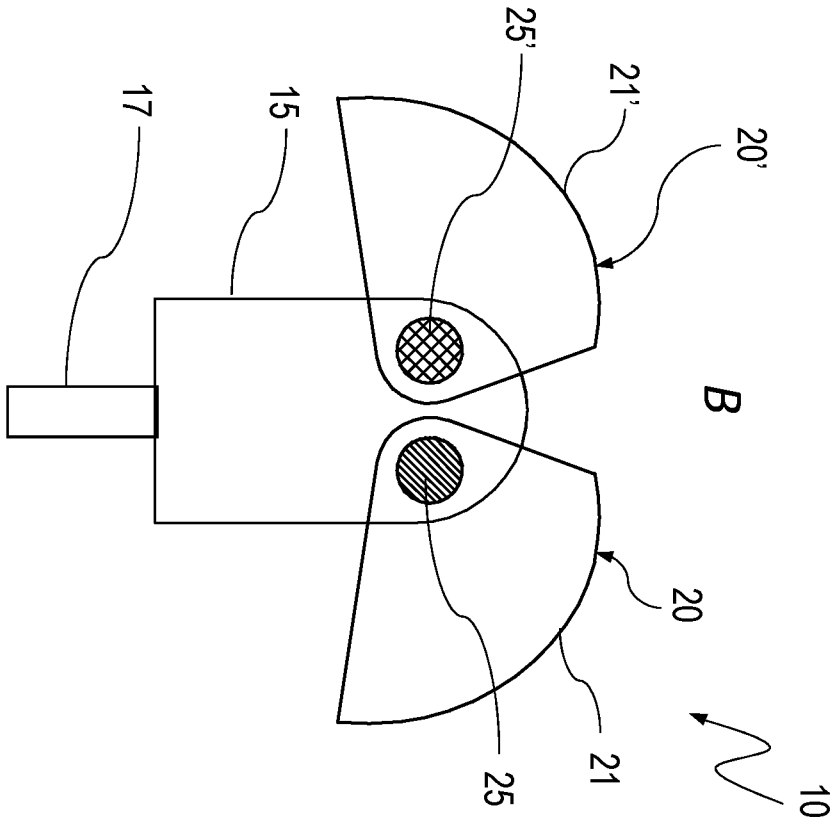
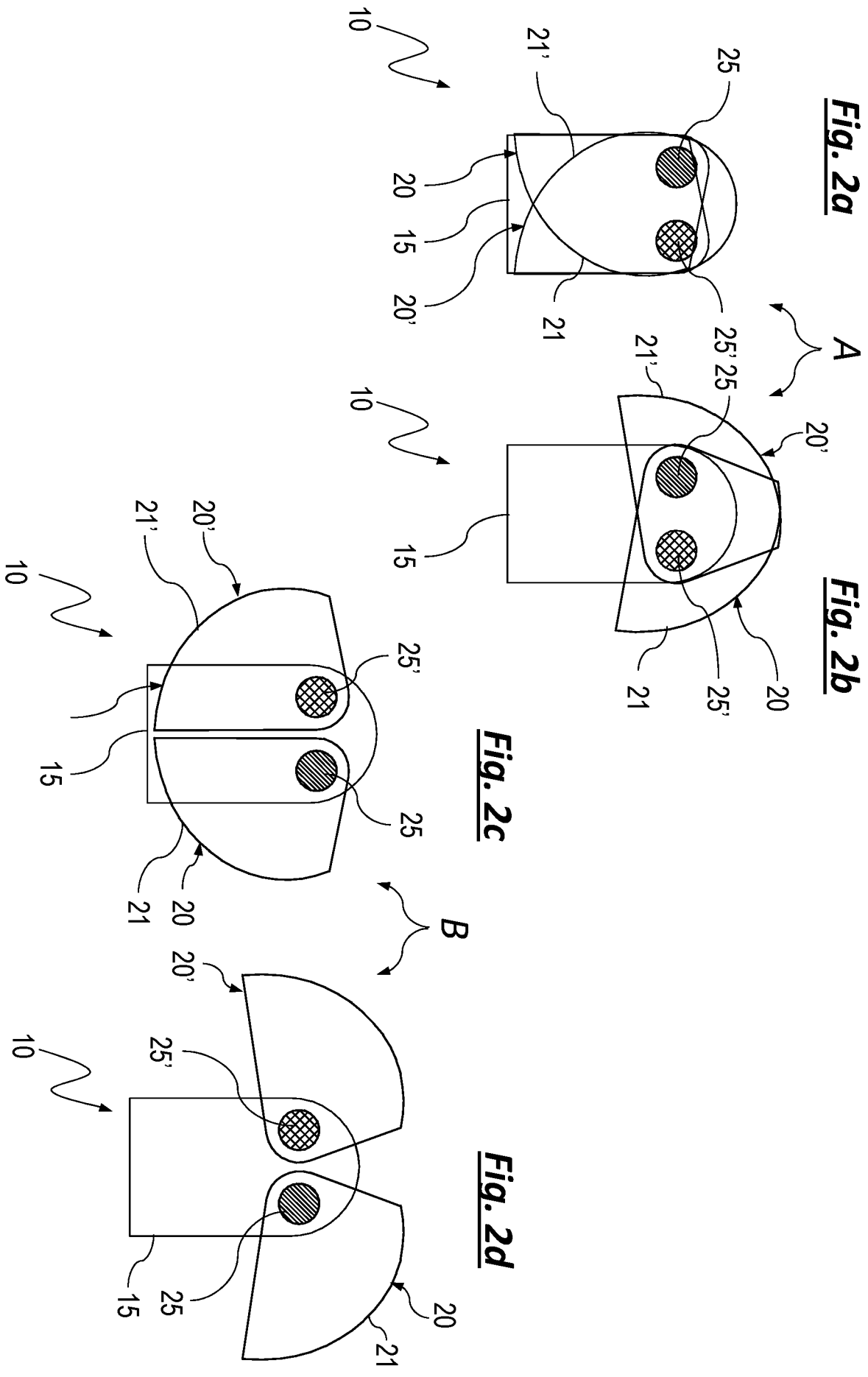


Fig. 1b


10
21'
25
20
15
20'
21
25'
A
20'
Fig. 2a
Fig. 2b
Fig. 2c
Fig. 2d
B

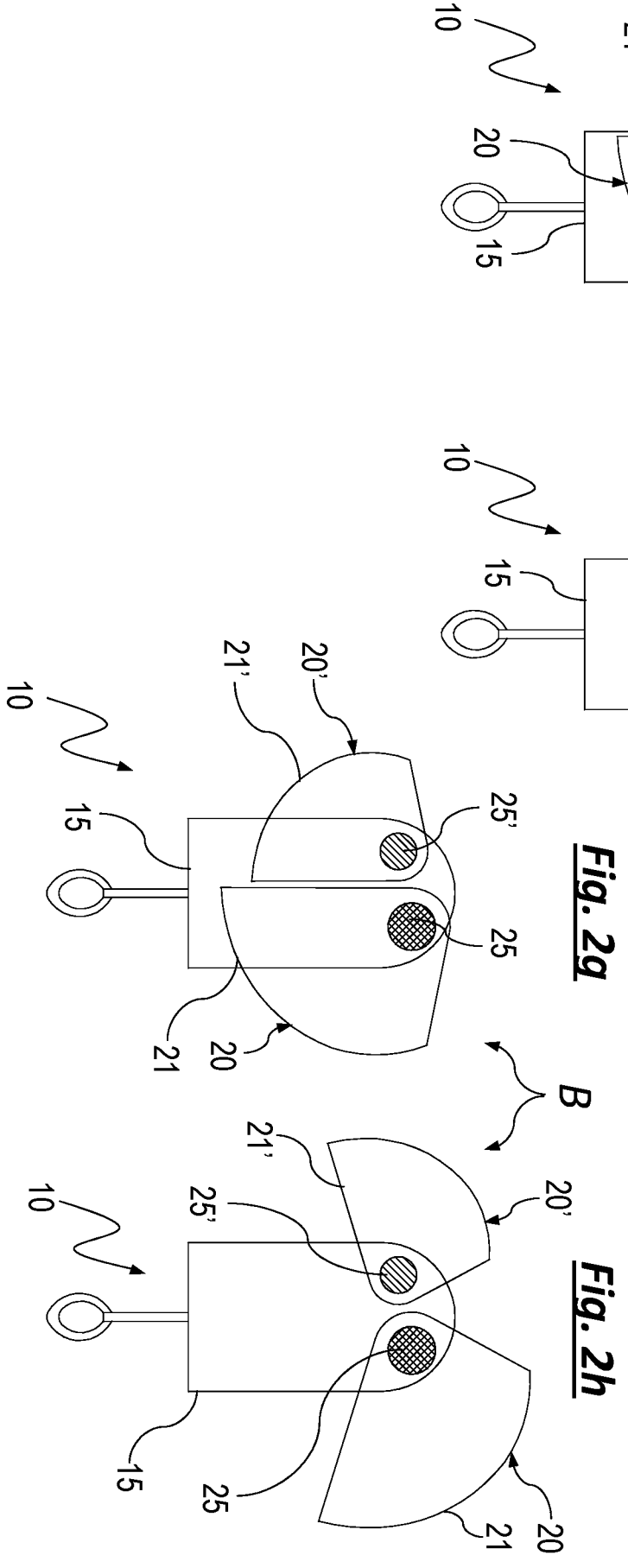


Fig. 2e

Fig. 2f

Fig. 2g

Fig. 2h

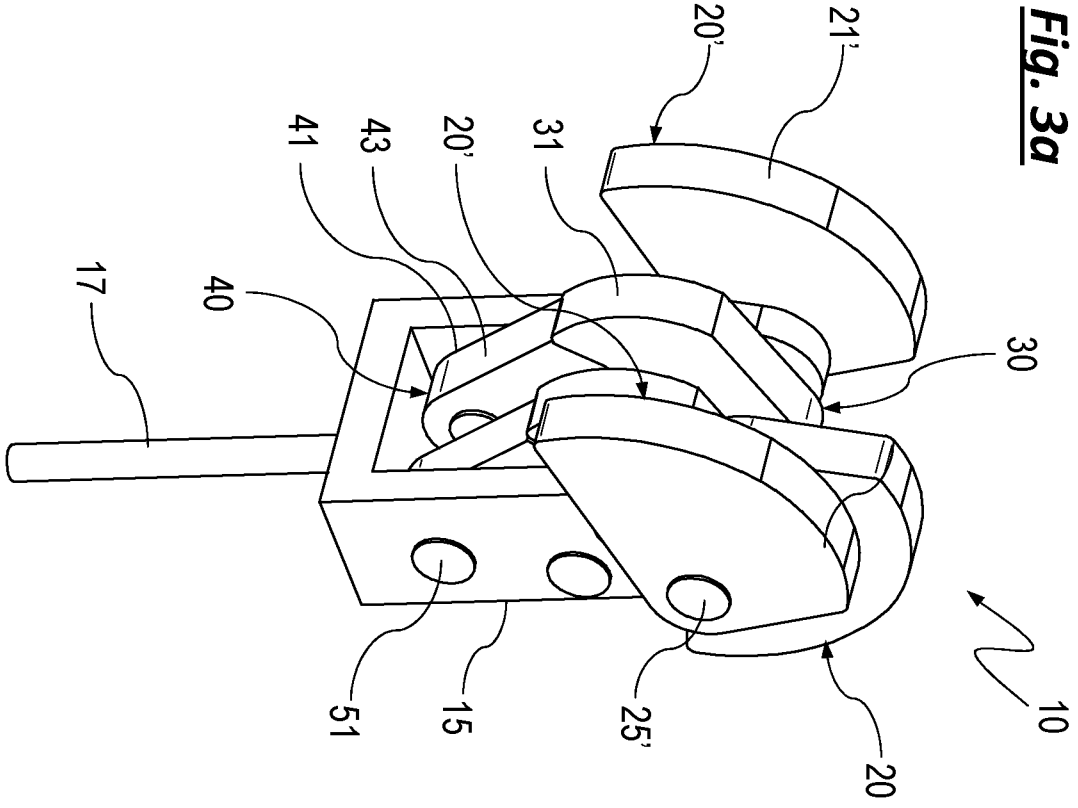

20'
21'
41
43
20'
31
17
40
30
51
15
25'
20
10

Fig. 3a

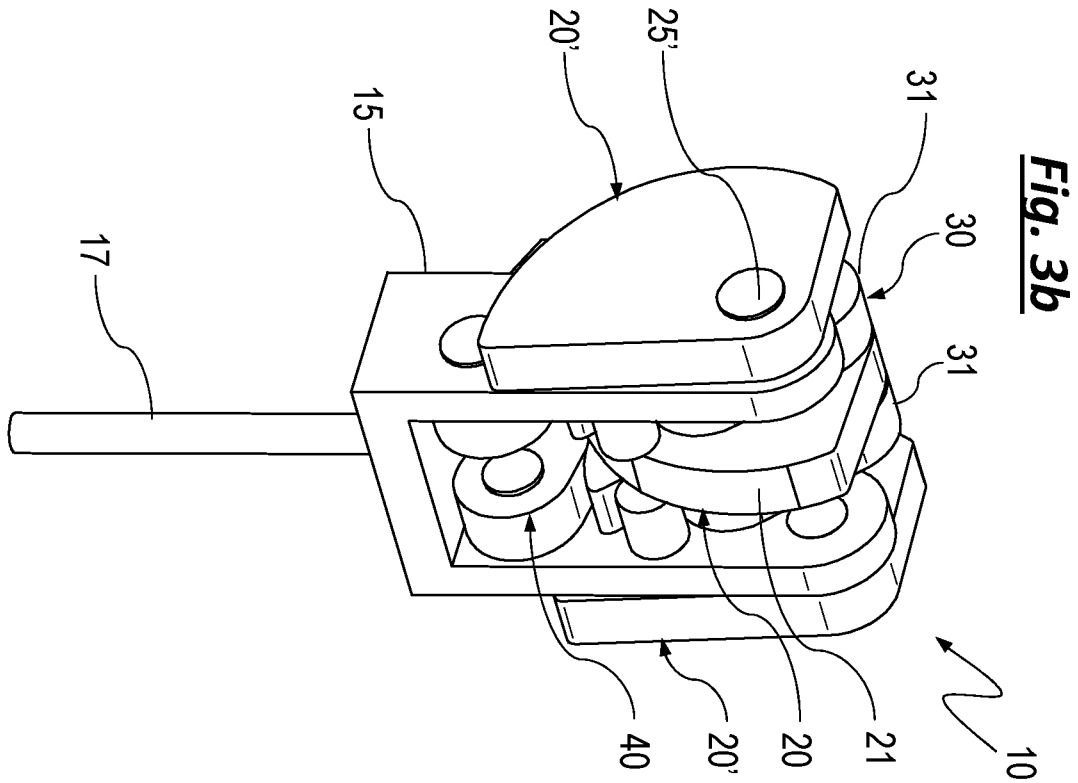
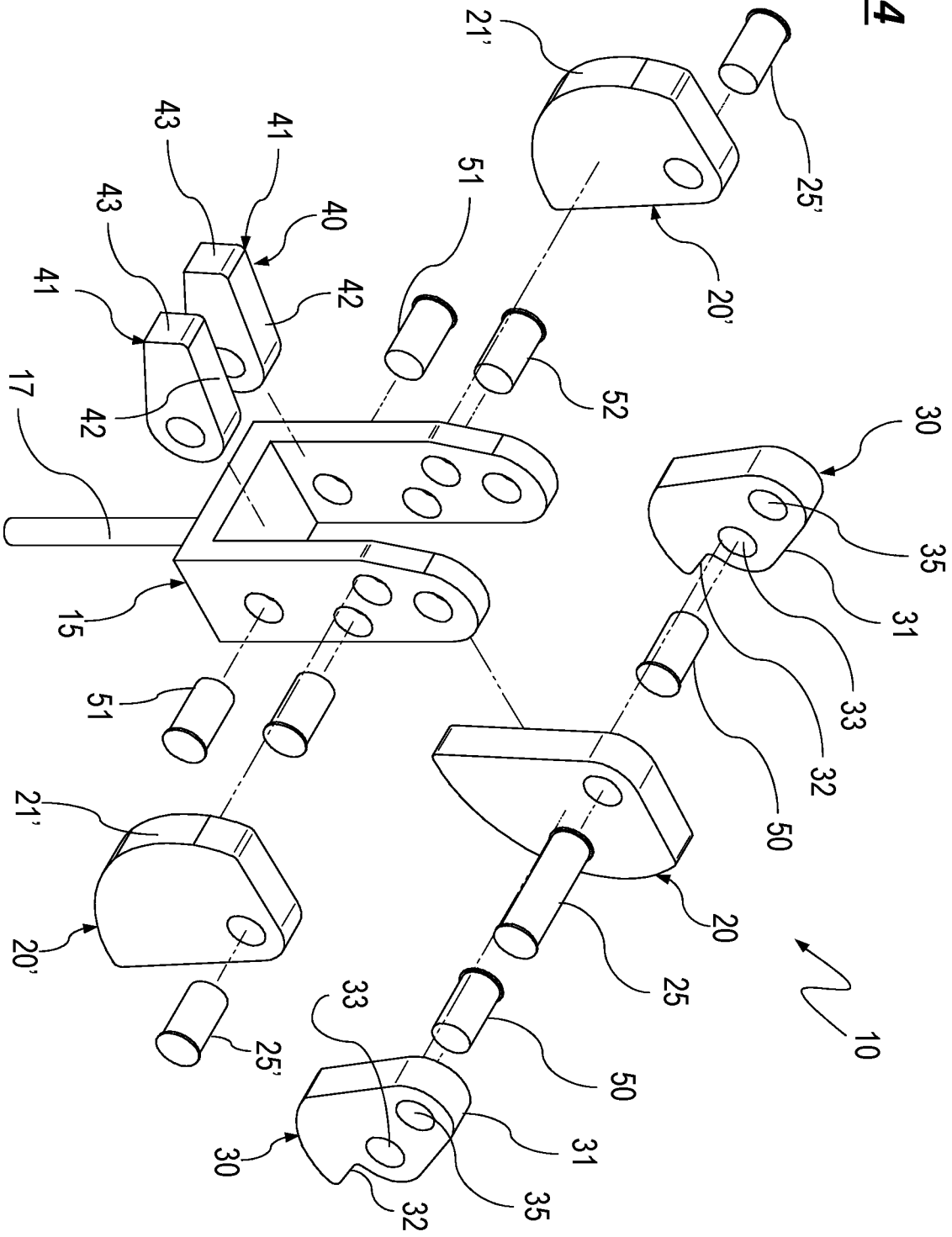

20'
25'
31
15
30
17
31
40
20'
20
21
10

Fig. 3b

Fig. 4



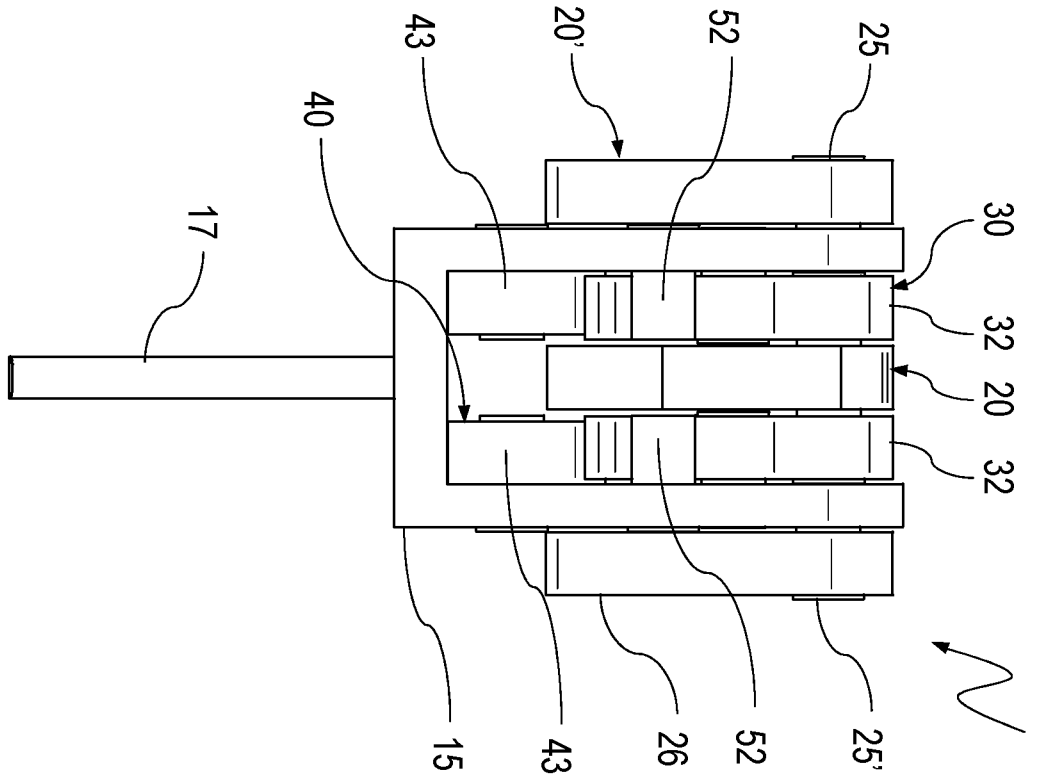


Fig. 5a

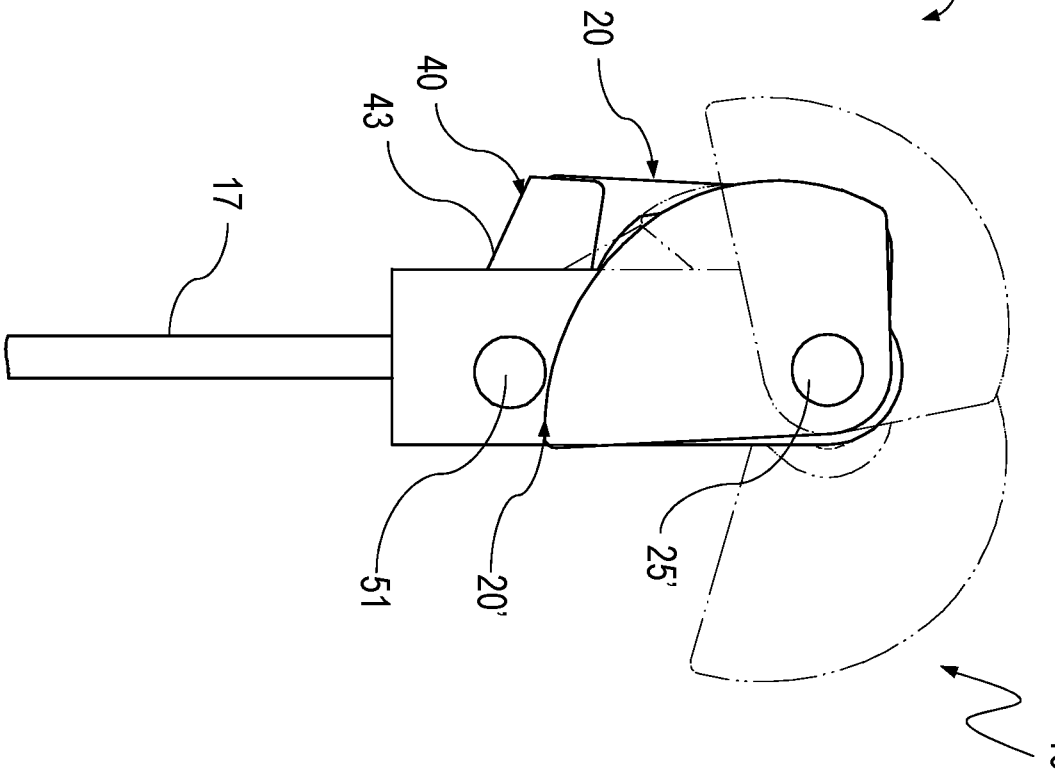


Fig. 5b

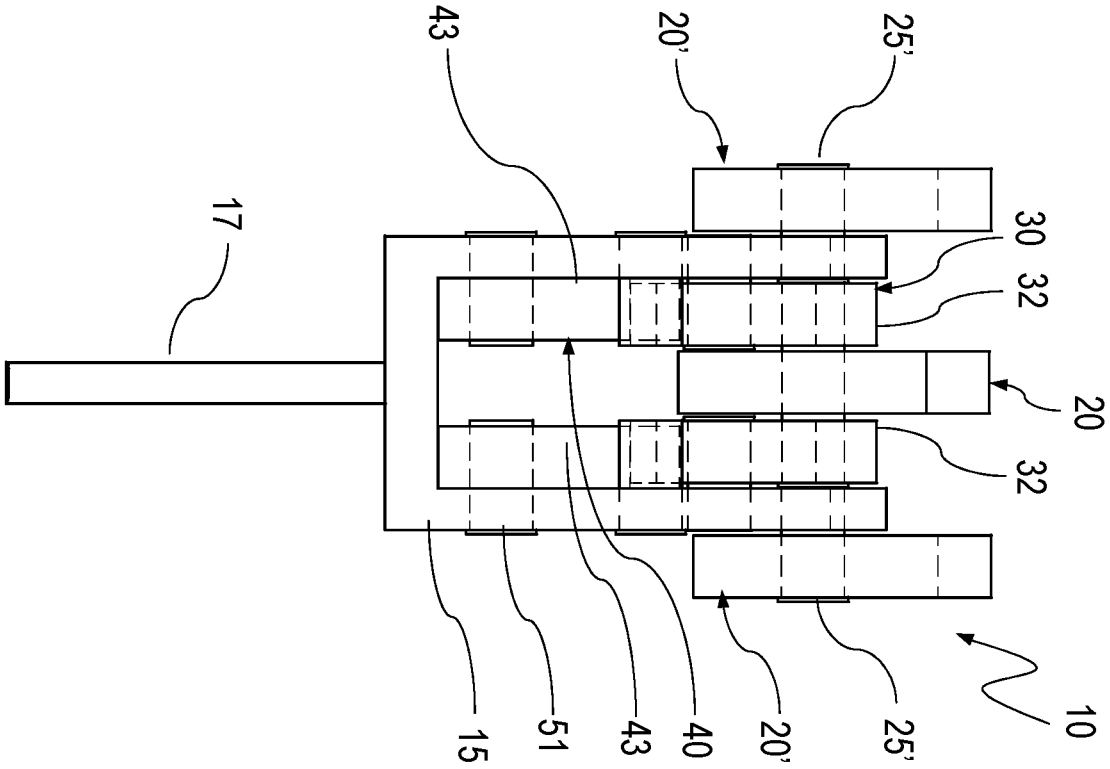

43
20'
25'
17
30
32
20
32
15
51
43
40
20'
25'
10

Fig. 6a

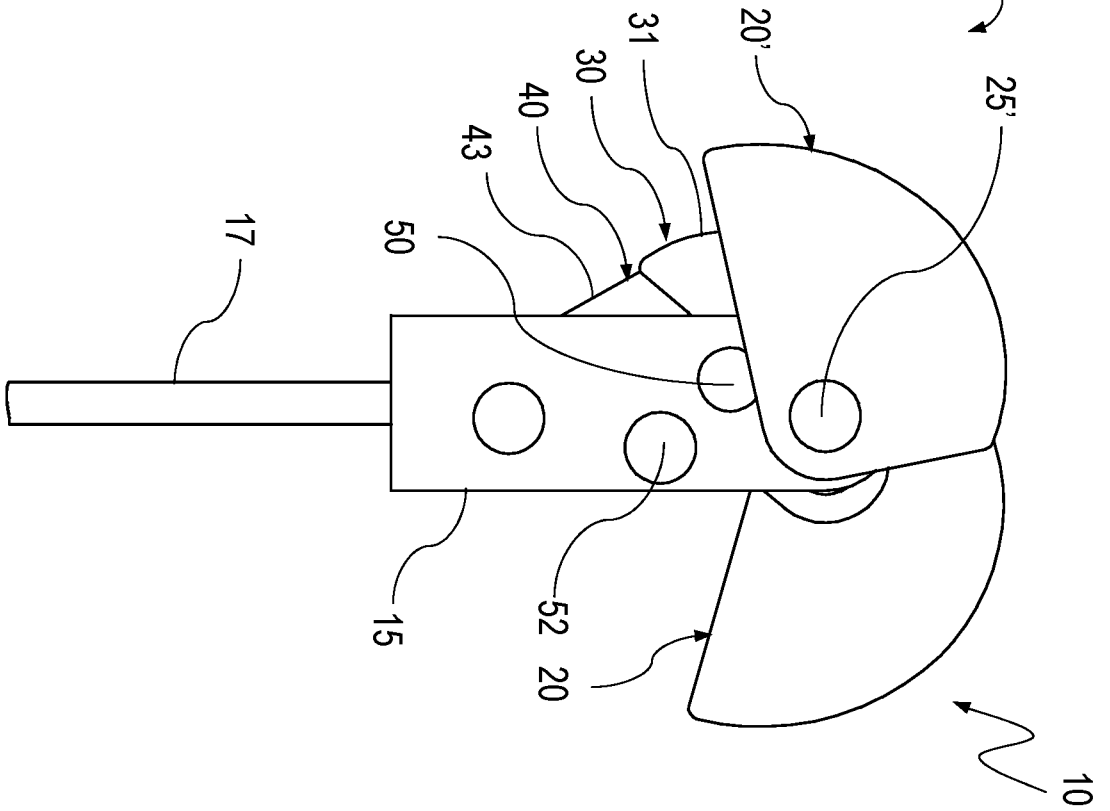

B
20'
31
30
40
43
25'
17
50
15
52
20
10

Fig. 6b

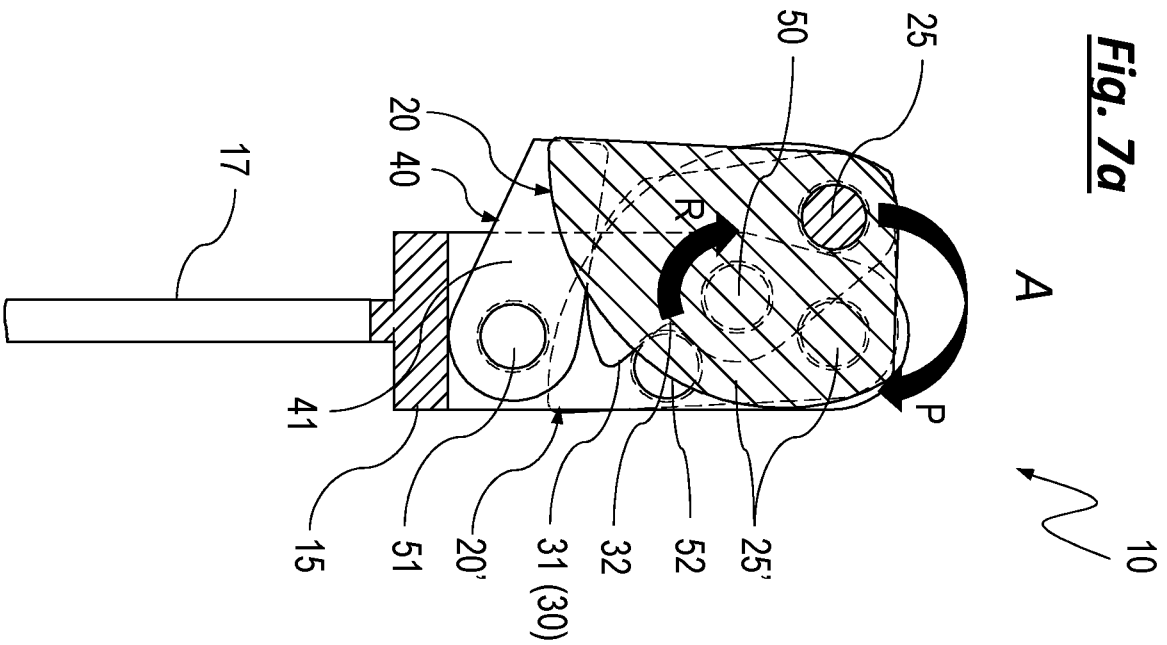

50
25
20 40
17
R
A
P
41
15
51
20'
31 (30)
32
52
25'
10

Fig. 7a

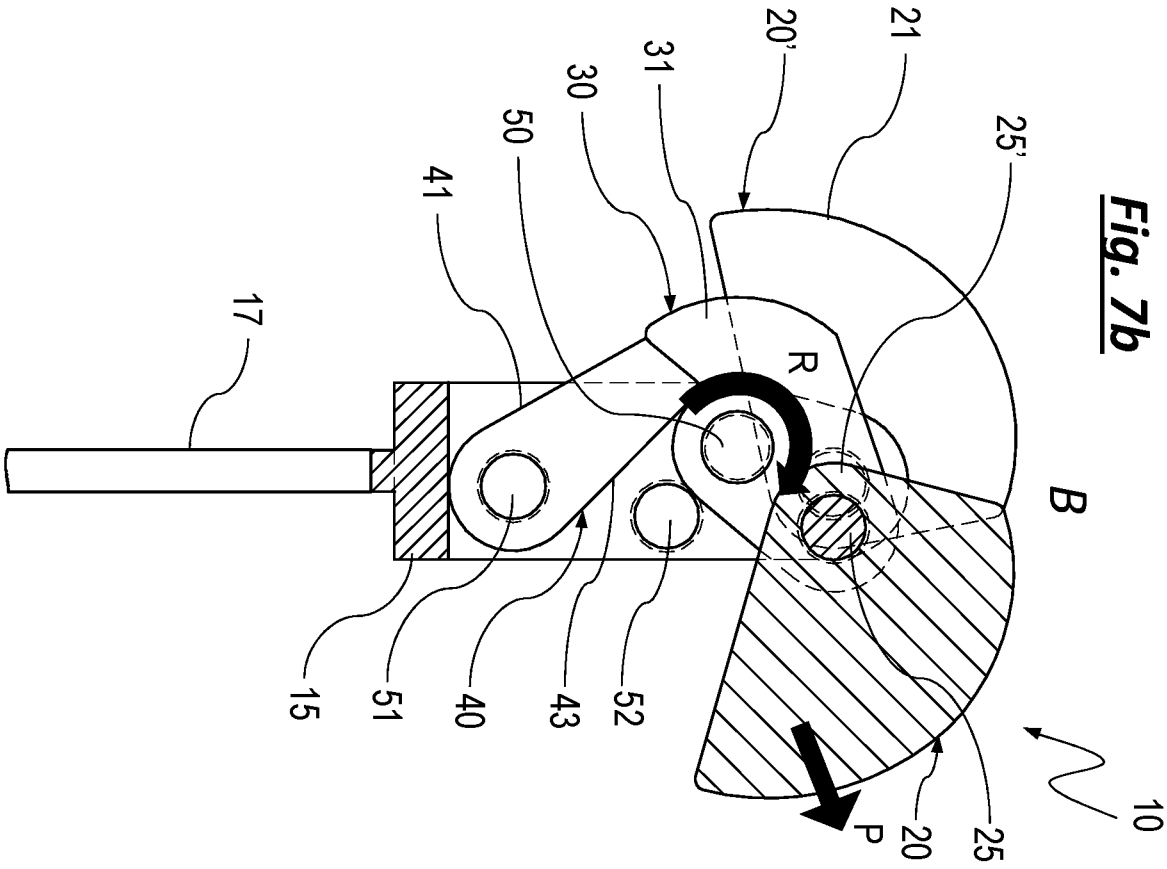

20'
21
31
30
25'
50
41
17
R
B
15
51
40
43
52
20
25
P
10

Fig. 7b

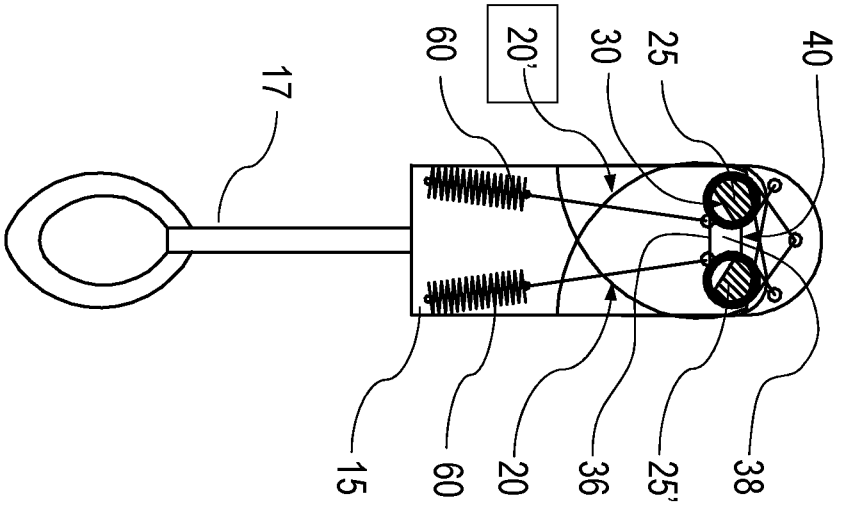

17
60
20'
30
25
40
A
10
15
60
20
36
25'
38

Fig. 8a

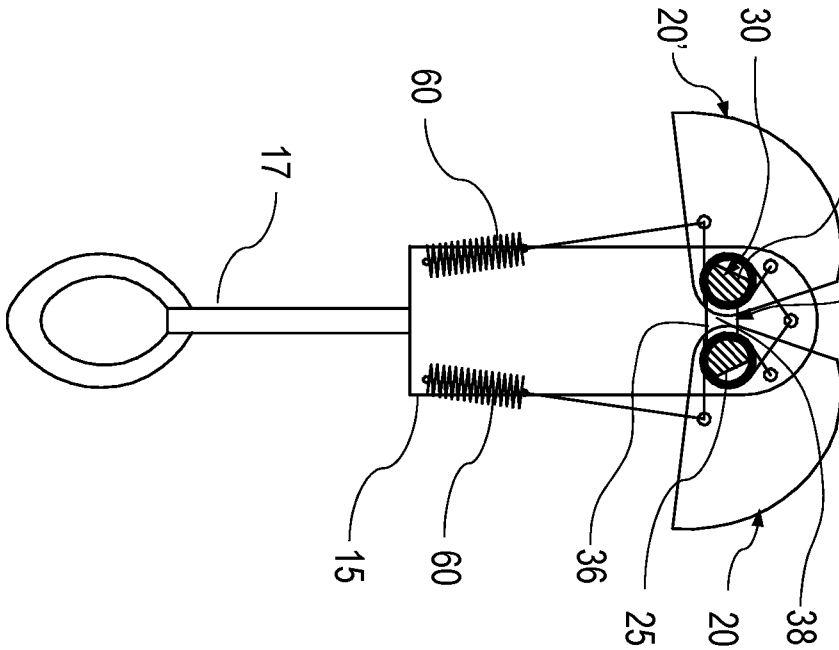

17
60
20'
30
25'
40
B
10
15
60
36
25
20
38

Fig. 8b

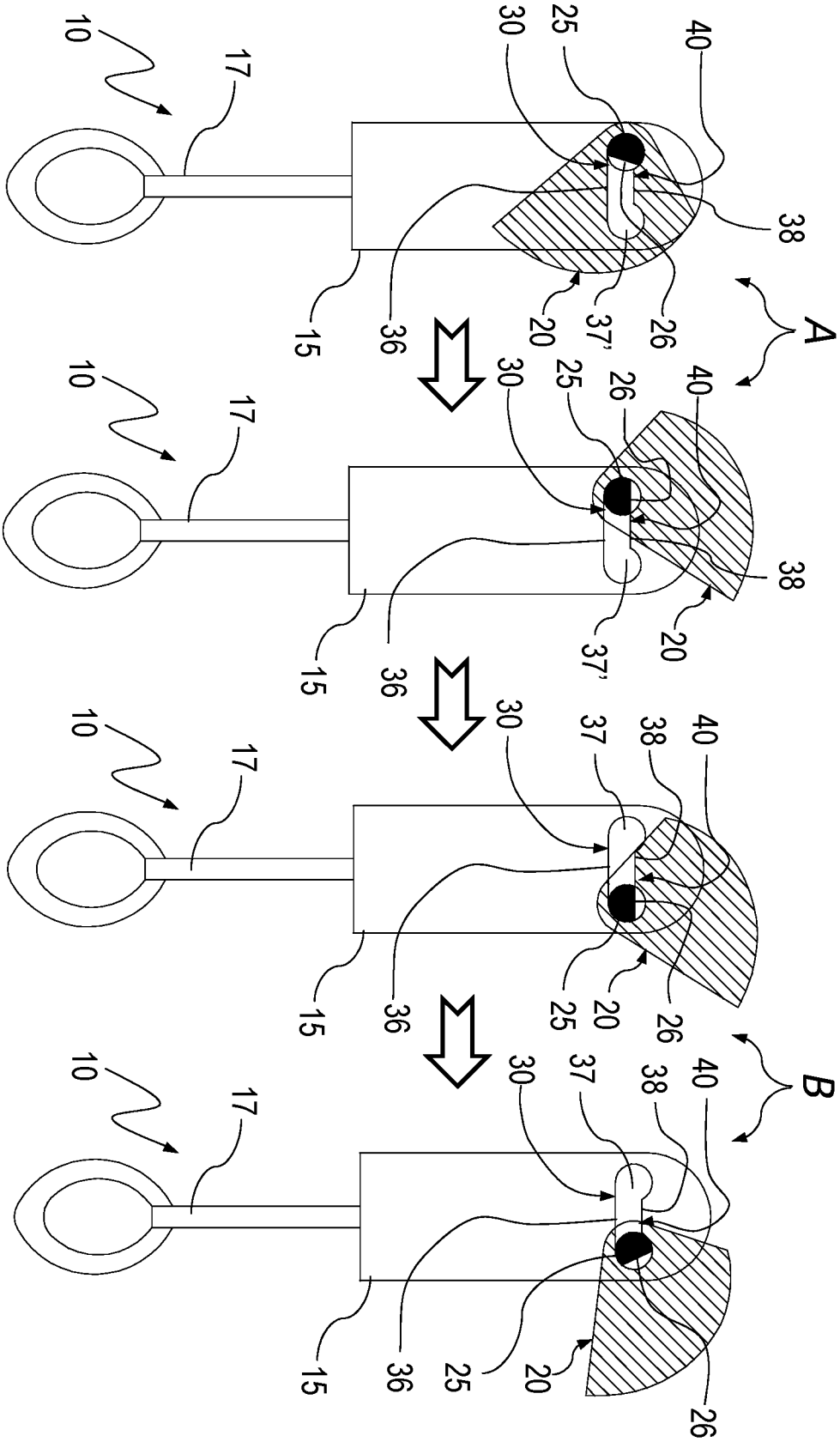


Fig. 9a

Fig. 9b

Fig. 9c

Fig. 9d

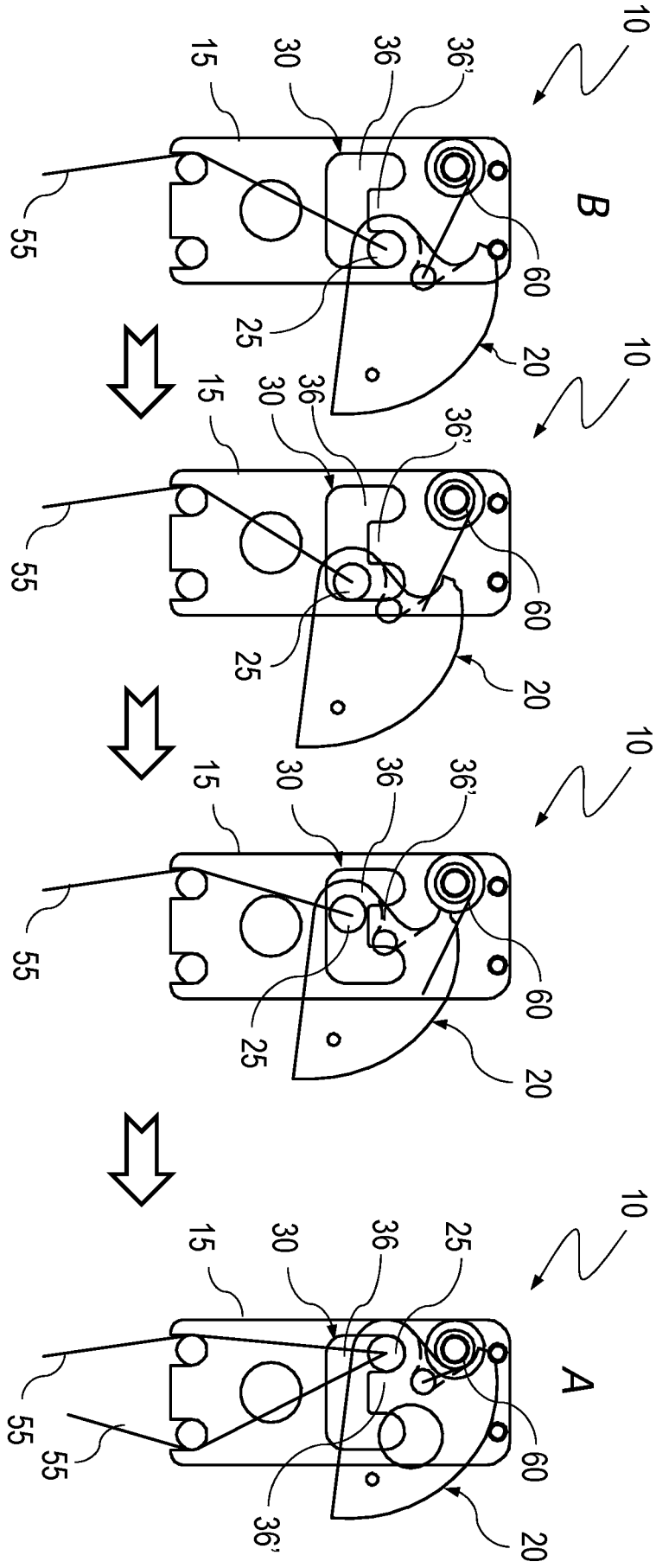


Fig. 10a

Fig. 10b

Fig.10c

Fig. 10d

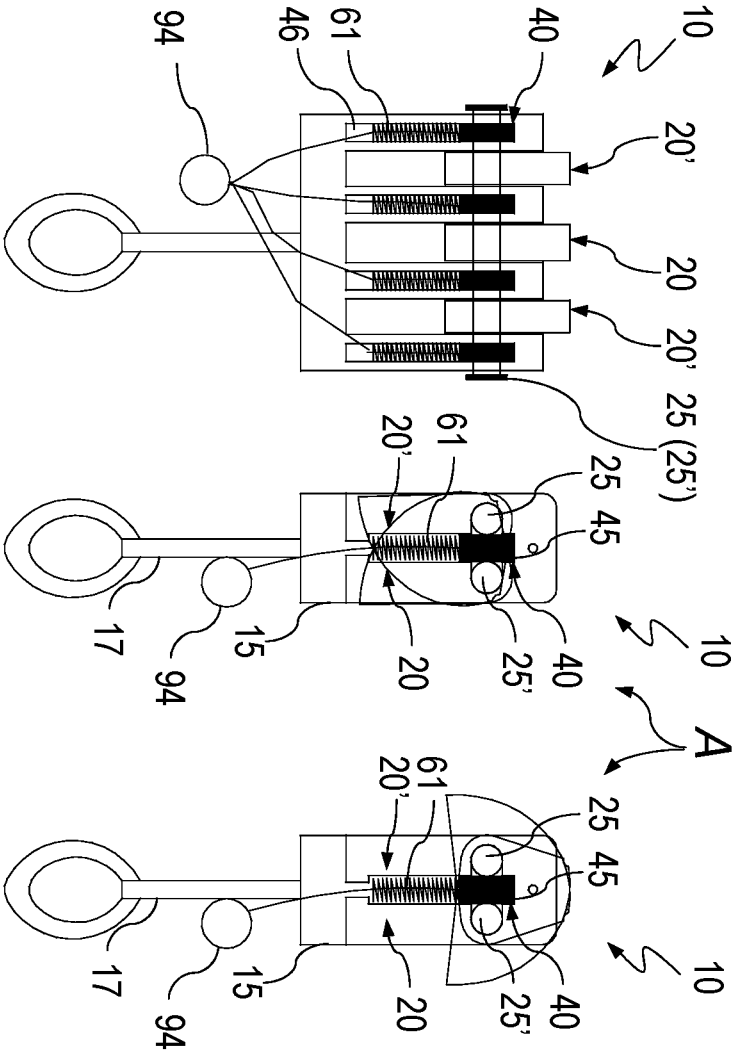


Fig. 11a

Fig. 11b

Fig. 11c

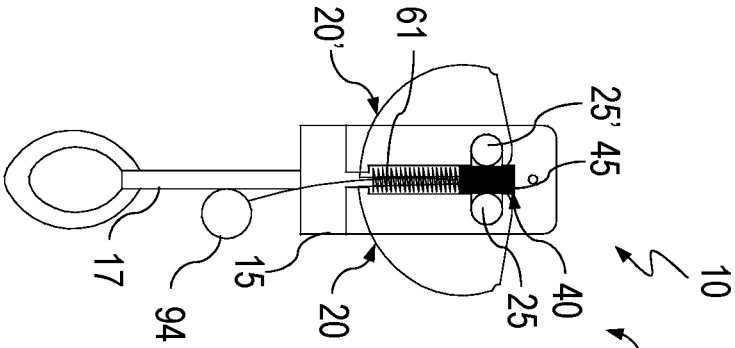


Fig.11d

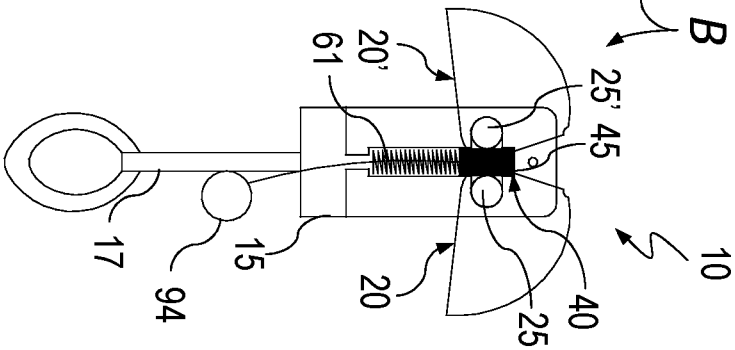


Fig.11e

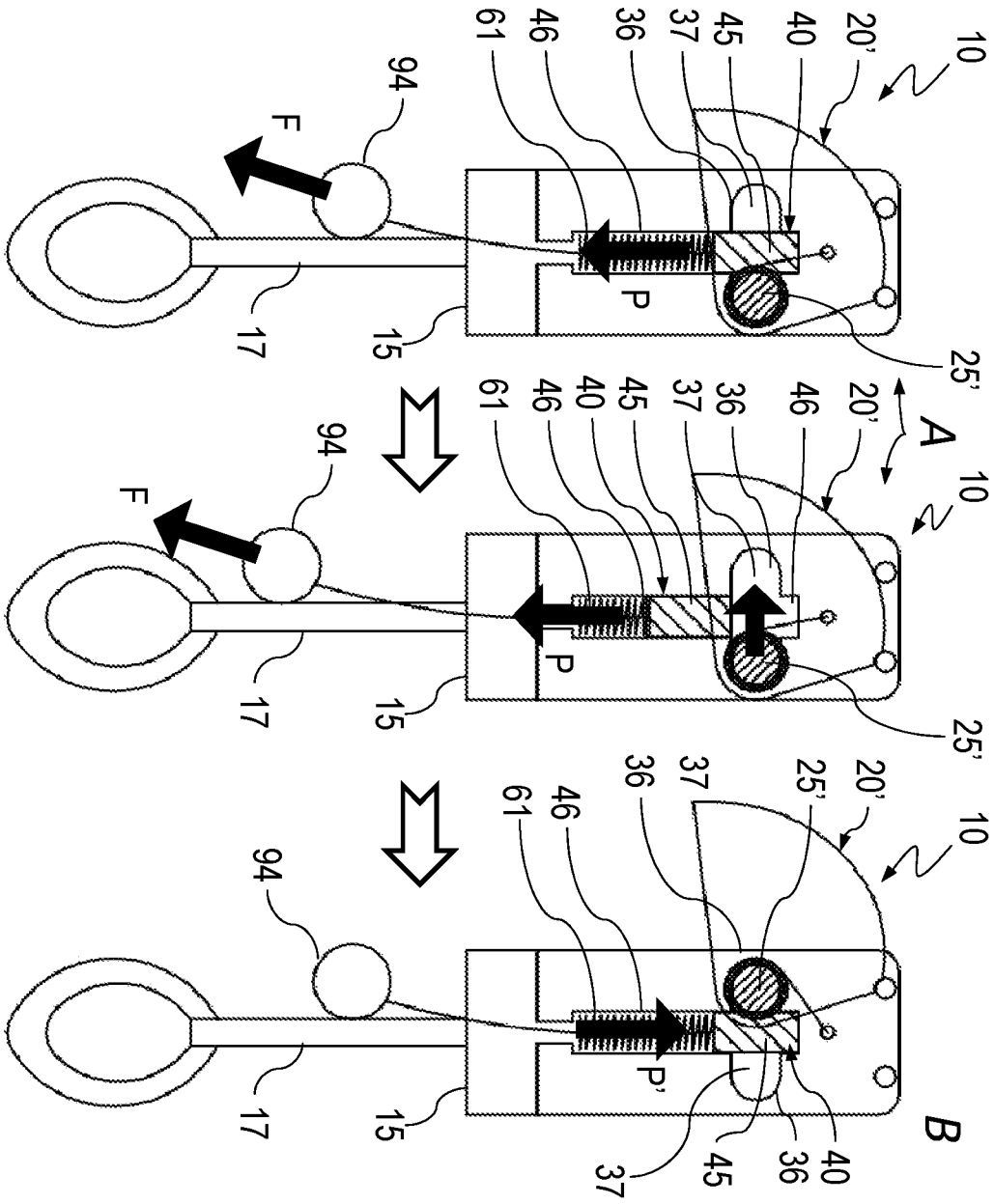


Fig. 11f

Fig. 11g

Fig.11h

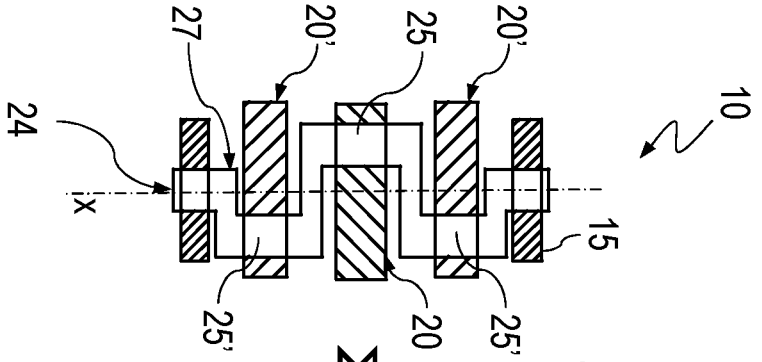


Fig. 12a

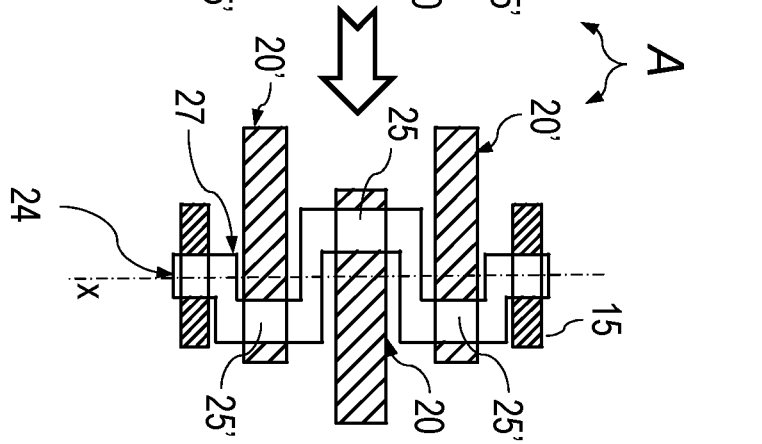


Fig. 12b

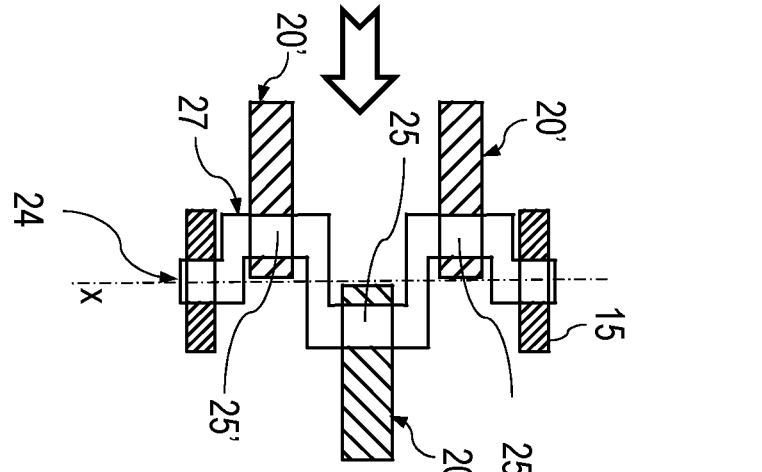


Fig. 12c

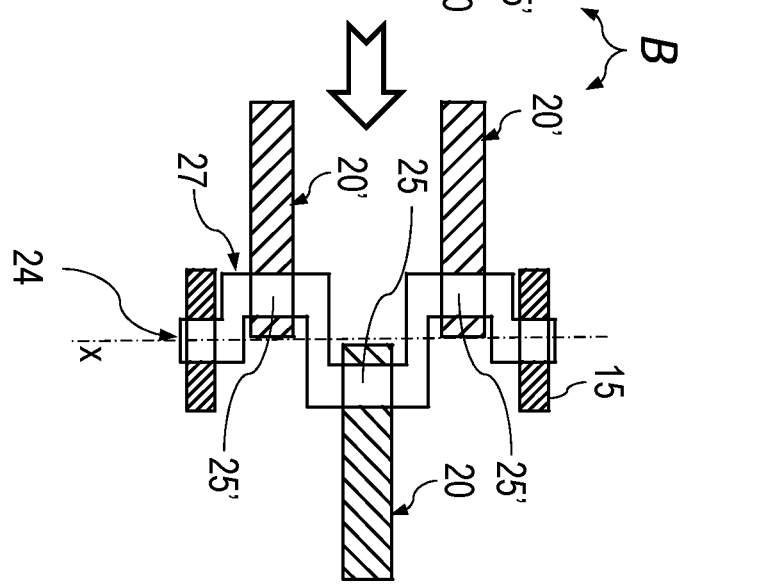


Fig. 12d

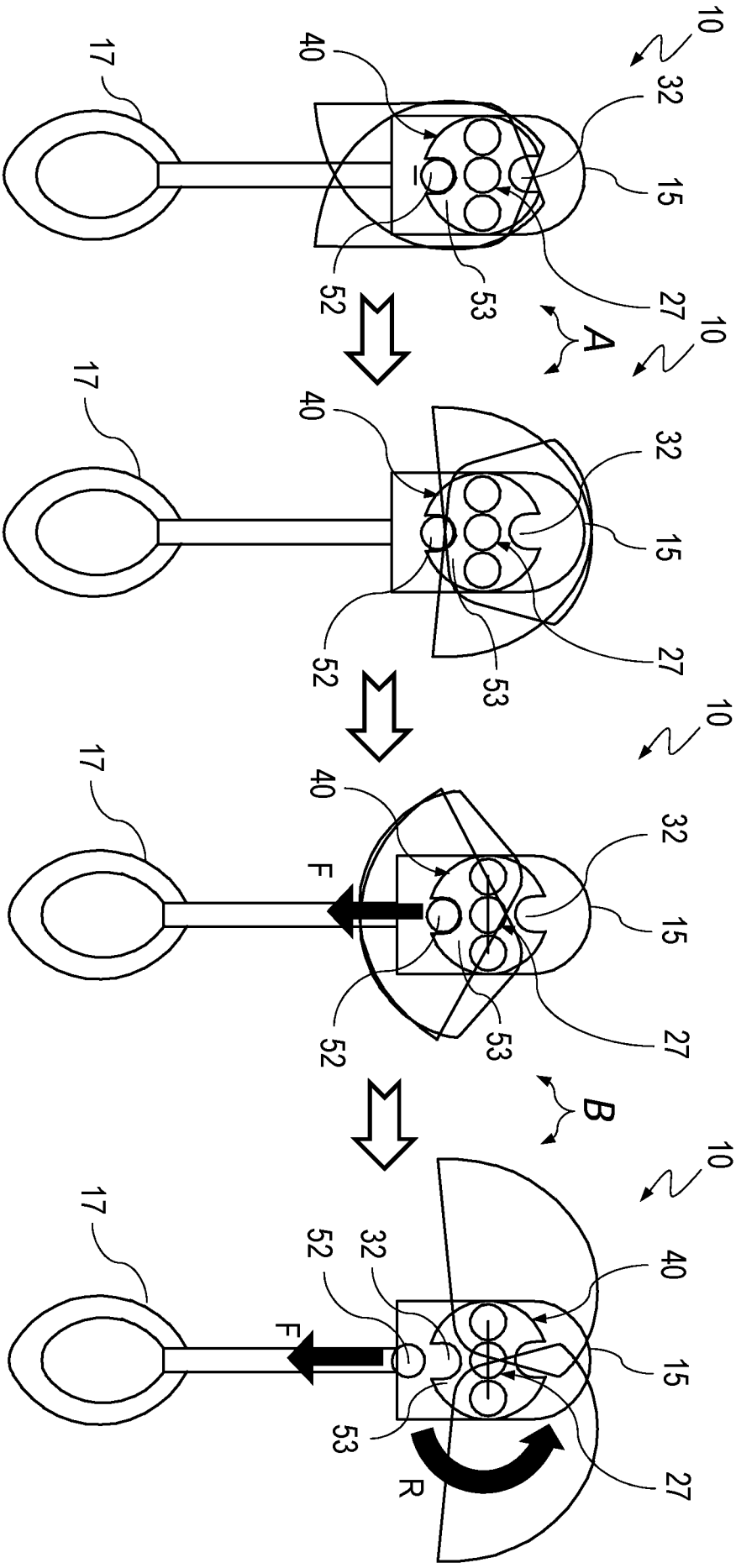


Fig. 13a

Fig. 13b

Fig. 13c

Fig. 13d

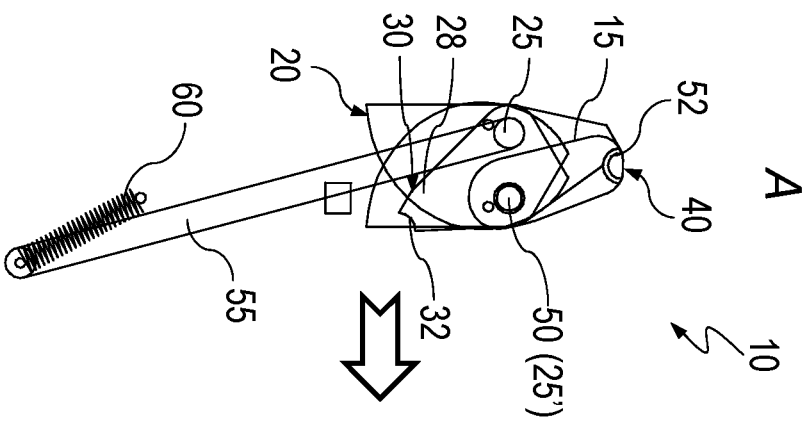


Fig. 14a

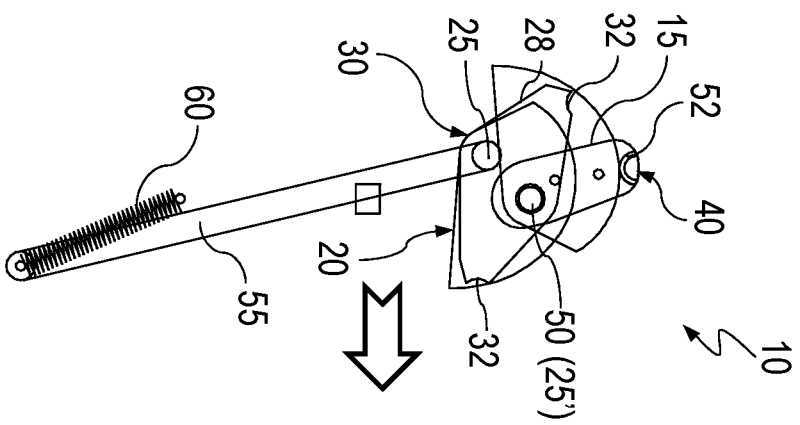


Fig. 14b

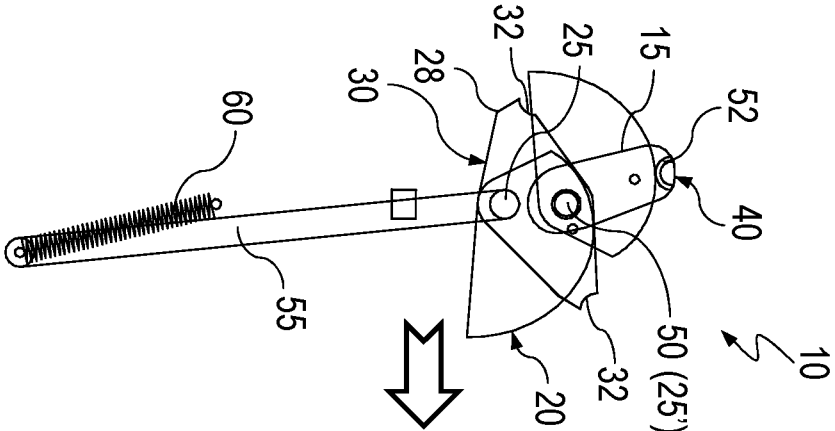


Fig. 14c

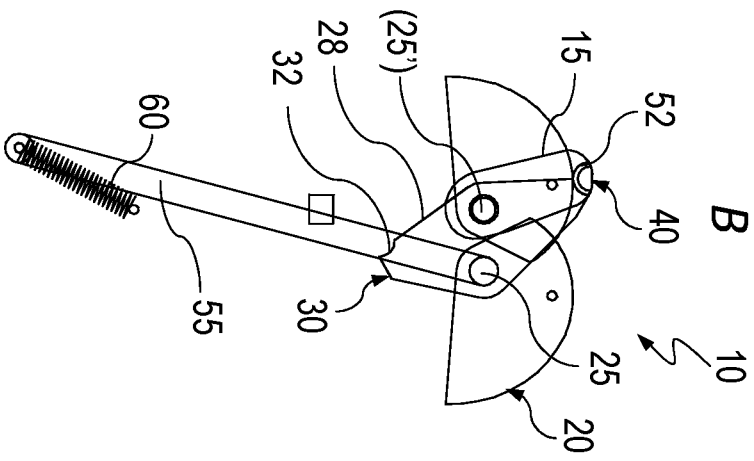


Fig. 14d

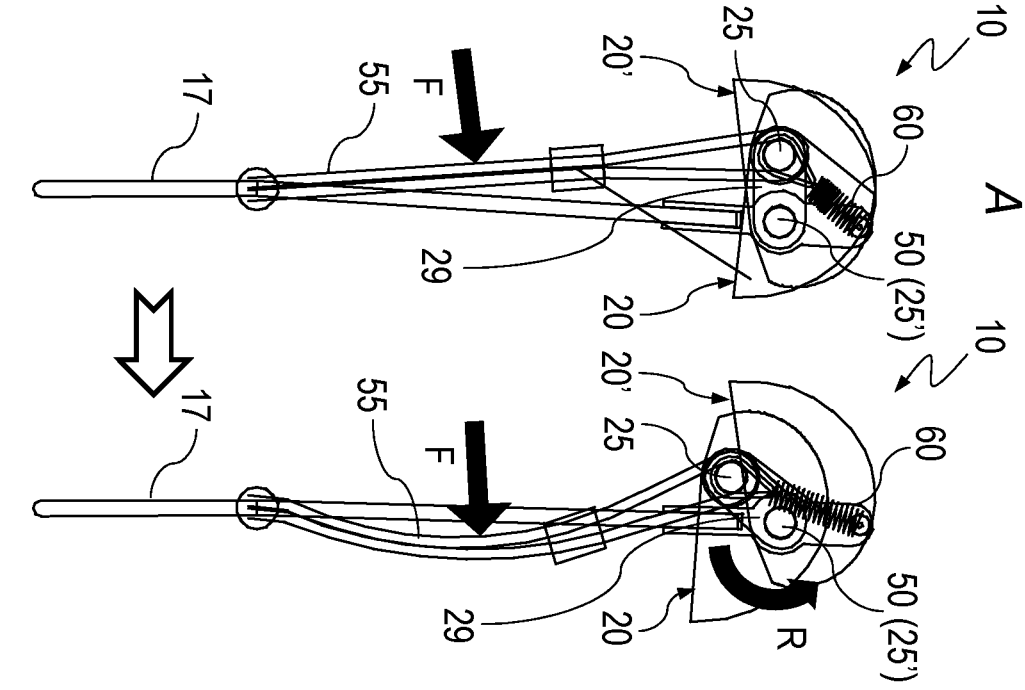


Fig. 15a

Fig. 15b

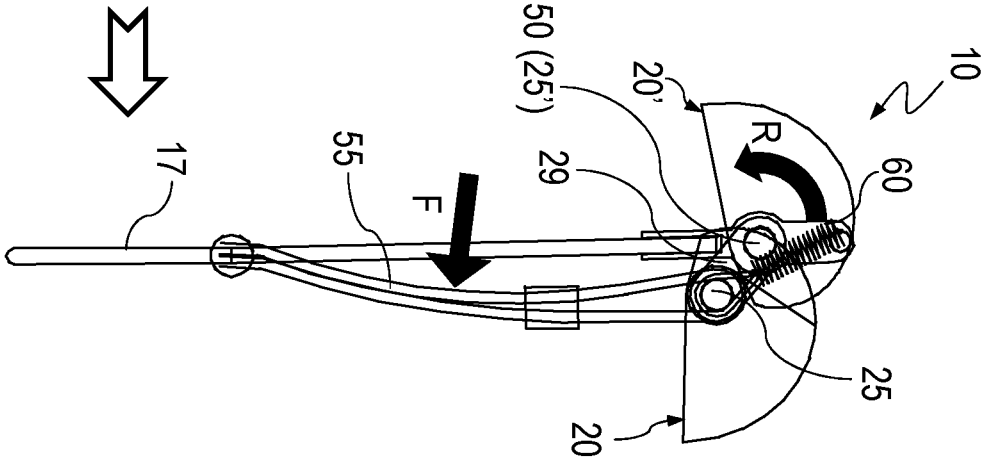


Fig. 15c

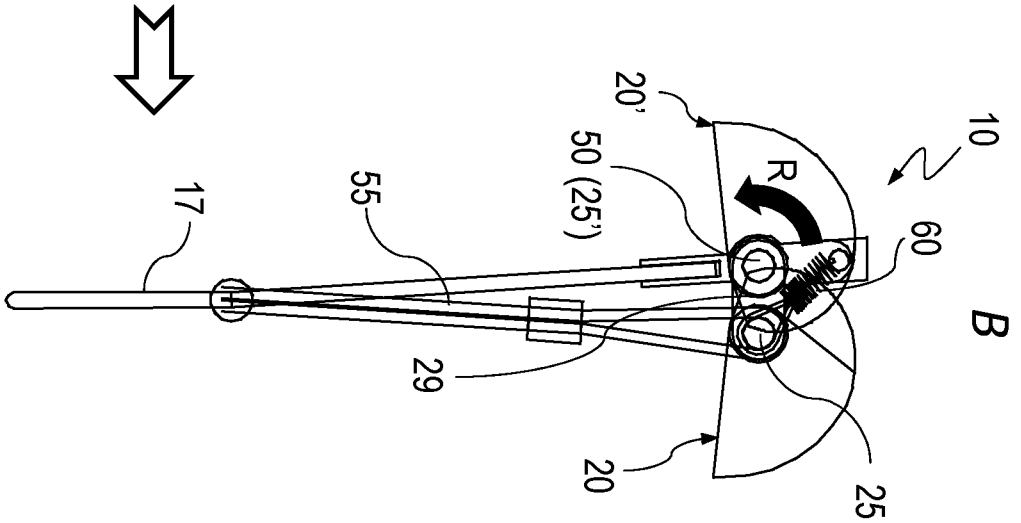


Fig. 15d

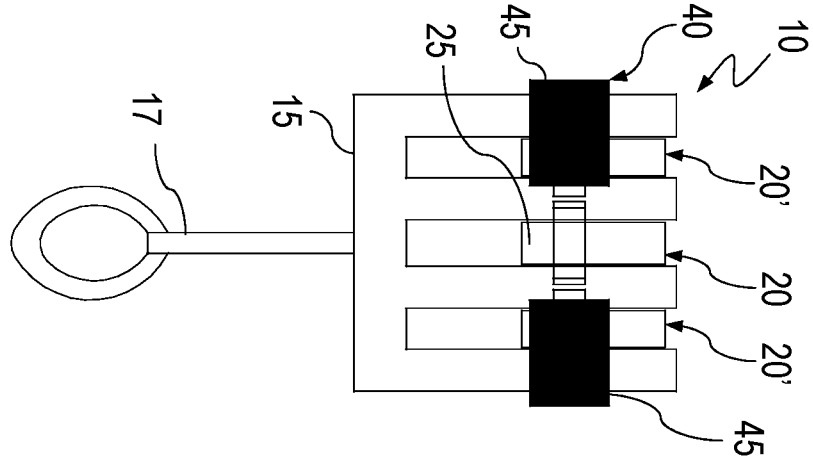


Fig. 16a

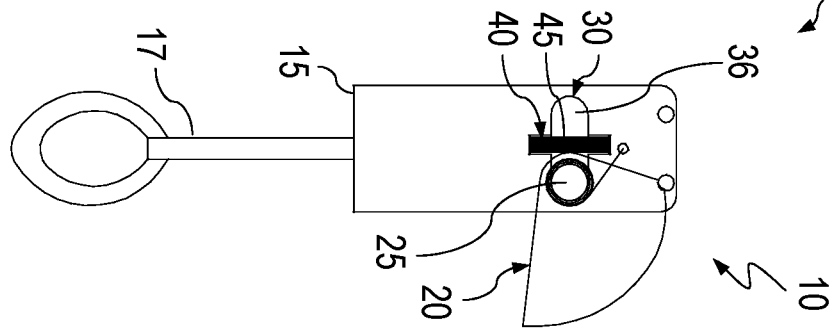


Fig. 16b

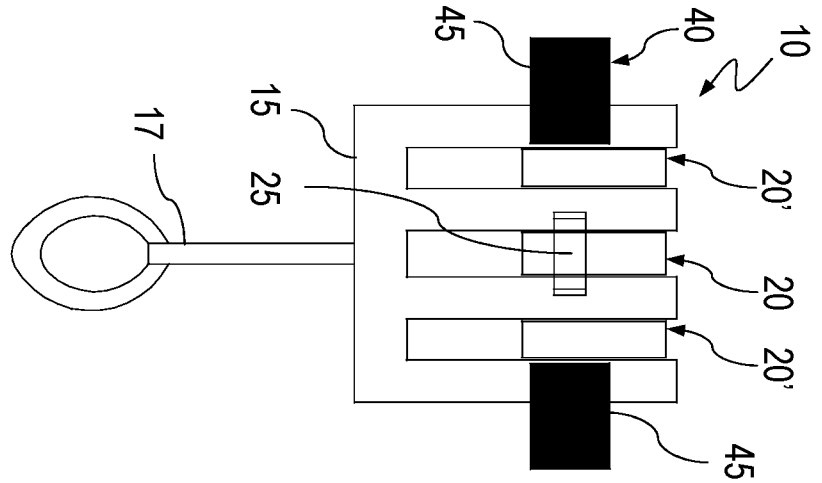


Fig. 16c

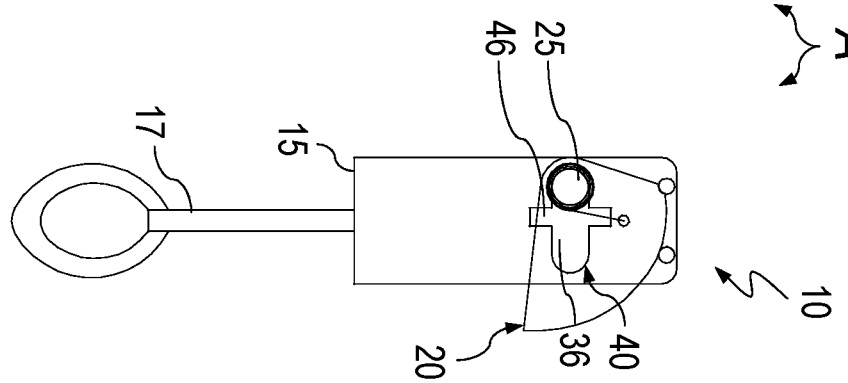


Fig. 16d

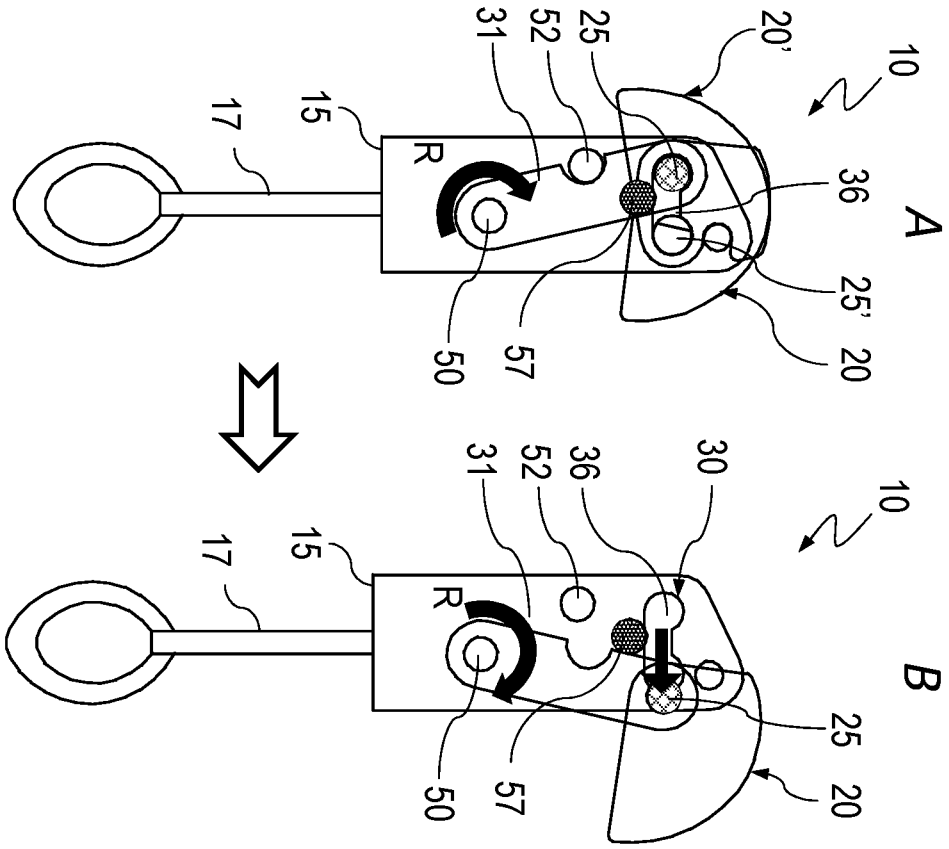


Fig. 17a

Fig. 17b

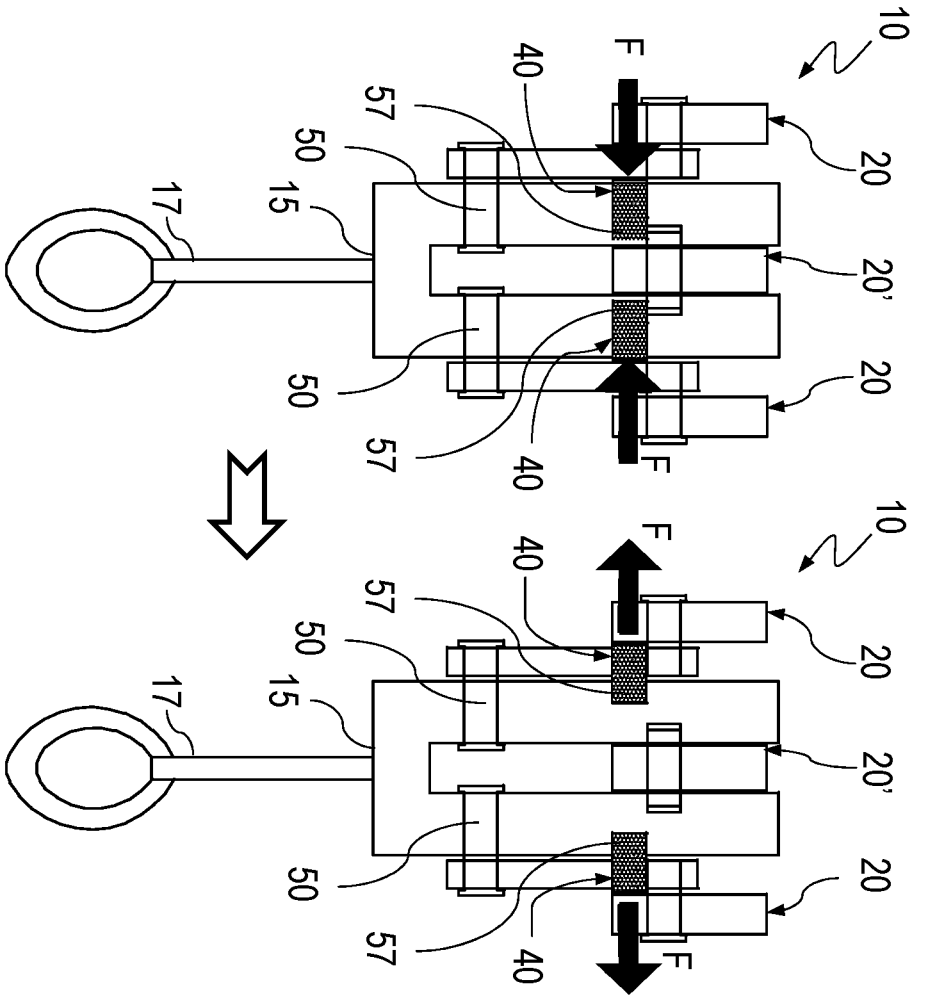


Fig. 17c

Fig. 17d

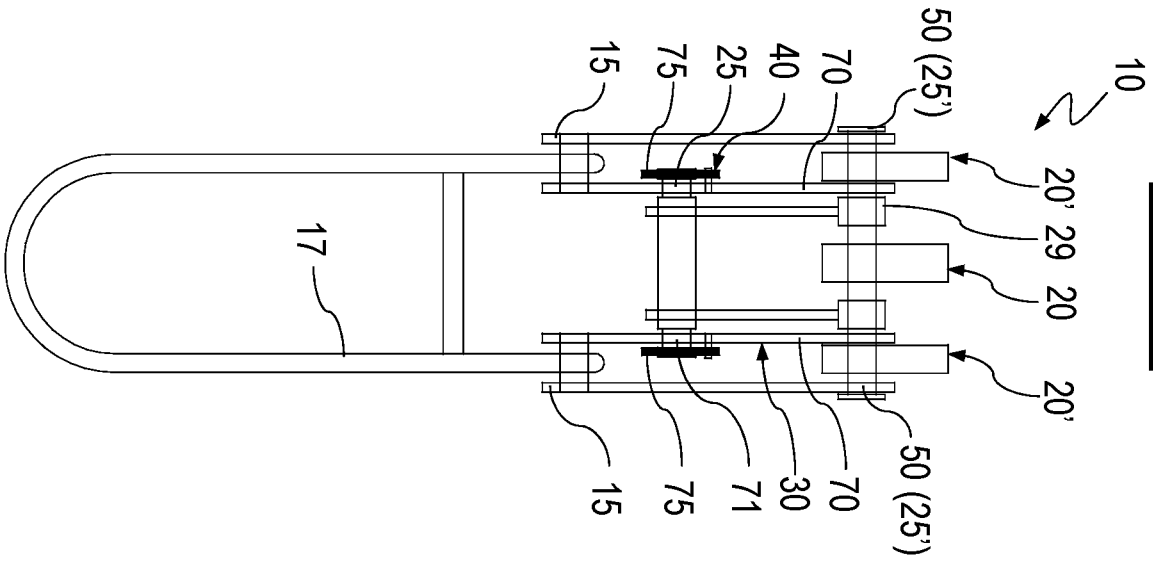


Fig. 18a

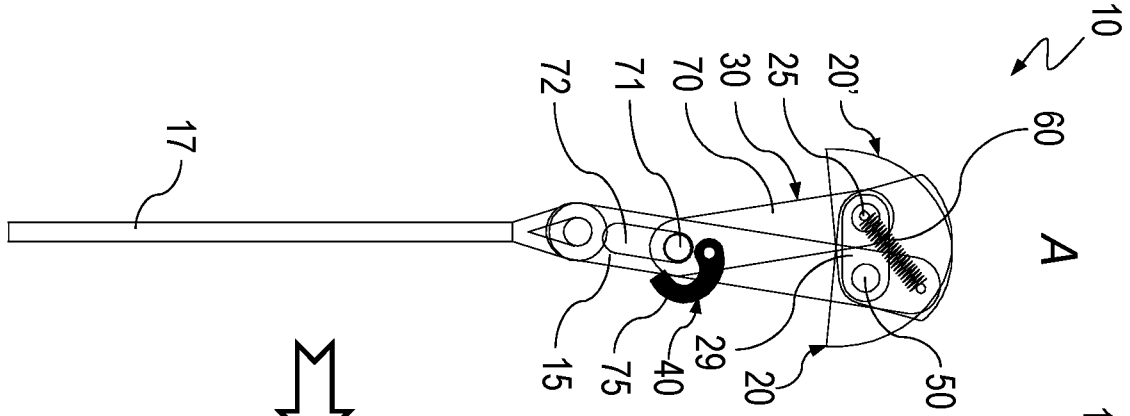


Fig. 18b

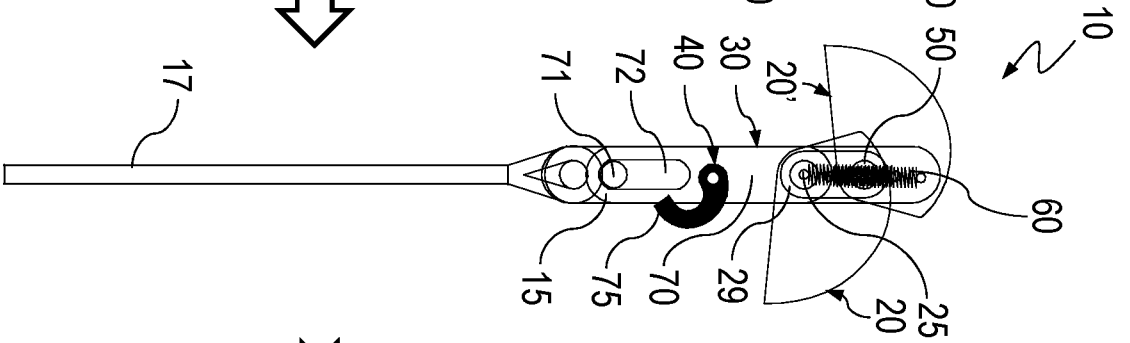


Fig. 18c

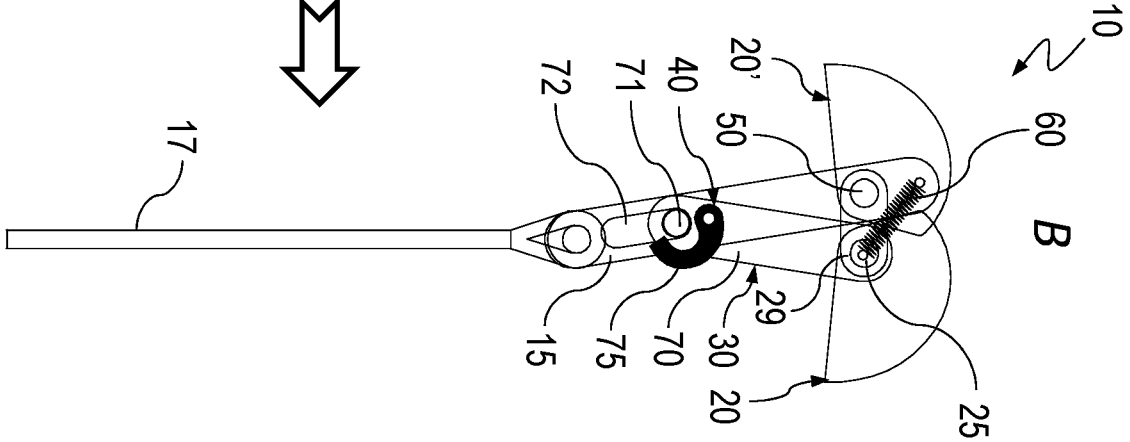


Fig. 18d

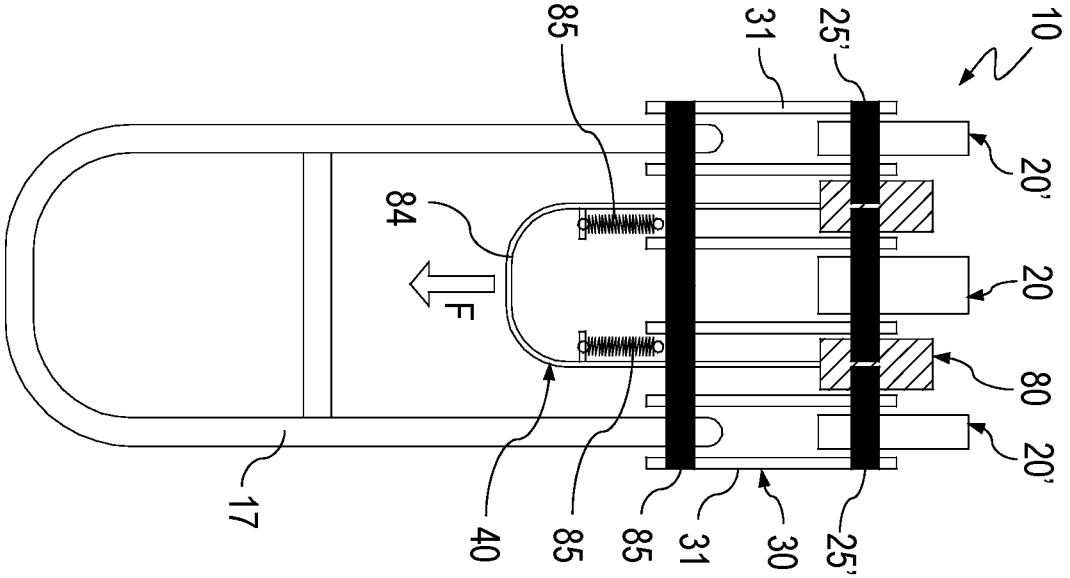


Fig. 19a

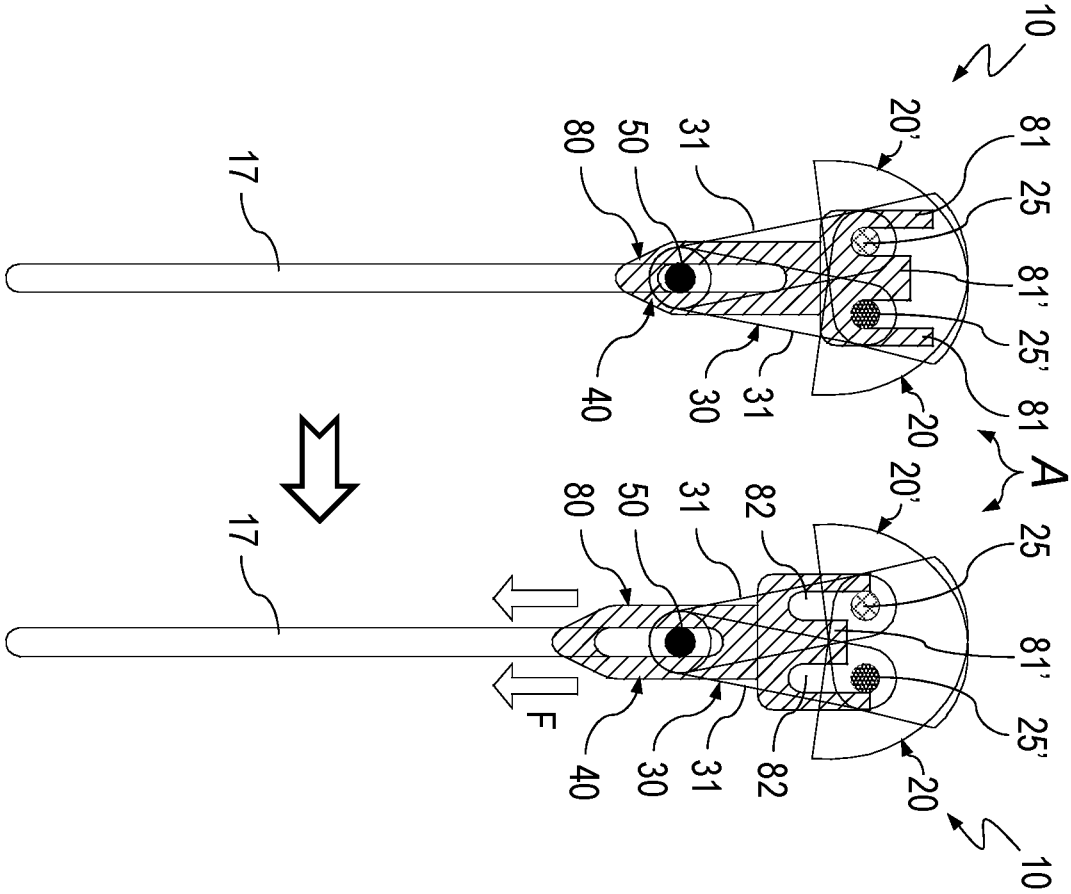


Fig. 19b

Fig. 19c

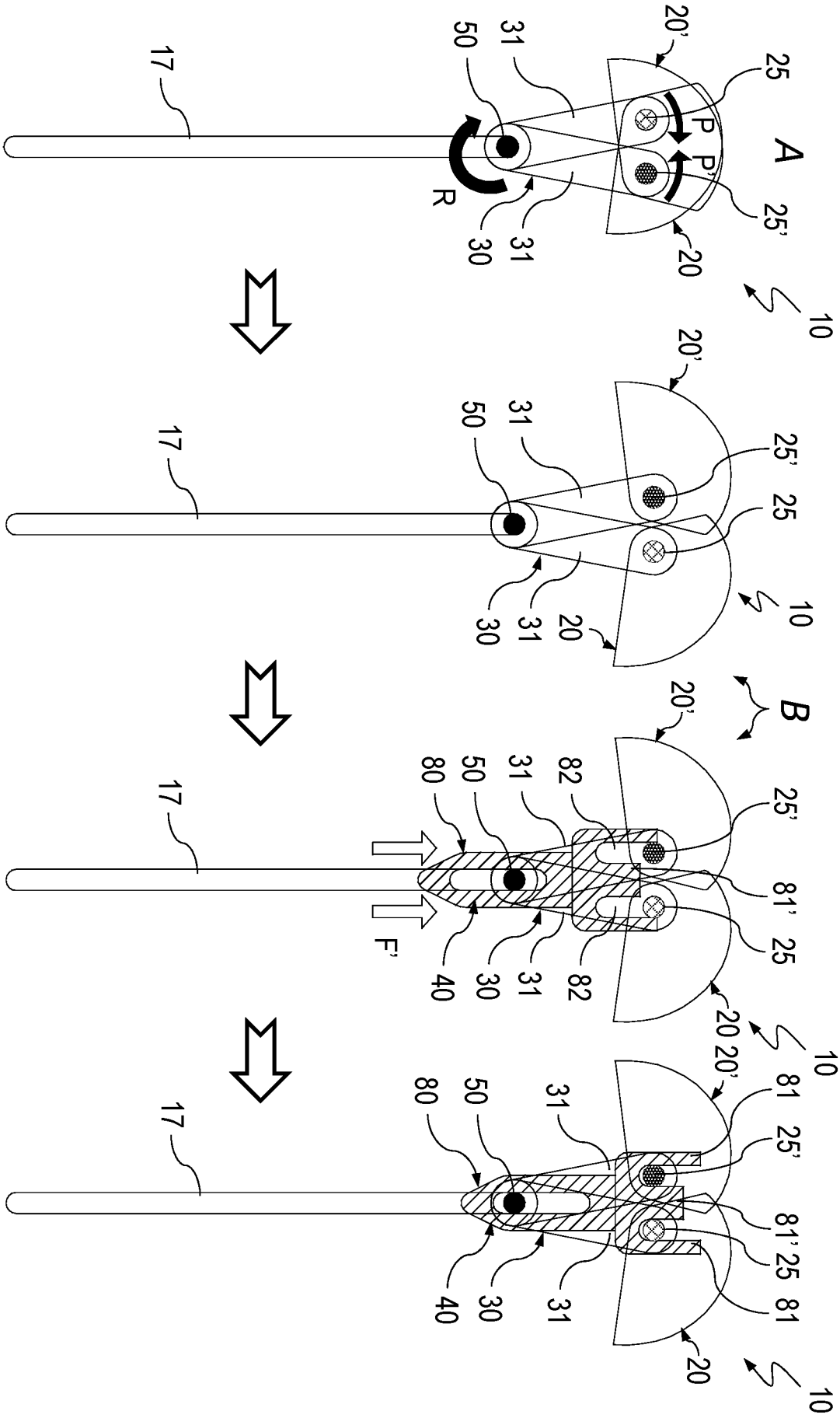


Fig. 19d

Fig. 19e

Fig. 19f

Fig. 19g

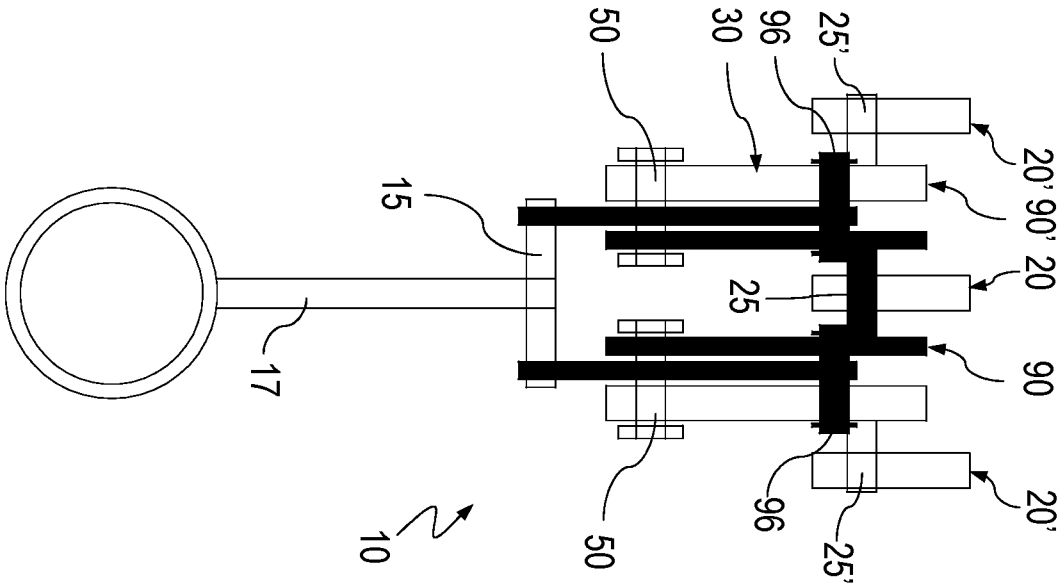


Fig. 20a

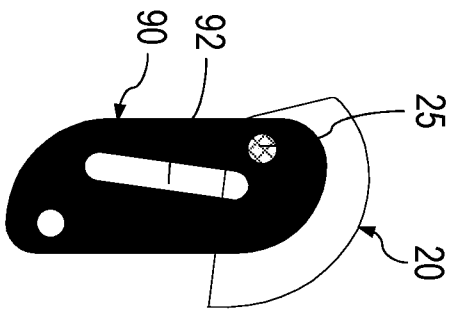


Fig. 20b

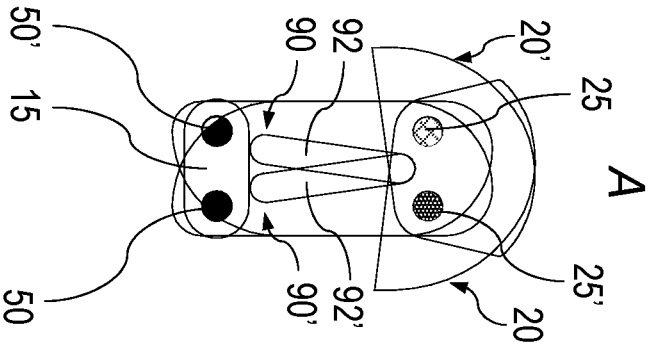


Fig. 20c

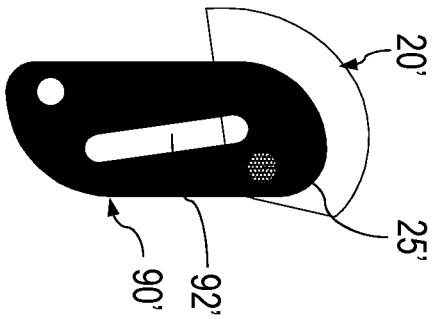


Fig. 20d

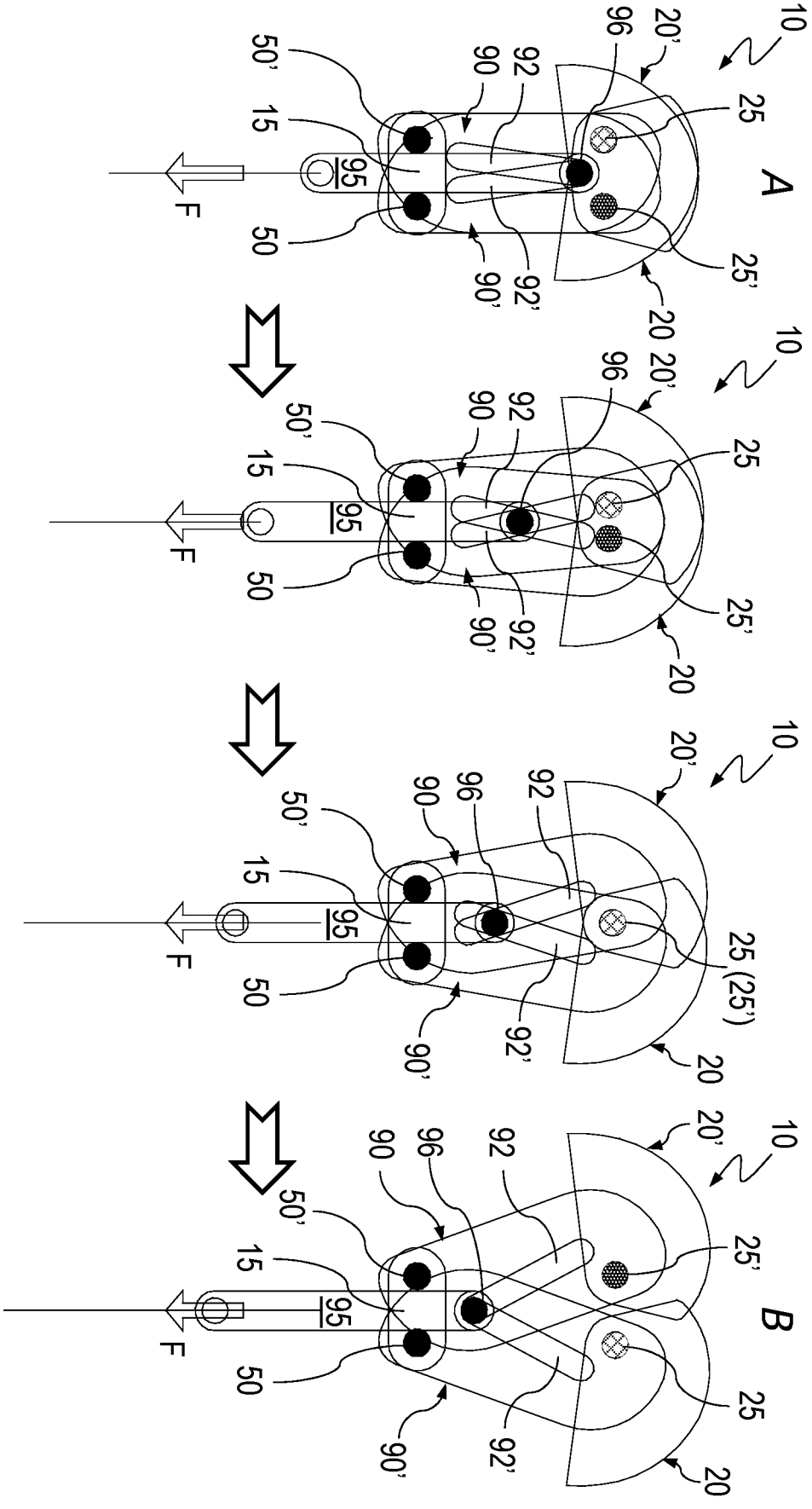

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Fig. 20e
Fig. 20f
Fig. 20g
Fig. 20h
B
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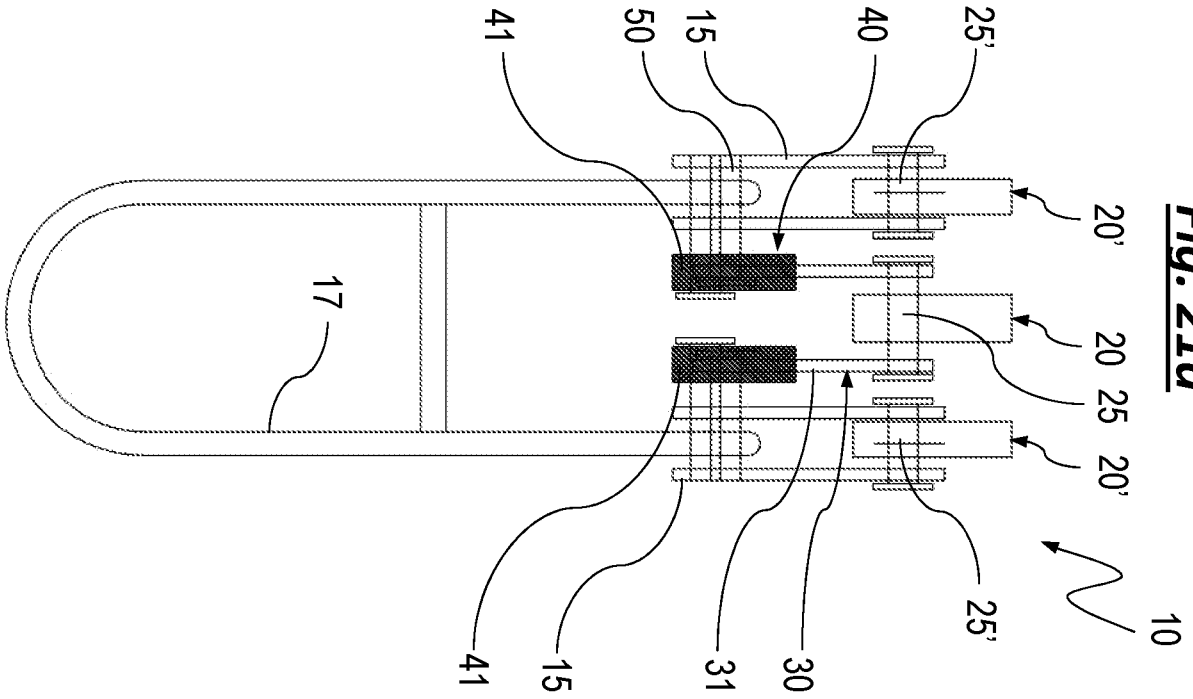


Fig. 21a

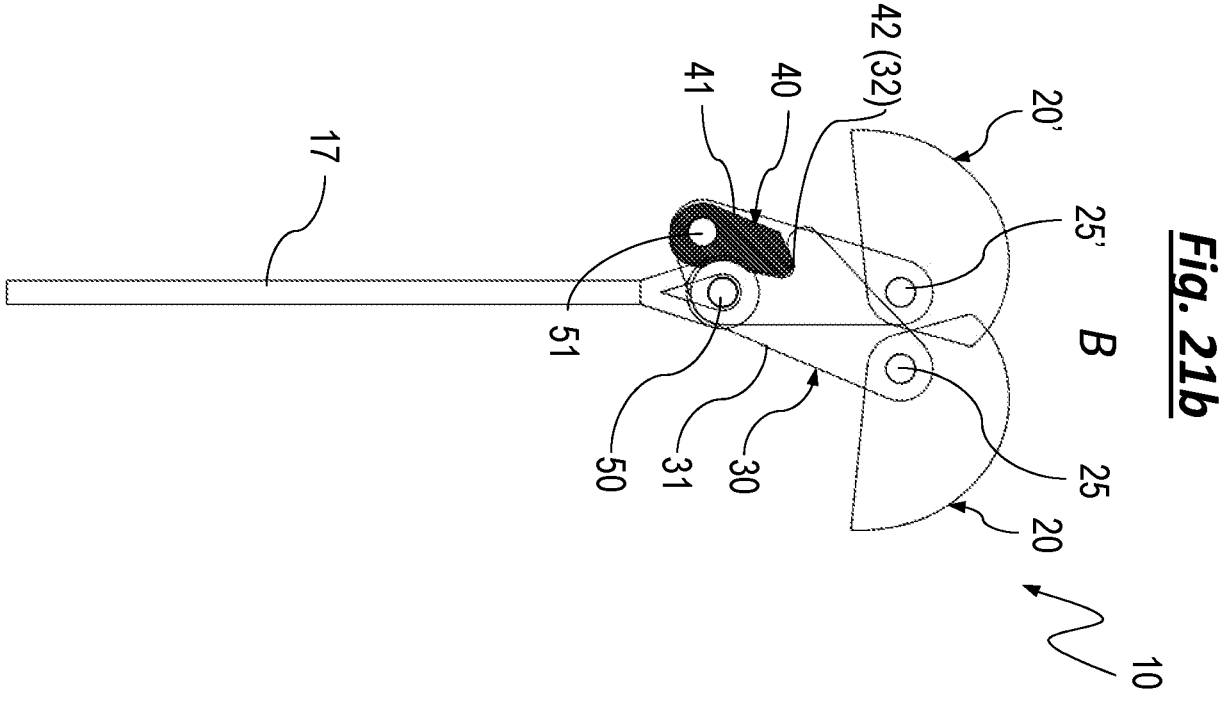


Fig. 21b

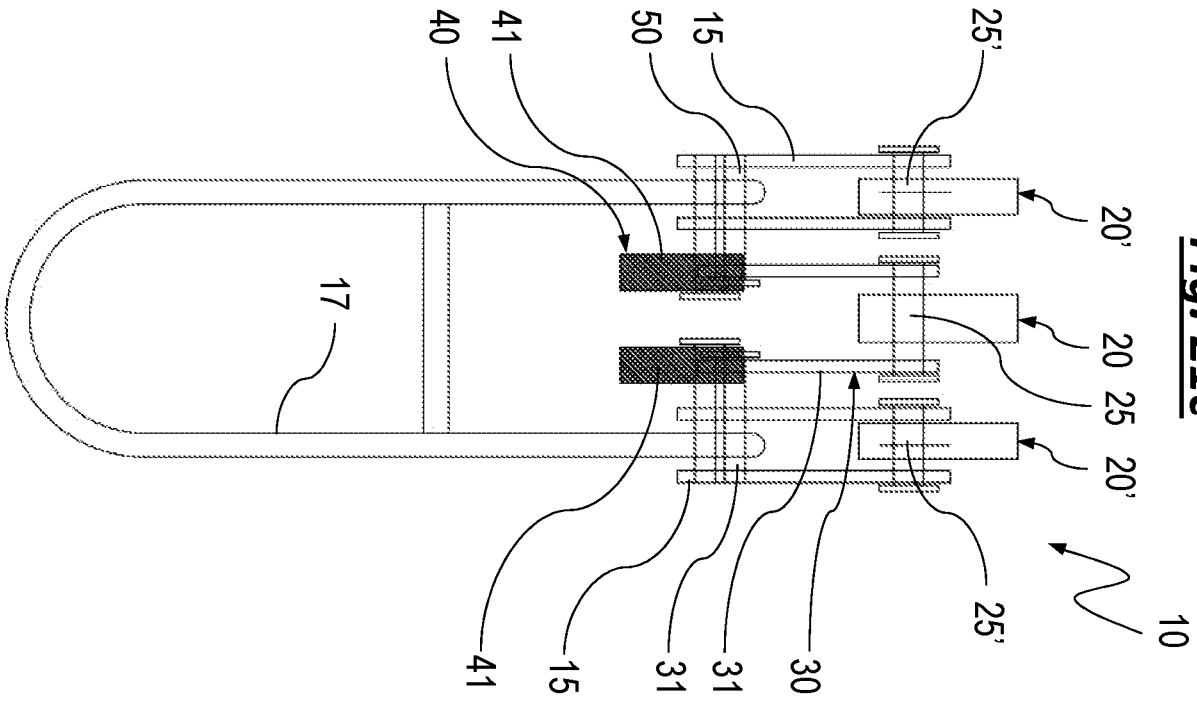


Fig. 21c

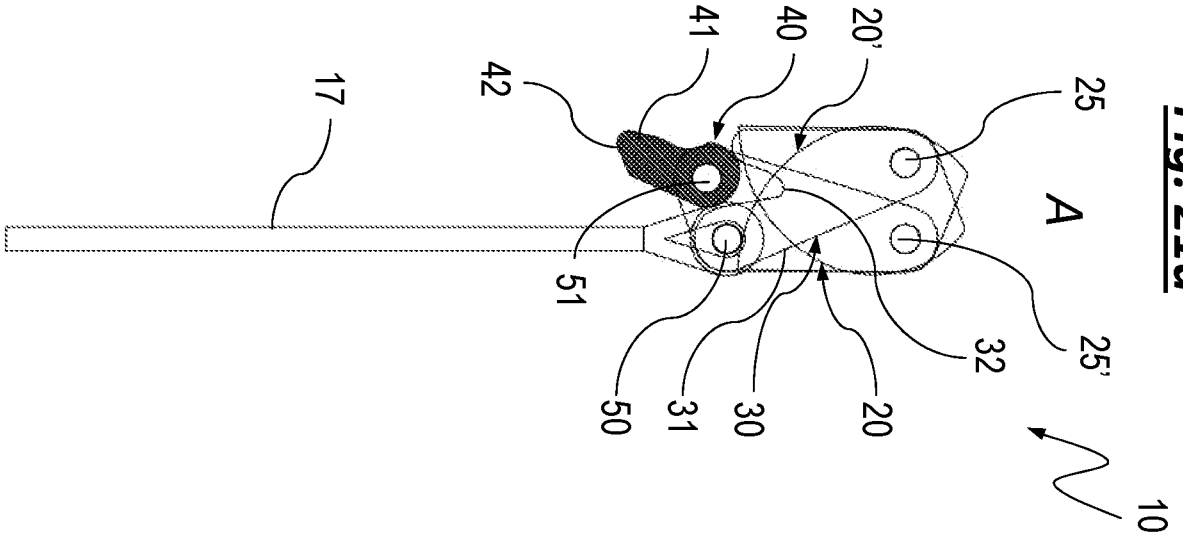
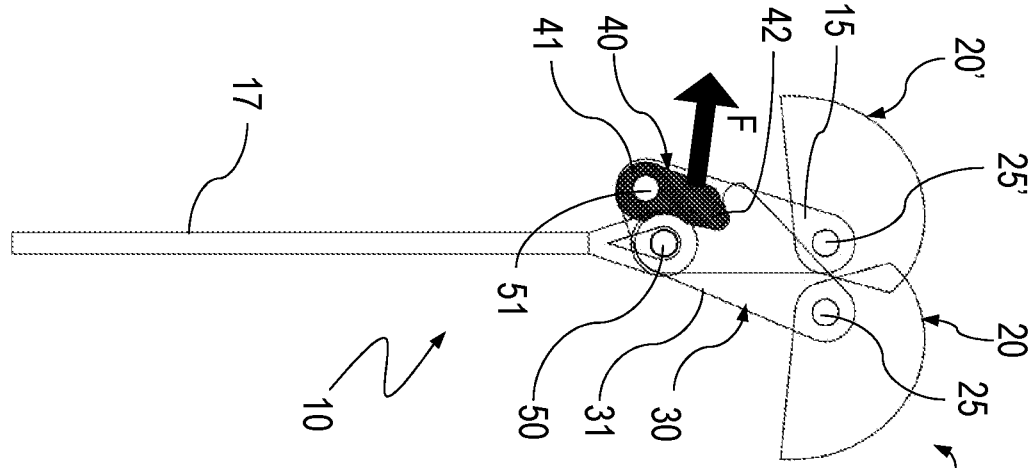


Fig. 21d



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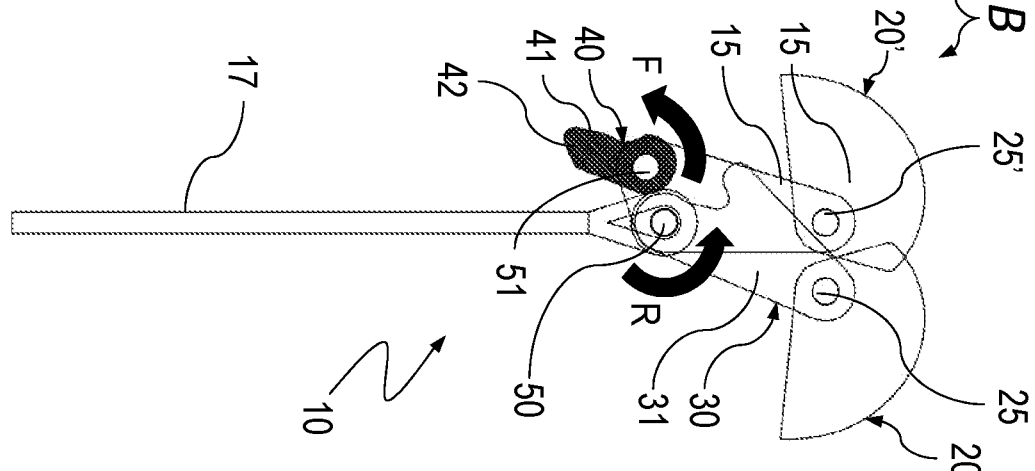

Fig. 21f

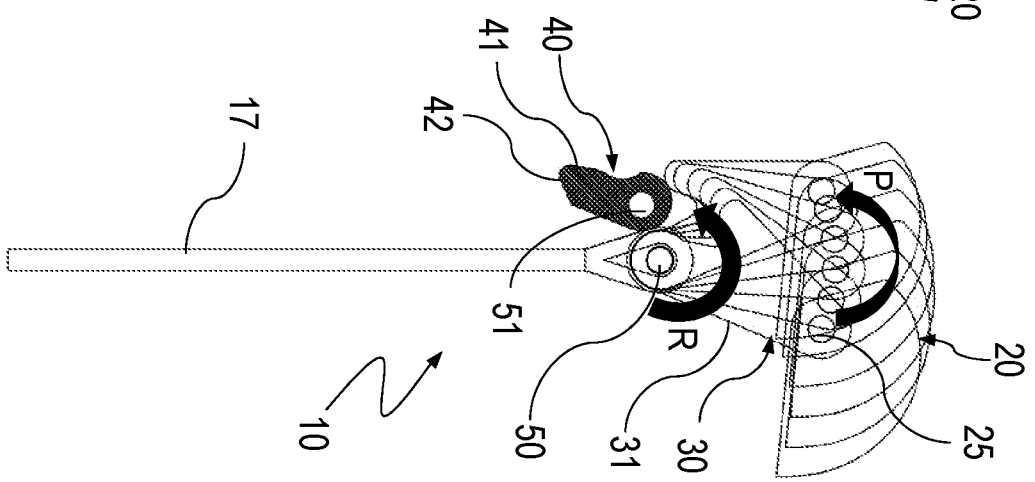

Fig. 21g

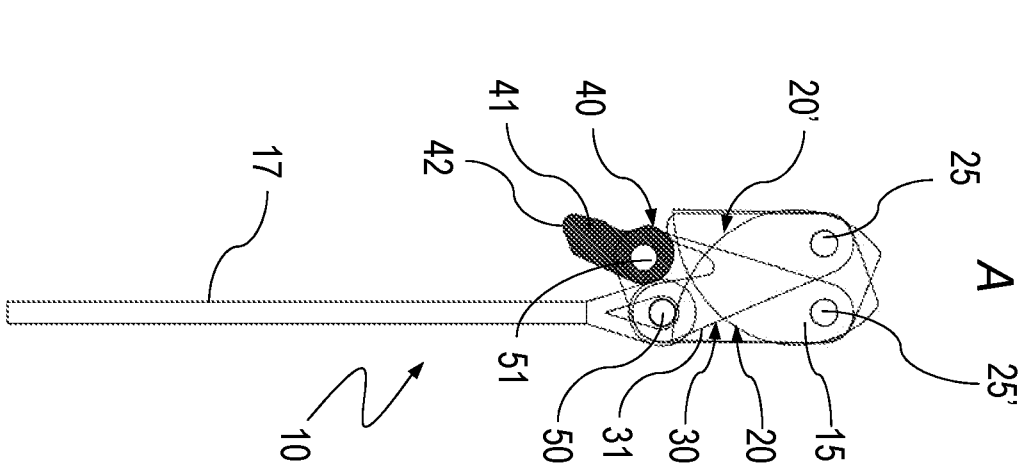

Fig. 21h

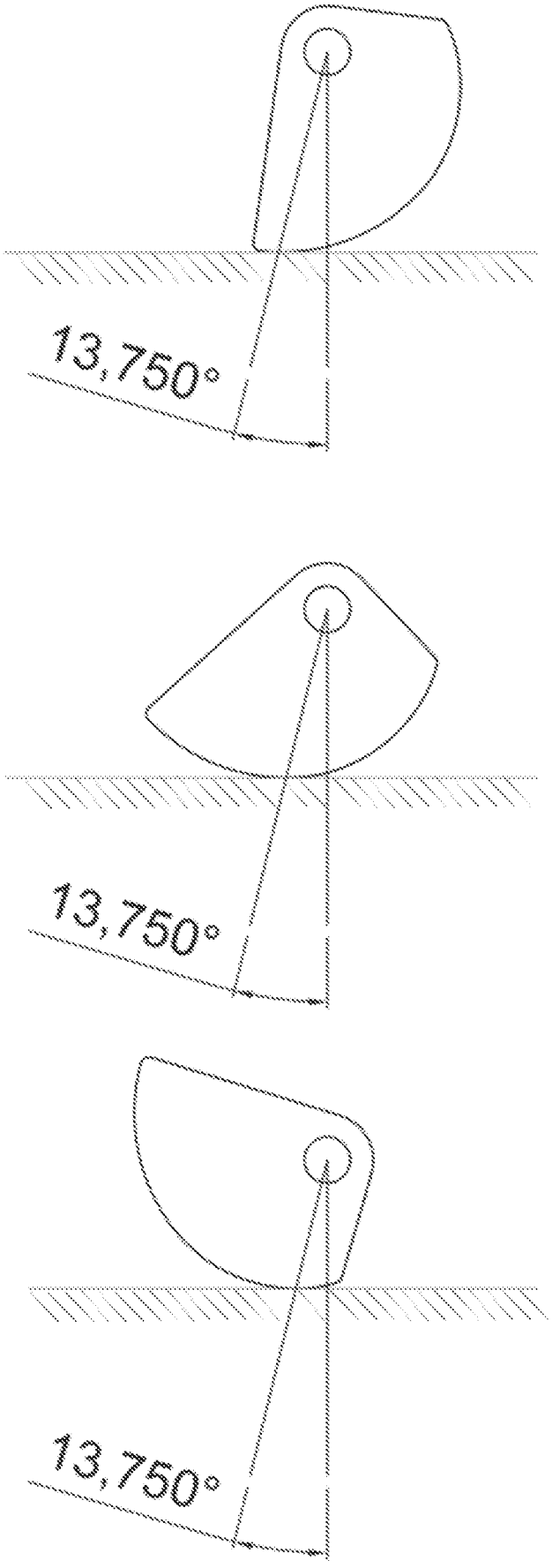

Fig. 22

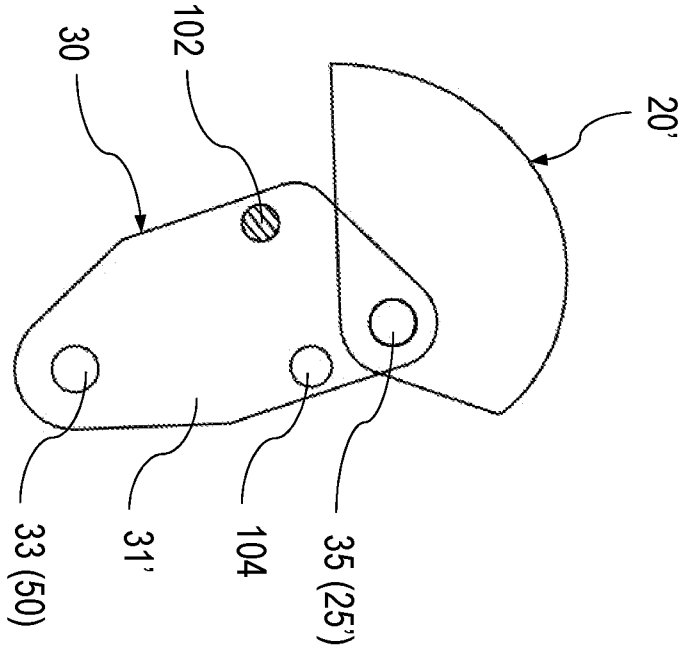

Fig. 23a

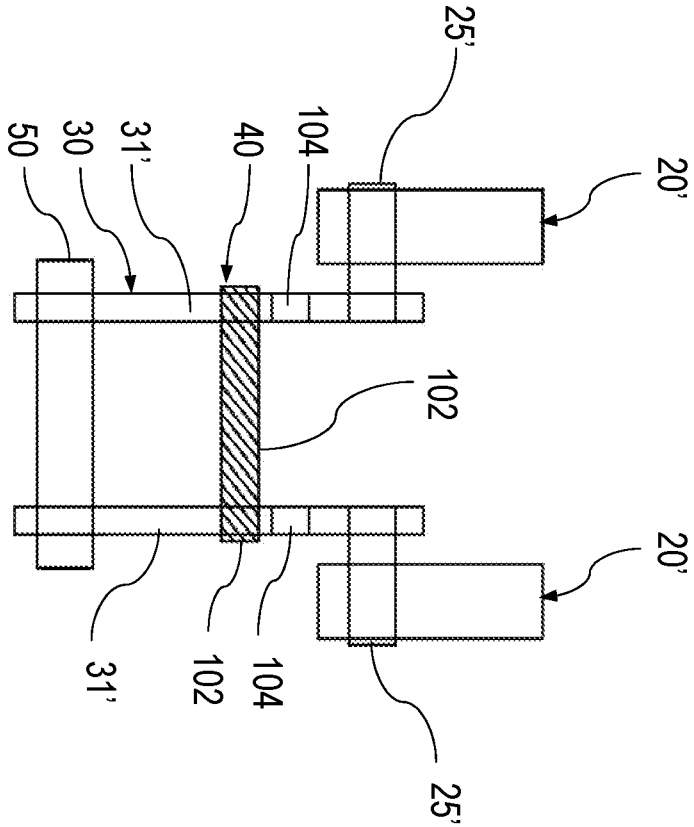

Fig. 23b

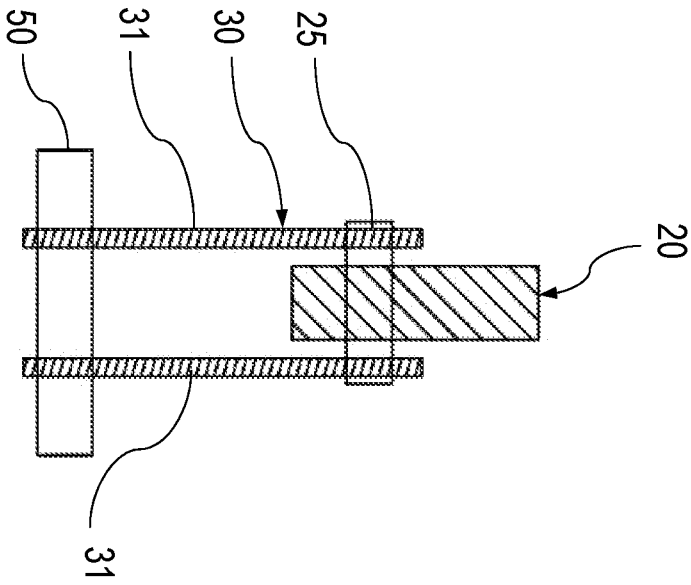

Fig. 24a

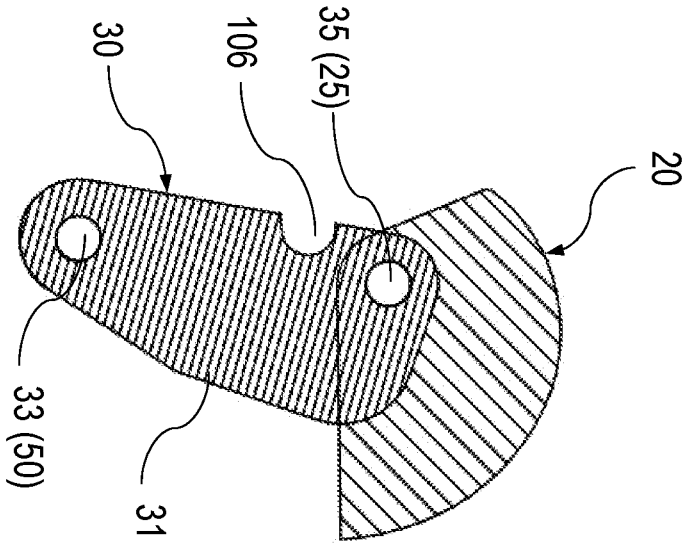

Fig. 24b

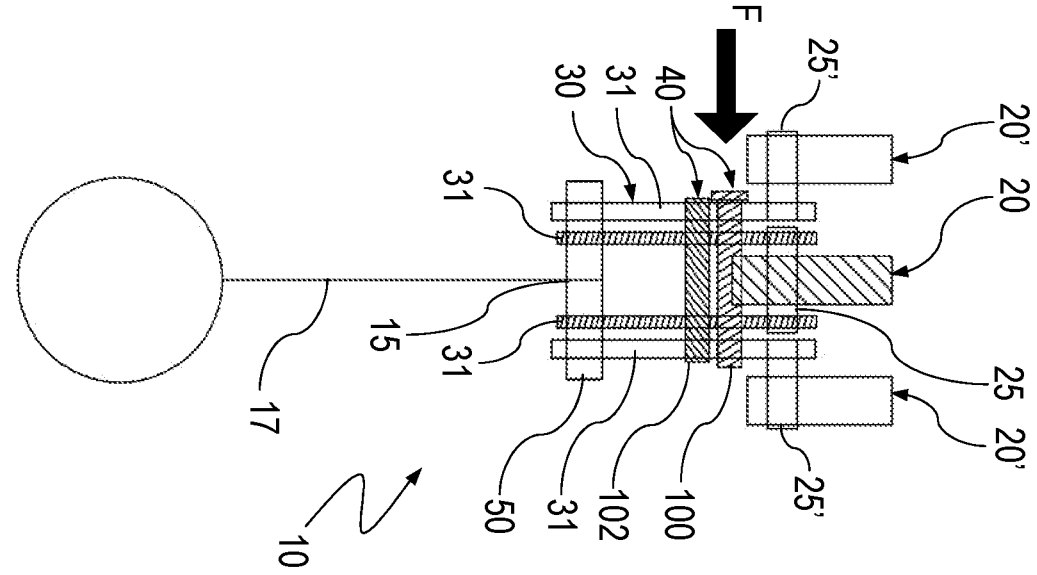

Fig. 25a

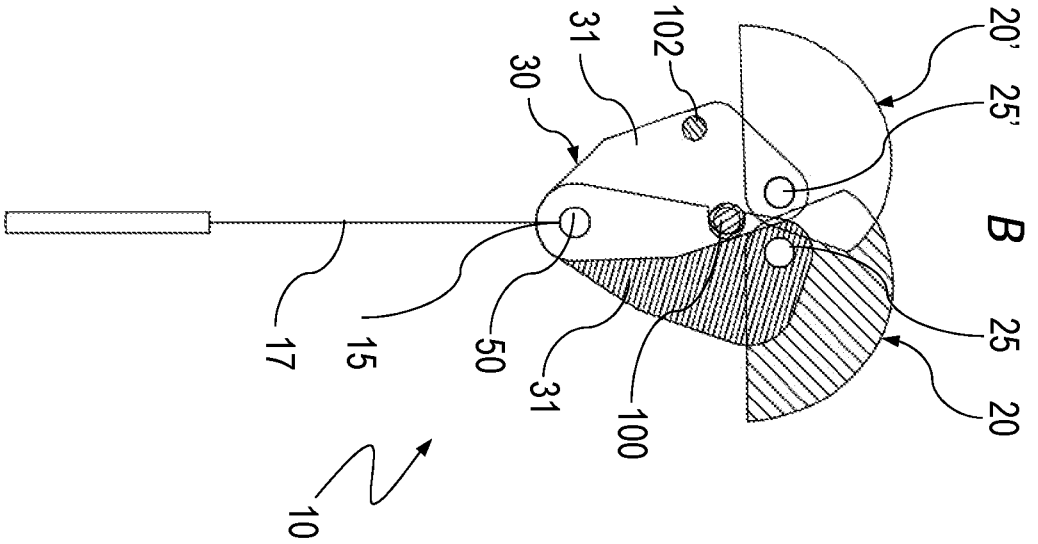

Fig. 25b

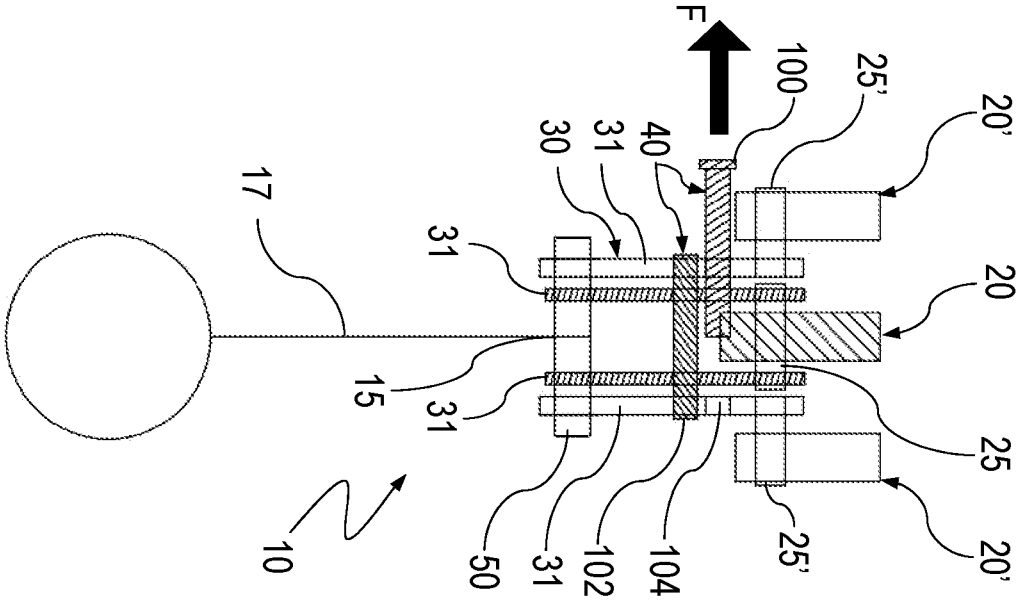

Fig. 25c

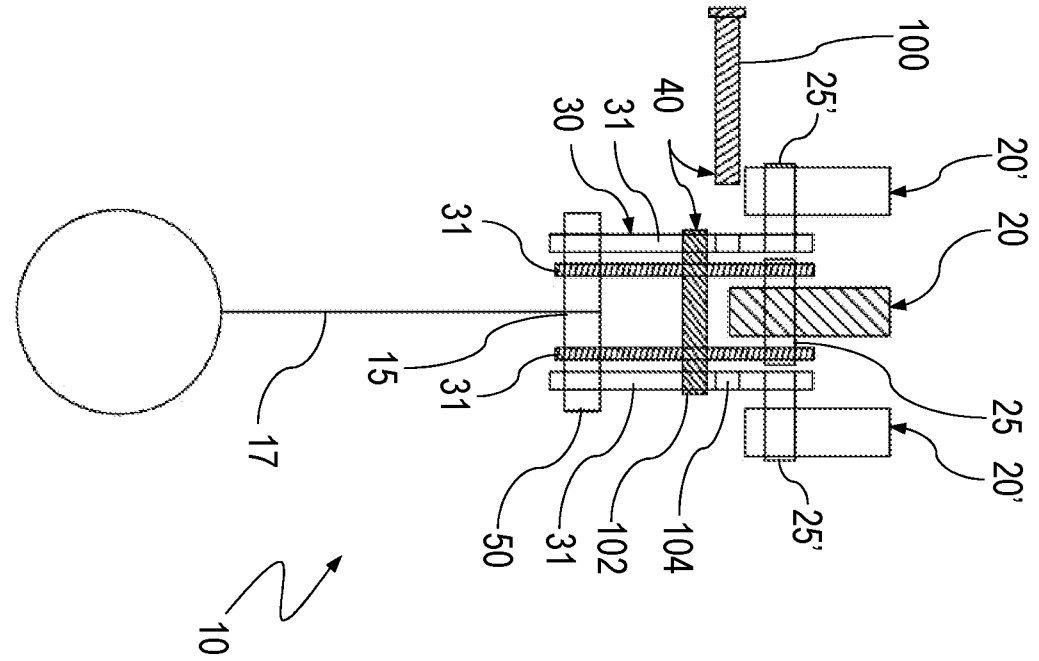

Fig. 26a

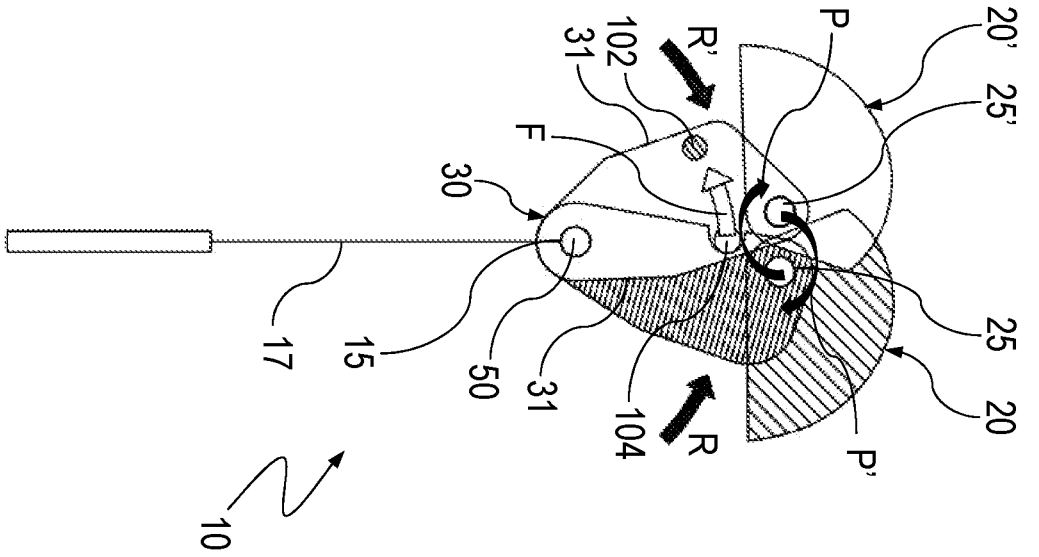

Fig. 26b

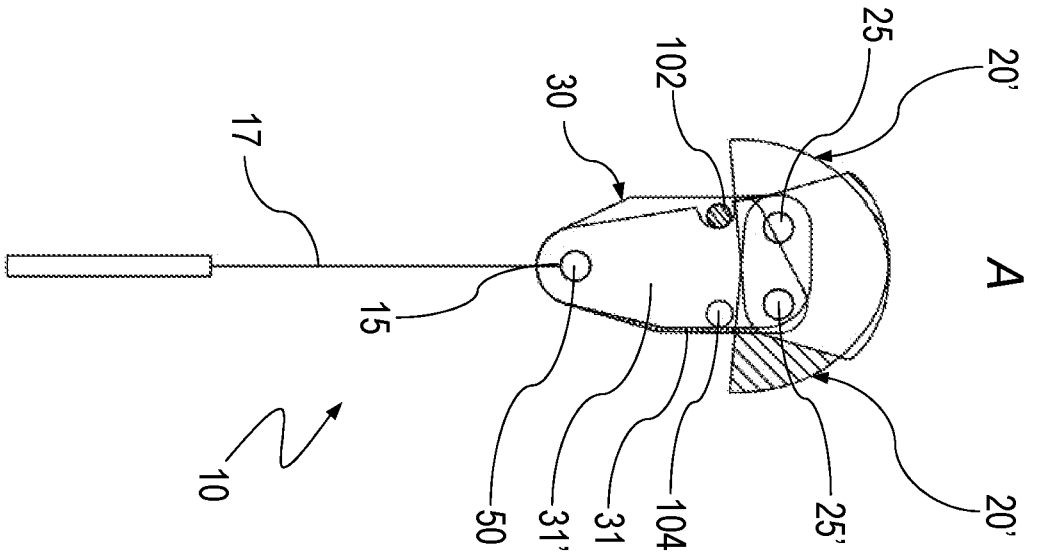

Fig. 26c

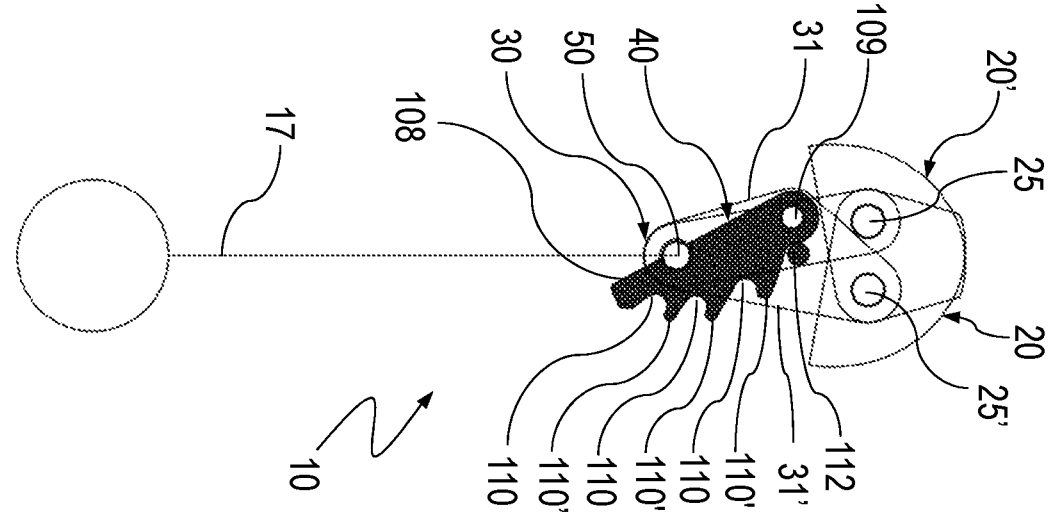

Fig. 27a

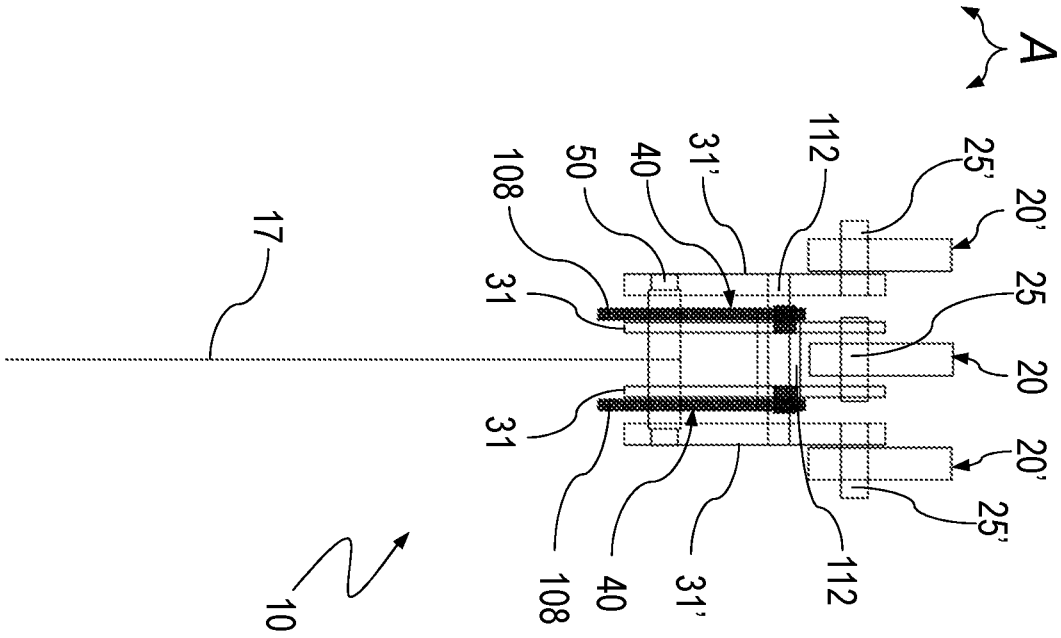

Fig.27b

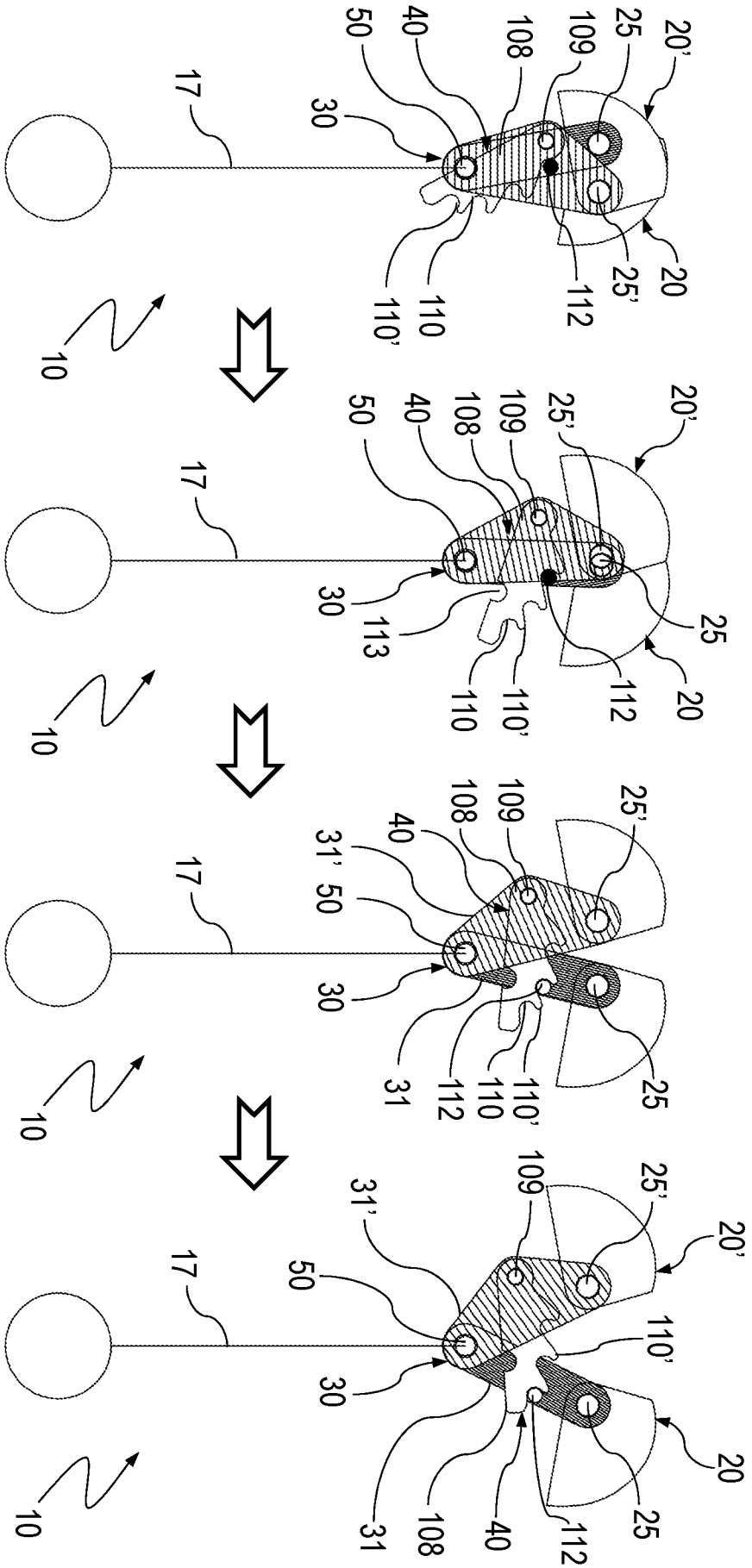

Fig. 28a

Fig. 28b

Fig. 28c

Fig. 28d

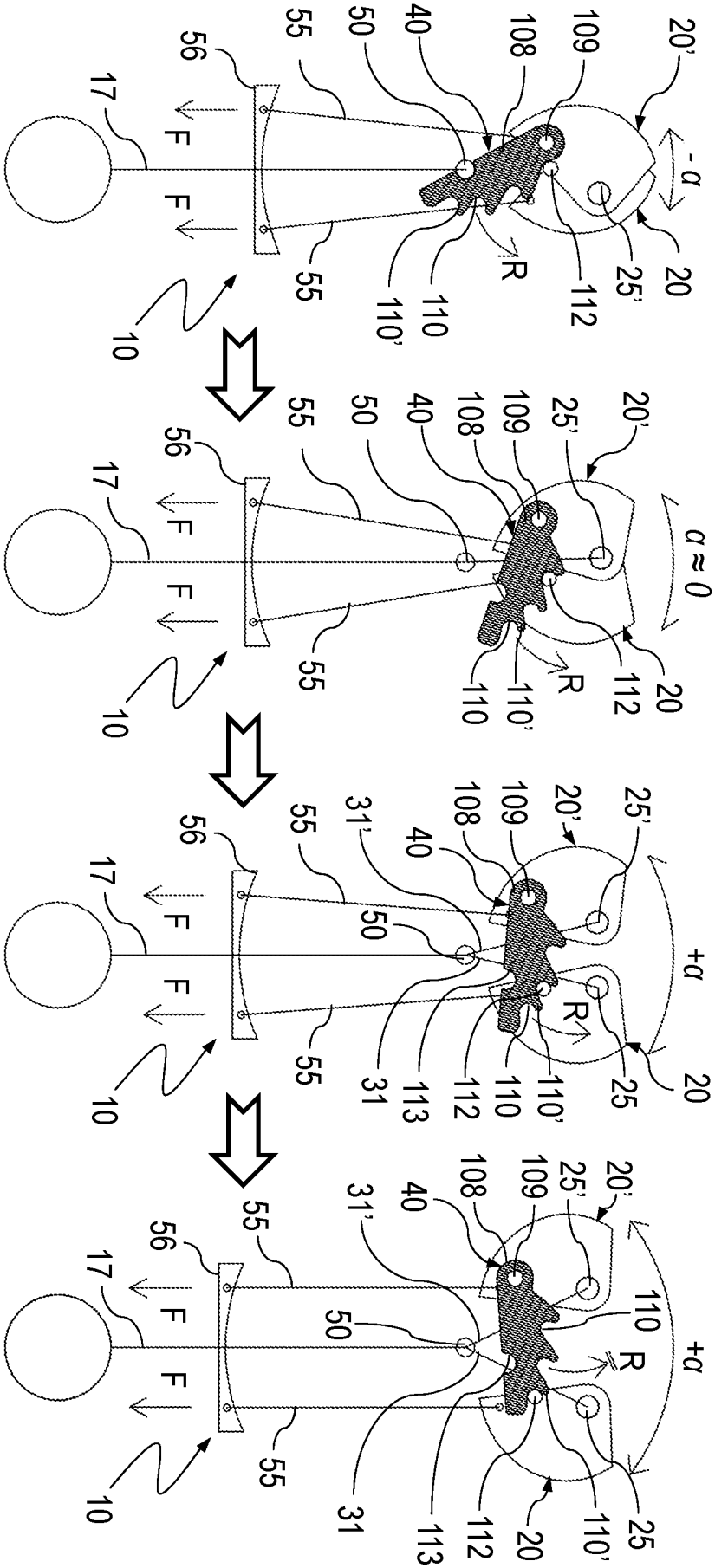

Fig. 29a

Fig. 29b

Fig. 29c

Fig. 29d

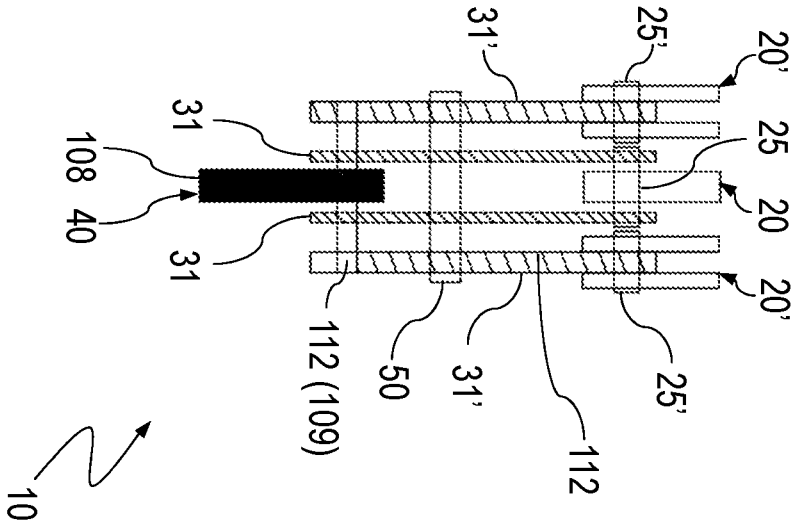

Fig. 30a

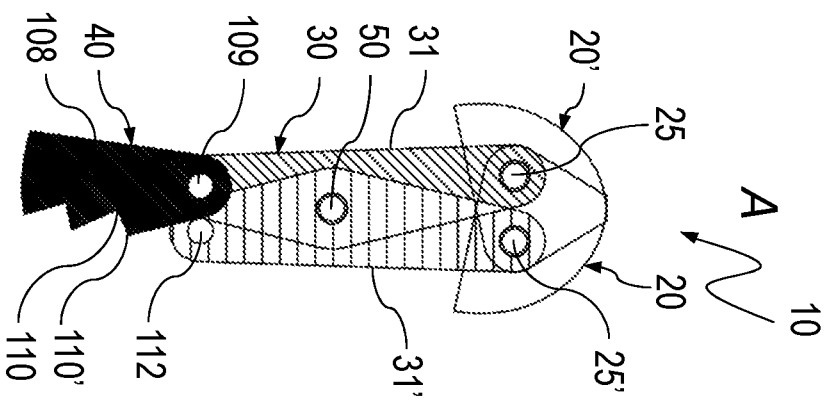

Fig. 30b

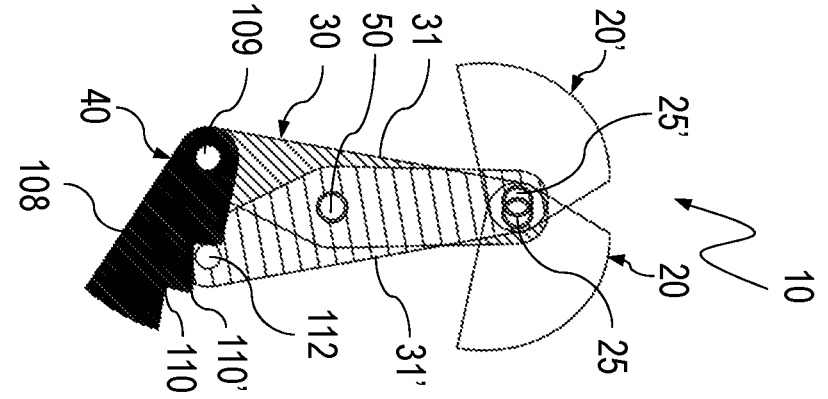

Fig. 30c

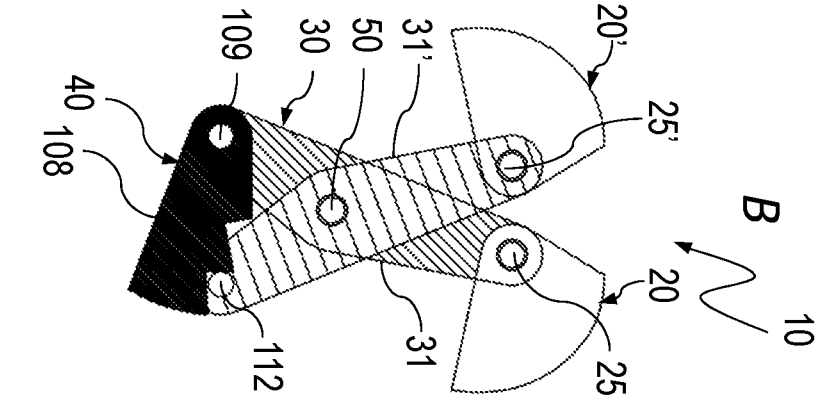

Fig. 30d

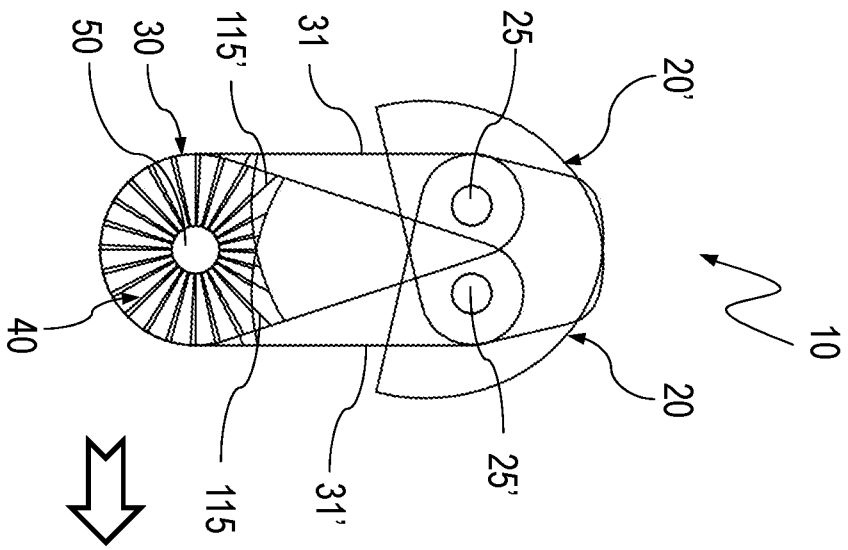

Fig. 31a

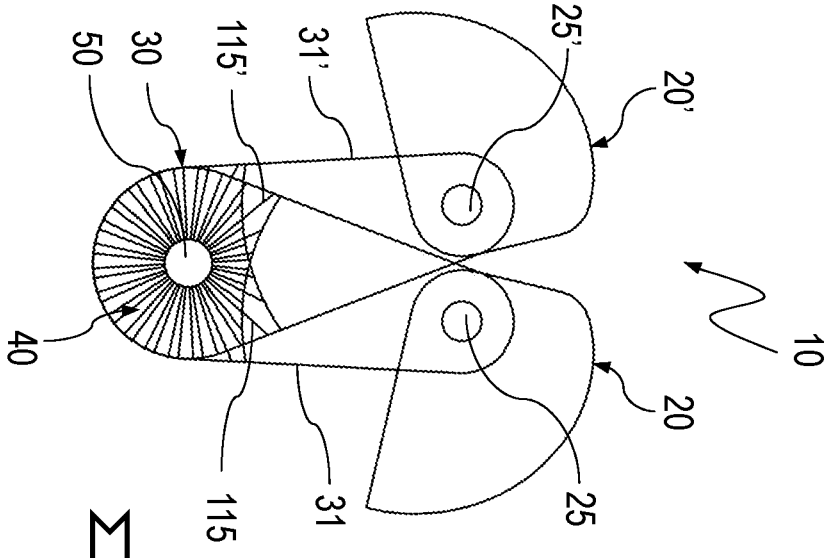

Fig. 31b

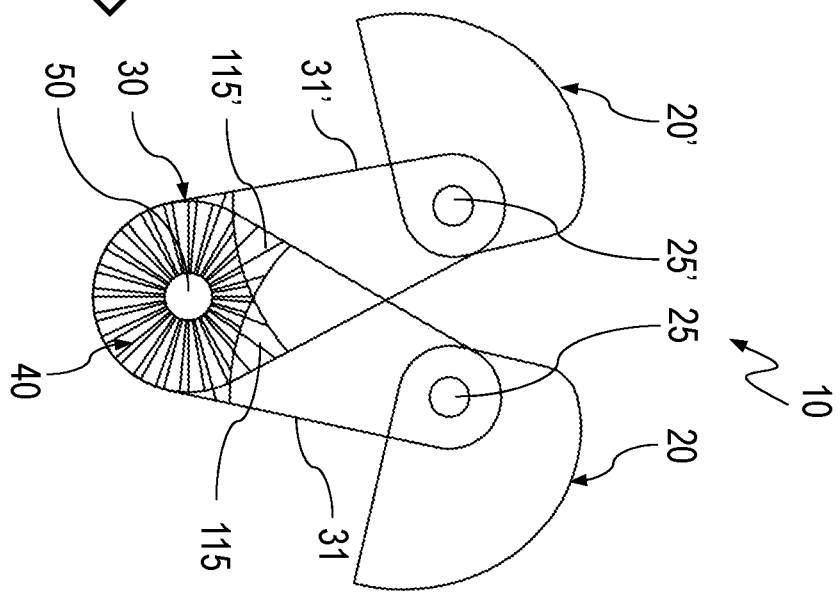

Fig. 31c

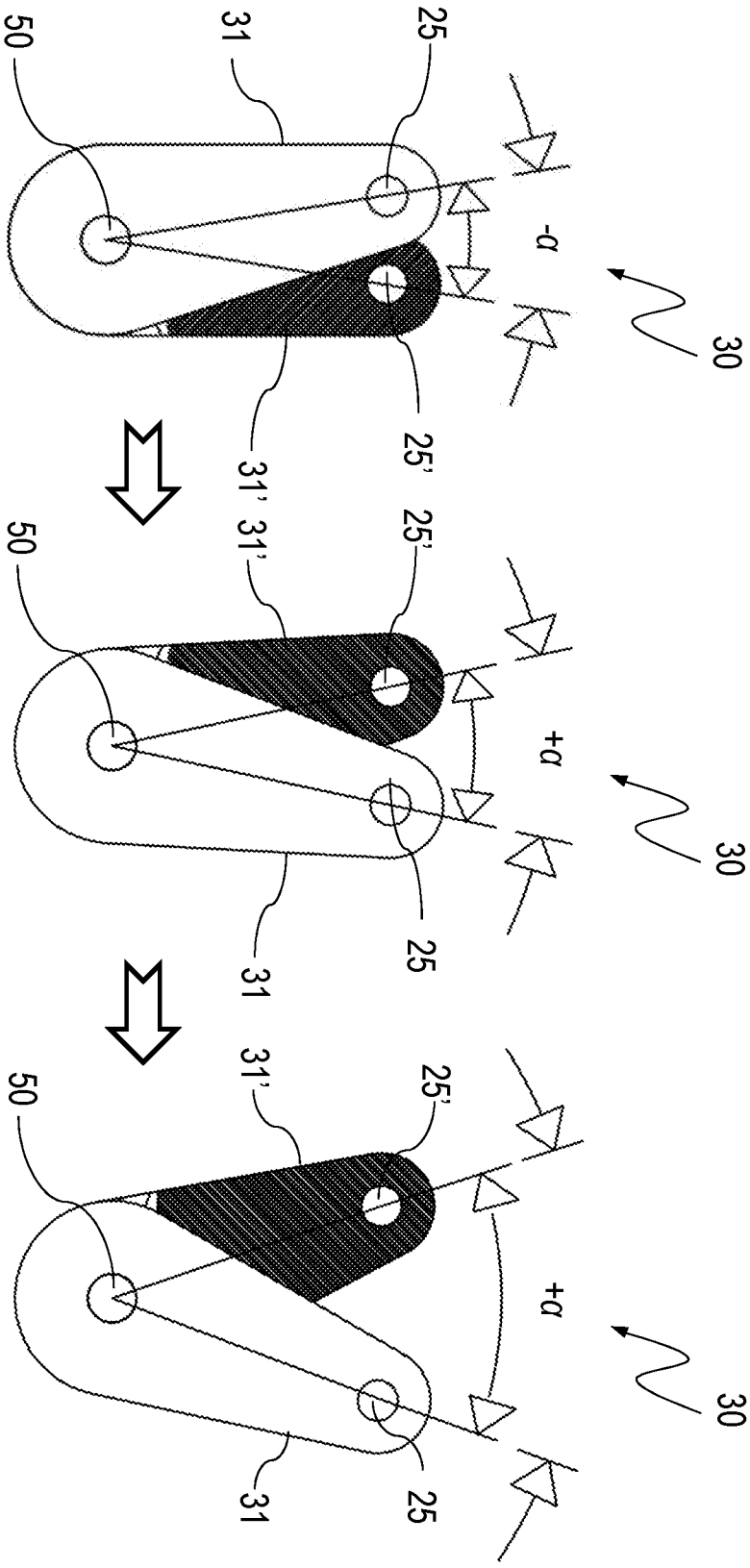

Fig. 32a

Fig. 32b

Fig. 32c

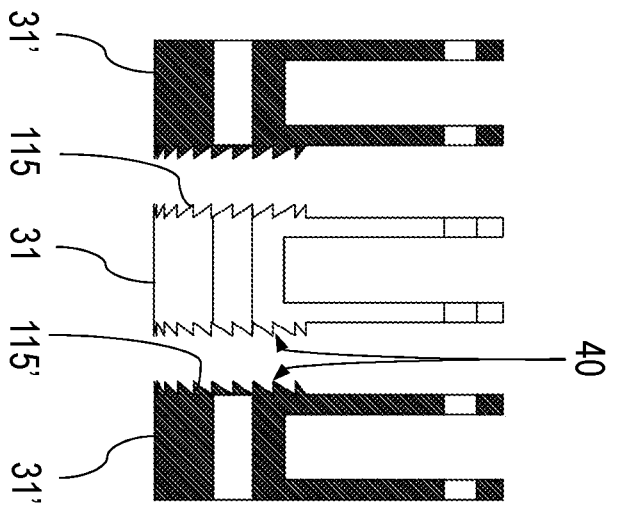

Fig. 33a

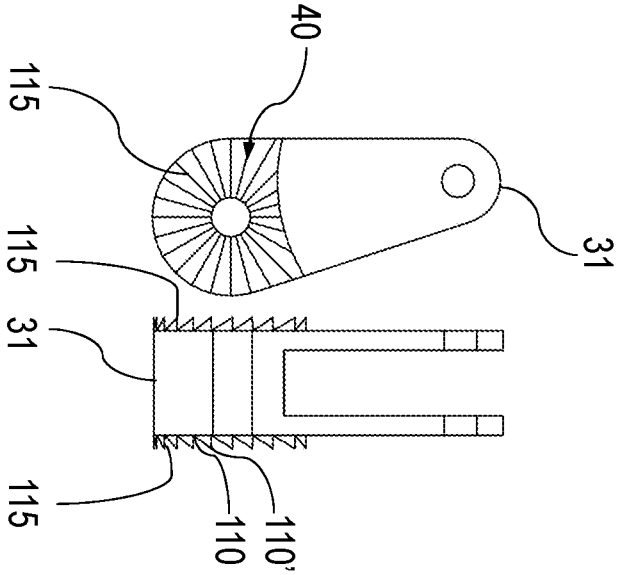

Fig. 33b

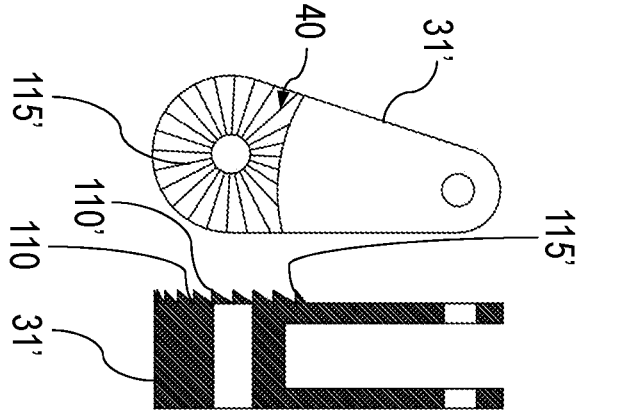

Fig. 33c

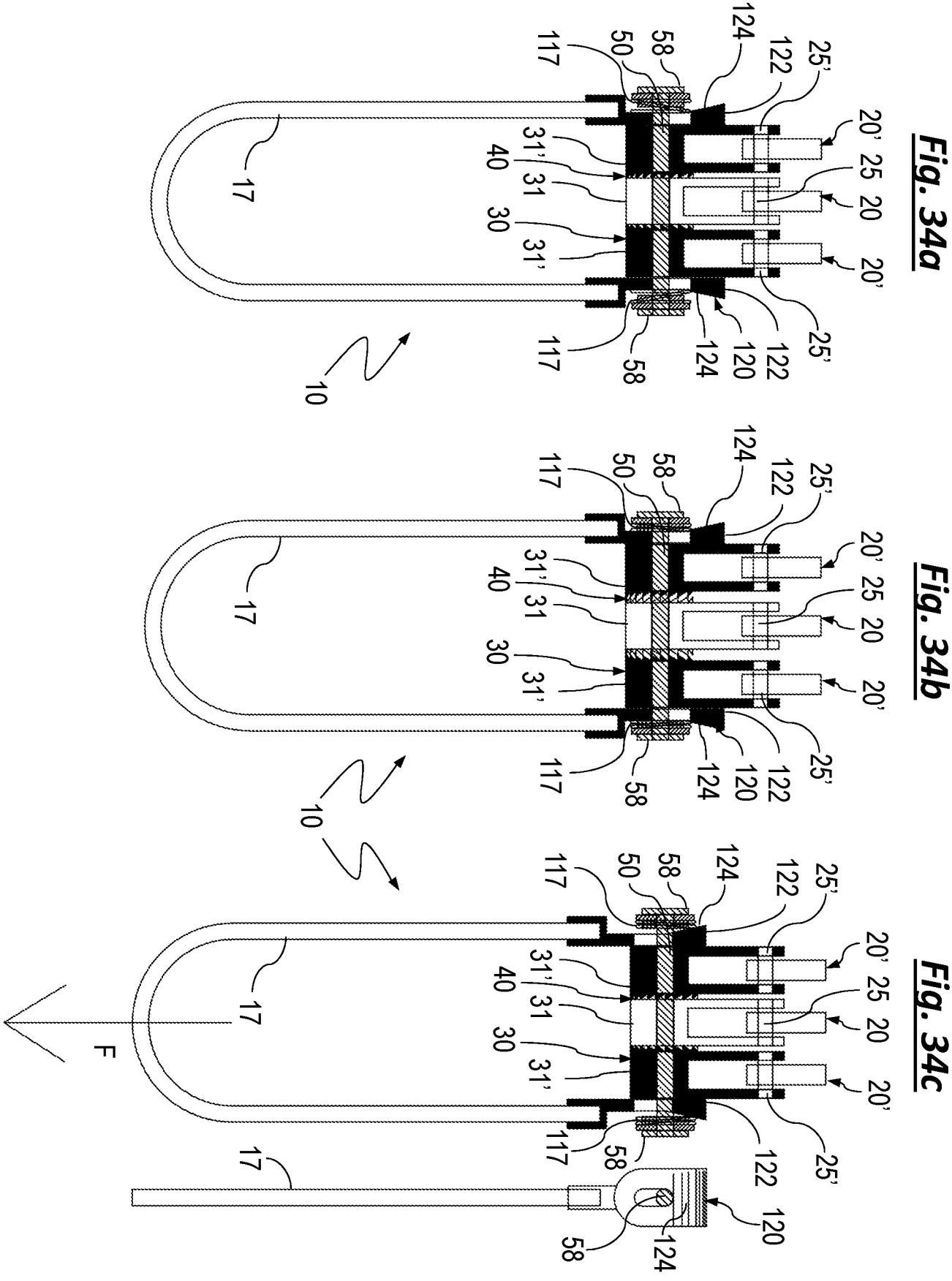
Fig. 34a
Fig. 34b
Fig. 34c
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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/060327

A. CLASSIFICATION OF SUBJECT MATTER
INV. A63B29/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	GB 2 426 466 A (UNIV LIVERPOOL JOHN MOORES [GB]) 29 November 2006 (2006-11-29) page 6, line 17 - page 11, line 12; figures 1-12	1,2 3-8
A	GB 2 347 360 A (ARRAN JOHN MICHAEL PETER [GB]) 6 September 2000 (2000-09-06) page 2, line 36 - page 3, line 8; figures 1-3	1-8
A	EP 1 854 511 A1 (TELLERIA GABIRIA AITZOL [ES]; TELLERIA GABIRIA ANDOITZ [ES]) 14 November 2007 (2007-11-14) paragraph [0008] - paragraph [0012]; figures 1-5	1-8

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 March 2020	27/03/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Jekabsons, Armands

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/060327

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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