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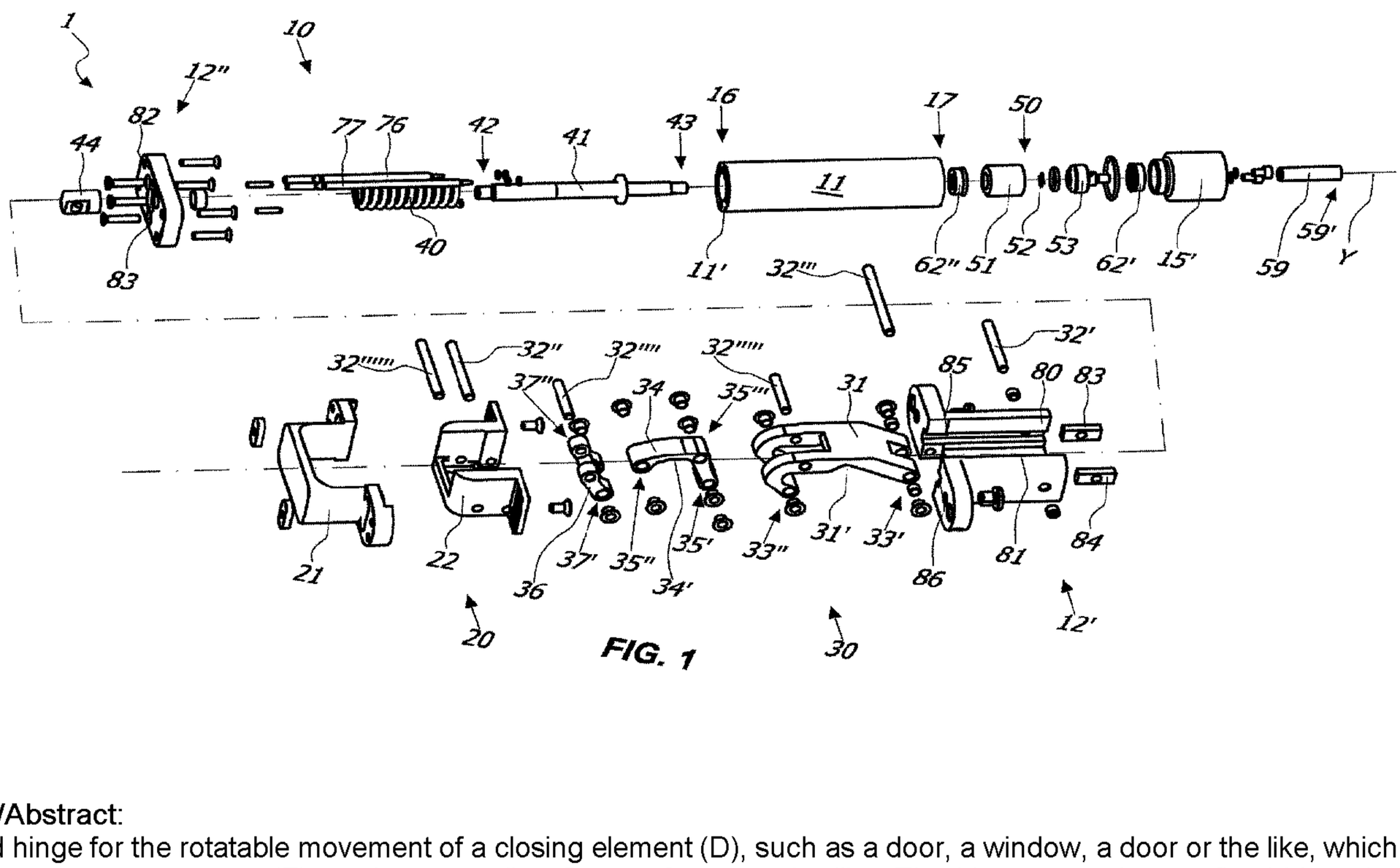

FIG. 1

(57) Abrégé/Abstract:
A concealed hinge for the rotatable movement of a closing element (D), such as a door, a window, a door or the like, which is fixed to a stationary support structure (F), such as a wall, a floor, a frame or the like. The hinge comprises: a fixed hinge body (20) anchorable to the stationary support structure (F); a movable hinge body (10) anchorable to the closing element (D); a connecting assembly (30) for mutual connection of the fixed hinge body (20) and movable hinge body (19) in such a manner that the latter (10) rotates with respect to the former (20) about a first longitudinal axis (X) between an open position and a closed position. One of the fixed hinge body (20) or the movable hinge body (10) includes a first box- shaped element (12) concealedly insertable within one of the closing element (D) and the stationary support structure (F). The other of the fixed hinge body (20) or the movable hinge body (10) comprises a second box-shaped element (20) concealedly insertable within the other of the closing element (D) and the stationary support structure (F). The one of the first box-shaped element (12) and the second box- shaped element (20) which is insertable within the stationary support structure (F) defines a second axis (Y) substantantally parallel to the first axis (X). The connecting assembly (30) protrudes from the first box- shaped element (12) in the open position of the movable element (10), the first box-shaped element (12) being susceptible to infernally contain the connecting assembly (30) in the closed position of the movable element (10).

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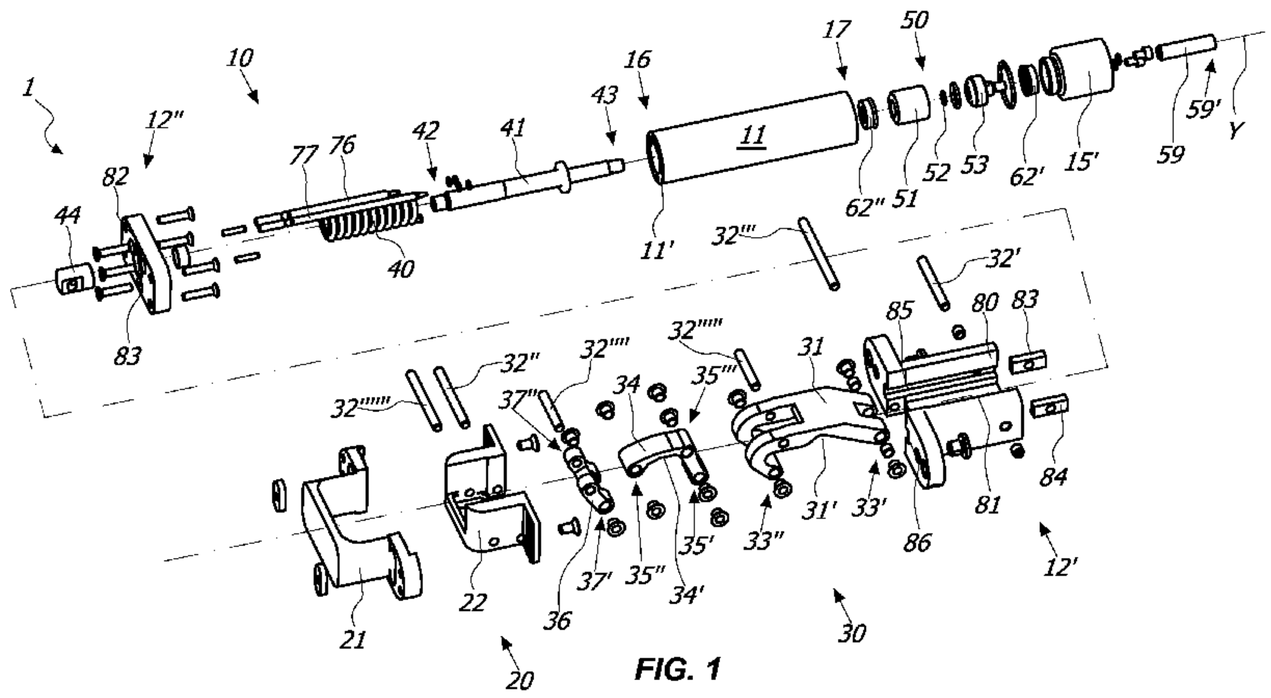

FIG. 1

(57) Abstract: A concealed hinge for the rotatable movement of a closing element (D), such as a door, a window, a door or the like, which is fixed to a stationary support structure (F), such as a wall, a floor, a frame or the like. The hinge comprises: a fixed hinge body (20) anchorable to the stationary support structure (F); a movable hinge body (10) anchorable to the closing element (D); a connecting assembly (30) for mutual connection of the fixed hinge body (20) and movable hinge body (19) in such a manner that the latter (10) rotates with respect to the former (20) about a first longitudinal axis (X) between an open position and a closed position. One of the fixed hinge body (20) or the movable hinge body (10) includes a first box- shaped element (12) concealedly insertable within one of the closing element (D) and the stationary support structure (F). The other of the fixed hinge body (20) or the movable hinge body (10) comprises a second box-shaped element (20) concealedly insertable within the other of the closing element (D) and the stationary support structure (F). The one of the first box-shaped element (12) and the second box- shaped element (20) which is insertable within the stationary support structure (F) defines a second axis (Y) substantantally parallel to the first axis (X). The con - necting assembly (30) protrudes from the first box- shaped element (12) in the open position of the movable element (10), the first box-shaped element (12) being susceptible to infernally contain the connecting assembly (30) in the closed position of the movable element (10).

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CONCEALED HINGE FOR DOORS

DESCRIPTION

Field of invention

The present invention is generally applicable in the technical field of hinges, and particularly relates to a concealed hinge for doors.

Background of the invention

Hinges are known which comprise a fixed hinge body to be concealedly embedded in a wall, a movable hinge body to be anchored to a door and a connection assembly for mutual connection of the fixed hinge body and the movable one. In this way, the movable hinge body rotates with respect to the fixed one around a vertical axis between an open door position and a closed door position.

The fixed hinge body includes a generally box-shaped element susceptible to internally contain the connection assembly of when the movable hinge body is in the closed door position. The connection assembly protrudes from the box-shaped element when the movable hinge body is in the open door position.

The concelaed hinges of the type mentioned above available today on the market does not allow the control of the closing element during opening and/or closing.

They are further bulky and include a large number of parts.

Another drawback is the poor safety of such hinges, due to the fact that the doors to which are connected if pushed by a careless user is free to strongly impact against the frame to which they are anchored.

From the documents GB1252757, US4102006, GB2503753, US882721, DE102007031175, US2007/294860 and US2709276 concealed hinges are known.

Summary of the invention

The object of the present invention is to overcome at least partly the above mentioned drawbacks, by providing a hinge having characteristics of high functionality and low cost.

Another object of the invention is to provide a hinge of limited dimensions.

Another object of the invention is to provide a hinge that is capable of supporting also very heavy doors, without changing the behavior.

Another object of the invention is to provide a hinge which has a minimum number of constituent parts.

Another object of the invention is to provide a hinge capable of maintaining the exact closing position over time.

Another object of the invention is to provide a safe hinge.

Another object of the invention is to provide a hinge easy to install.

The above objects, as well as others that will appear more clearly hereinafter, are achieved by a

hinge according to which is herein described and/or shown and/or claimed.

Advantageous embodiments of the invention are defined according to the dependent claims.

Brief description of the drawings

Further features and advantages of the invention will appear more evident upon reading the detailed description of a preferred, non-exclusive embodiment of a hinge **1**, which is described as non-limiting example with the help of the annexed drawings, wherein:

FIG. 1 is an exploded isometric view of an embodiment of the hinge **1**;

FIGs. 2a, **2b** and **2c** are views respectively top, sectioned along a plane *IIb - IIb* and partially sectioned along a plane perpendicular to the plane *IIb - IIb* of the embodiment of the hinge **1** of FIG. 1 in the closed position;

FIGs. 3a, **3b** and **3c** are views respectively top, sectioned along a plane *IIIb - IIIb* and partially sectioned along a plane perpendicular to the plane *IIIb - IIIb* of the embodiment of the hinge **1** of FIG. 1 in a partially open position;

FIGs. 4a, **4b** and **4c** are views respectively top, sectioned along a plane *IVb - IVb* and partially sectioned along a plane perpendicular to the plane *IVb - IVb* of the embodiment of the hinge **1** of FIG. 1 in the fully open position at 180°;

FIGs. 5a, **5b** and **5c** are partially sectional views similar to FIGS. 2c, 3c and 4c of an alternative embodiment of the hinge **1** that in the fully open position reaches 155°;

FIGs. 6a, **6b**, **6c** and **6d** are views respectively top, partially sectioned according to a plane *VIb – VIb* and sectioned along planes *VIc - VIc* and *VId - VId* of the embodiment of the hinge **1** of FIG. 1;

FIGs. 7a, **7b** and **7c** are views respectively axonometric in the open position and sectioned along a plane *VIIb - VIIb* and *VIIc - VIIc* of a further embodiment of the hinge **1**;

FIG. 8 is an exploded isometric view of a further embodiment of the hinge **1**;

FIGs. 9a, **9b** and **9c** are views respectively top in the open position and sectioned along a plane *IXb - IXb* and *IXc - IXc* of the embodiment of the hinge **1** of FIG. 8, with in **FIG. 9d** some enlarged details of FIG. 9a;

FIGs. 10a and **10b** are views respectively top in the closed position and sectioned along a plane *Xb - Xb* of the embodiment of the hinge **1** of FIG. 8, with in **FIGs. 10c** and **10d** some enlarged details of FIG. 10b;

FIG. 11 is a front view of the embodiment of the hinge **1** of FIG. 8;

FIGs. 12a, **12b** and **12c** are views respectively sectioned along planes *XIIa - XIIa*, *XIIb - XIIb* and *XIIc - XIIc* in FIG. 11 of the embodiment of the hinge **1** of FIG. 8, with in **FIG. 12d** some enlarged details of FIG. 12c;

FIG. 13 is a sectional view of some details of a further embodiment of the hinge **1**;

FIG. 14 is an exploded isometric view of a further embodiment of the hinge **1**;

FIG. 15 is a sectioned view of the embodiment of the hinge **1** of FIG. 14 in the closed position;

FIG. 16 is a schematic axonometric view of the hinge **1** mounted on a door **D** and a frame **F**, with in **FIG. 16a** some enlarged details;

FIGs. 17a and **17b** are front views of respectively the movable hinge body **10** and the fixed hinge body **20** of the hinge **1**.

Detailed description of some preferrred embodiments

With reference to the above figures, the hinge **1** is advantageously to be used for the rotatable movement of a door, during both opening and closing thereof.

In general, the embodiments of the hinge **1** according to the figures 1 to 13 may be used for hydraulically closing and/or opening and/or checking any closing element, such as a door, a window, a shutter or the like, anchored to any stationary support structure, such as a wall, a floor, a frame or the like, without departing from the scope of the appended claims.

On the other side, the embodiment of the hinge **1** according to the figures 14 and 15 may be used to nechanically connect the closing element and the stationary support structure.

In particular, the hinge **1** may be of the concealed type and can be advantageously used with an internal door **D**, for example a wooden door, supported by a frame **F**.

Essentially, the hinge **1** may include a fixed hinge body **20**, a movable hinge body **10** and a connection assembly, indicated generally with **30**, for mutual connection thereof.

As a result of this connection, the movable hinge body **10** rotates with respect to the fixed one **20** around a longitudinal axis **X**, which may be substantially vertical, between an open door position, shown for example in FIGs. 3a to 4c, and a closed door position, shown for example in FIGs. 2a and 2b.

Suitably, the fixed hinge body **20** may be concealedly embedded within the frame **F** that acts as a stationary support for the door **D**. On the other hand, the movable hinge body **10** may be connected to the door **D**.

However, the opposite is possible, that is the fixed hinge body **20** may be anchored to the wall and the movable one **10** may be concealedly embedded within the door, without departing from the scope of the appended claims.

Advantageously, in the embodiments according to the figures 1 to 13 the movable hinge body **10** may include a tubular member **11** defining an axis **Y** substantially perpendicular to the axis **X** and a first box-shaped element **12** susceptible to contain in its interior the connection assembly **30** when the movable hinge body **10** is in the door closed position, as shown for example in FIG. 2a.

It is understood that the tubular element **11** may also belong to the hinge body **20**, as well as that the hinge **1** can include more than one tubular element **11**, without departing from the scope of the appended claims.

It is also understood that the tubular element **11** may have any shape, for example a cylindrical or

parallelepiped shape with square or rectangular section, provided that it is internally hollow.

The connection assembly **30** is further configured to protude from the first box-shaped element **12** when the movable hinge body **20** is in the open door position, as shown for example in FIGs. 3a and 4a. The particular configuration of the connection assembly **30** is described later.

It is understood that the hinge **1** may have a different configuration, provided however that it includes a fixed element and a movable element coupled each other to rotate around an axis, without departing from the scope of the appended claims. The fixed and movable elements may be coupled in any manner, for example by a pivot.

The fixed hinge body **20** may include a second box-shaped element formed by a first outer element **21** and a second element **22** internal thereto, the latter cooperating with each other. The fixed hinge body **20** can be designed to be concealedly embedded within the door **D** or the frame **F**.

In some preferred but not exclusive embodiments, shown for example in FIGS. 8 to 12d and in FIGS. 14 and 15, the first outer element **21** may include first guide means for guiding the sliding of the second inner element **22** along a direction **d** which is substantially perpendicular to the axis **X** and the axis **Y**.

It is understood that in the embodiments which do not include the tubular element **11** the axis **Y** may be defined by the fixed hinge body **20** conceadly embedded within the frame **F**.

To do this, the first outer element **21** may include a pair of first grooved surfaces **121** with a plurality of rows defining the direction **d**, while the second inner element **22** may include at least one corresponding pair of second countershaped surfaces **122** engaged with the first surfaces **121**, which surfaces define the first guide means.

The grooved surfaces **121**, the countershaped surfaces **122** and a pair of screw elements **123'**, **123''** designed for mutually engaging/disengaging thereof may define means for reciprocally blocking/unblocking the first outer element **21** and the second inner element **22**.

Advantageously, each of the screw elements **123'**, **123''** may include a respective screw **124'**, **124''** to be engaged in a corresponding engagement element **125'**, **125''** sliding in a respective elongate slot **126'**, **126''**, the latter being placed on surfaces **127'**, **127''** opposite to the second countershaped surfaces **122**.

In a preferred but not exclusive embodiment, the screws **124'**, **124''** may be inserted through respective slots **129'**, **129''** passing-through the second inner element **22** and through a second hole **130'**, **130''** passing-through the first outer element **21**. The slots **129'**, **129''** may be substantially parallel to the axis **X**, so as to allow the second inner element **22** to slide vertically.

Suitably, the first outer element **21** may include second guide means for guiding the sliding of the second inner element **22** along a direction **d'** substantially parallel to the axis **X** and perpendicular to both the axis **Y** and to the direction **d**. The second guide means may include two or more adjusting screws **128'**,

128'' placed at opposite sides of the second inner element 22.

The adjusting screws 128', 128'' may be inserted through the first outer element 21 to interact with the second inner element 22.

In order to allow an operator to operate on the adjusting screws 128', 128'', the first outer element 21 and/or the second inner element 22 may include two or more front apertures 131', 131'' in correspondences of the adjusting screws 128', 128''. In this manner, an operator can easily access the latter when the second box-shaped element 20 is concealedly inserted within the stationary support structure, i.e. when the closing element D is mounted on the frame F.

Suitably, each of the adjusting screws 128', 128'' may include one or more seats 132', 132'' to be engaged by a suitable adjusting tool, e.g. a wrench, through said front apertures 131', 131''.

During use, the second guide means may be operateable by an operator upon mutual disengagement of the surfaces 121 and 122 by acting on the screws 124', 124''. After operation, the latter may be mutually reengaged.

It is understood that the adjusting screw 128' may support the second inner element 22 during the sliding thereof along the direction d.

The box-shaped element 12 can be formed by a first outer element 12' and a second element 12'' internal thereto, the latter being mutually coupled each other. As a whole, the box-shaped element 12 may define a hollow body with a pair of upper and lower walls 80, 81 substantially parallel to the axis Y joined by a side wall 82' and a bottom wall 82, the latter being substantially perpendicular to the side wall 82' and the axis Y.

More particularly, the upper and lower walls 80, 81 and the side wall 82' belong to the first outer element 12', while the bottom wall 82 may be a plate attached thereto.

In use, the side wall 82', the upper and lower walls 80, 81 and the bottom wall 82 are susceptible to be concealed within the door or the wall, their inner side being however accessible from the outside. More precisely, if necessary, an operator can access from the outside, possibly with a tool (for example, a screwdriver), to the lower surface of the upper wall 80, the upper surface of the bottom wall 81, the front surface of the bottom wall 82 and to the inner surface of the side wall 82'.

Moreover, the box-shaped element may include two plate-shaped elements 87, 88 for attaching the movable hinge body 10 to the wall, preferably with screws or dowels to be inserted in the housings 89', 89''.

The front surface of the plate-shaped elements 87, 88 is susceptible to remain flush with the door and accessible once the hinge body 10 is concealed therein.

In a preferred but not exclusive embodiment, shown in FIGs. 8 to 12d, the first box-shaped element 12 may comprise means for adjusting the sliding of the second inner element 12'' with respect to the first outer element 12' along a plane substantially parallel to the axes X and Y, so as to adjust the

distance and/or the inclination of the door with respect to the wall.

Suitably, the adjustment means may comprise a pair of actuator elements **212'**, **212''** to be controlled by a user which are located at opposite end portions **213'**, **213''** of the second inner element **12''**.

Each of the actuator elements **212'**, **212''** may be configured so that the rotation thereof imparted by the user corresponds to the sliding of the end portions **213'**, **213''** along a direction **d''** substantially parallel to the axis **Y**.

The two actuator elements **212'**, **212''** may be equal to each other. Therefore, hereinafter it is described only one of them, it being understood that the other has the same configuration.

The actuator element **212''** may include a pin **214** having a first threaded portion **215'** engaged in a corresponding counterthreaded seat **12'''** of the first outer element **12'** and a second portion **215''** integrally coupled with a control element **216**. More particularly, the latter and the pin **214** may be rotationally blocked relative to one another, for example by a plug or a suitable shaping with mutually engaged flat portions, and may be mutually coupled by means of a blocking element **217** adapted to mutually blocking relative to each other the second threaded portion **215''**, the end portion **213''** of the second inner element **12''** and the same control element **216**.

Therefore, the end portion **213''** of the second inner element **12''** is interposed between the second threaded portion **215'** and the control element **216**.

Moreover, this is rotationally controlled from the outside by a user so that the rotation of the same control element **216** corresponds to the rotation of the pin **214**. As a consequence, the user by doing so can adjust the relative position of the door with respect to the wall, in terms of distance and/or inclination.

Moreover, thanks to the above configuration, the mounting is extremely simplified. It is in fact sufficient to insert the pin **214** into the counterthreaded seat **12'''**, to insert the second inner element **12''** into the first outer element **12'** by placing the end portion **213''** at the second threaded portion **215'**, to insert the control element **216** of the latter and block the assembly by means of the blocking element **217**.

In the embodiments of the hinge **1** shown in the figures 1 to 13 the tubular element **11** may internally include a working chamber **13**, which may in turn include means **40** for the automatic closing of the closing element once opened, and means **50** for the hydraulic damping of the pivotal movement of the movable hinge body **10**.

The embodiment of the hinge **1** shown in FIGs. 14 and 15 is practically equal to the one shown in FIGs. 8 to 12c, with the exception that the former does not include the tubular element with the hydraulic damping means **50** and/or the means **40** for the automatic closing of the closing element once opened. In other words, the embodiment of the hinge **1** shown in FIGs. 14 and 15 is a mechanical connecting hinge

for rotatably moving the door **D**.

Suitably, the means **40** for the automatic closing of the closing element after opening can be defined by elastic counteracting means, for example a coil spring.

Moreover, the means **50** for the hydraulic damping of the pivotal movement of the movable hinge body **10** may advantageously include a plunger member **51** sliding along the axis **Y** and a working fluid, such as oil, hydraulically acting thereon.

It is understood that the hinge **1** may also be free of automatic closing means **40**, thus being a hydraulic checking hinge or hydraulic brake. In this case, elastic counteracting means adapted to restore the initial position of the plunger member may be present or not.

The plunger member **51** may be mutually connected with the fixed hinge body **20** so that the rotation of the movable element **10** corresponds to the sliding of the former and vice-versa.

For this purpose, at least one shaft **41** may be provided having a first end **42** operatively connected with the connection assembly **30** and a second end **43** mutually connected with the plunger member **51**.

The first end **42** of the at least one shaft **41** may be connected to the connecting assembly **30** via the connecting element **44**, the latter being at one end screwed into the end **42** and at the other end connected to the first hook-shaped arm **31** by means of the first pin **32'**.

To allow the connection between the at least one shaft **41** and the connecting element **44**, the first end **42** of the former can pass through a central opening **83** of the bottom wall **82** of the box-shaped element **12**.

As better explained below, the second end **43** may be screwed onto the plunger member **51**.

The coil spring **40** can be fitted over the at least one shaft **41**. In particular, the former can be fitted over the at least one shaft **41** so as to be in a position of maximum elongation when the movable hinge body **20** is in the door closed position, such as shown in FIGs. 2b and 10b.

In order to functionally split the means **40** for the automatic closing of the closing element once opened and the means **50** for the hydraulic damping of the pivotal movement of the movable hinge body **10**, the working chamber **13** may be divided into two half-chambers **14**, **15** separated each other by separation means **60**.

Advantageously, the separation means **60** may include a pair of seal **62'**, **62''** so that the working fluid lies exclusively in the second half-chamber **15**, the first half-chamber **14** remaining dry.

In this way, it is possible to use a spring **40** greatly longer (and hence having more force) than the one which could have been inserted in the limited space of the half-chamber **15**.

Suitably, the first half-chamber **14** may include means **40** for the automatic closing of the closing element once opened, while the second half-chamber **15** may include the hydraulic damping means **50**. More particularly, the second half-chamber **15** may include the plunger member **51**, the working fluid and

at least one non-return valve which includes a respective at least one control member **52**, for example of the butterfly type, and at least one end element **53**.

The at least one control member **52** may be movable within a respective at least one seat **54** which is defined when the plunger member **51** and the at least one end element **53** are engaged with each other. In other words, at least one of the front or rear surfaces of the plunger member **51** and the front surface of the at least one end element **53** are suitably configured so as to define the at least one seat **54** for the at least one control member **52**.

Such details are described in detail later.

In a preferred but not exclusive embodiment, shown in FIGa. 1 to 7c, the first half-chamber **14** may be proximal to the axis **X** and/or to the first box-shaped element **12**, while the second half-chamber **15** may be distal therefrom.

In this case, the shaft **41** may be a single shaft placed in both the half-chambers **14** and **15**. More particularly, the shaft **41** may have the first end **42** protruding from the first half-chamber **14** through the free end **16** for connection with the connecting element **44** and the second end **43** passing through the separation means **60** to lie within the second half-chamber **15**.

The coil spring **40** can be fit onto the single shaft **41** at the second end **46**.

The separation means **60** may include a radial appendix **61** extending radially towards the inner side of the working chamber **13** susceptible to abut against a radial appendix **45** of the shaft **41** which extends radially outwardly with respect to the second axis **Y**. More particularly, the radial appendix **45** of the shaft **41** may include a front surface **46** susceptible to come into contact with the spring **40** and a rear surface **47** susceptible to come into contact with the radial appendix **61** to act as end-stroke for the shaft **41**.

In another preferred but not exclusive embodiment, shown in FIGs. 8 to 12d, the second half-chamber **15** may be proximal to the axis **X** and/or to the first box-shaped element **12**, while the first half-chamber **14** may be distal therefrom.

In this case, a first shaft **41** placed exclusively within the second half-chamber **15** and a second shaft **41'** placed within the first half-chamber **14** and the second half-chamber **15** may be provided.

The second shaft **41'** may have a third end **42'** operatively connected with the plunger member **51** and a fourth end **43'** lying in the first half-chamber **14**. The coil spring **40** may be fitted onto the second shaft **41'**.

Conveniently, the latter may include means for adjusting the preload of the coil spring **40** including a slider **140** slidable along the second shaft **41'** to act on the coil spring **40** and an actuator element **141** acting on the slider **140** to promote the sliding thereof in response to a rotation of the same actuator element **141** imparted by the user.

To do this, the actuator element **141** can be accessed from the outside by the same user, for

example by means of a tool with a shaped head inserted in a control countershaped portion **142** of the actuator element **141**. In a preferred but not exclusive embodiment, this shaped head may for example be hexagonal.

In order to preload the coil spring **40**, the slider 140 may be rotationally blocked, for example by one or more pins or by means of prismatic kinematic pairs, in particular two or more pairs of mutually engaged flat surfaces.

Suitably, pins or prismatic kinematic pairs also acts as guide means of the slider **140** along the second shaft **41'**.

The actuator element **141** may further be screwed on/unscrewed from the second shaft **41'** and idly coupled with the slider **140** so that the screwing/unscrewing of the former imparted by the user for example by means of the above shaped head tool corresponds to the sliding of the slider **140**.

Advantageously, the plunger member **51** may divide the second half-chamber **15** into two variable volume compartments **18**, **19**, fluidically communicating with each other and reciprocally adjacent.

Suitably, when the movable hinge body **10** is in the closed door position the first variable volume compartment **18** may have the maximum volume and the second variable volume compartment **19** may have the minimum volume. On the other hand, when the movable hinge body **20** is in the open door position the first variable volume compartment **18** may have the minimum volume and the second variable volume compartment **19** may have the maximum volume.

Therefore, upon the opening of the closing element the working fluid passes from the first variable volume compartment **18** to the second variable volume compartment **19**. To this end, in a first embodiment of the invention shown in FIGs. 1 to 7c, a first line **55** for the fluidic connection of the compartments **18**, **19** passing through the end element **53**, the seat **54**, the plunger member **51** and the second end **43** of the shaft **41** may be provided.

In a preferred but not exclusive embodiment, shown in FIG. 13, a spring **252** acting on the at least one control member **52** for forcing the closing thereof against the at least one seat **54** may be provided, so as to minimize the closing time of the at least one valve and to have an optimal control on the closing element.

The separation means **60** may be configured so that each of the half-chambers **14**, **15** is accessible only through the respective free end **16**, **17**.

Therefore, the at least one end element **53**, the at least one control member **52** and the plunger member **51** can be inserted within the second half-chamber **15** through the free end **17**.

To allow an operator to mount/dismount the at least one control member **52** in/from the at least one seat **54** which is formed by coupling the at least one end element **53** and the plunger member **51** outside the second half-chamber **15** and then insert the unitary assembly thus formed in the same second

half-chamber **15**, the at least one end element **53** and the plunger member **51** may be removably coupled. To do this, the plunger member **51** may include a threaded rear seat **56** adapted to receive the at least one end element **53**, which may have a peripheral counterthreaded area **57**.

To allow the operator to mount the unitary assembly of the at least one end element **53**, the at least one control member **52** and the plunger member **51** which has been previously formed onto the single shaft **41** in the case of the embodiment shown in FIGs. 1 to 7c and the second shaft **41'** in the case of the embodiment shown in FIGS. 8 to 12d, the plunger member **51** and the latter may also be removbly coupled.

To this end, the second end **43** of the shaft **41** or the third single end **42'** of the second shaft **41'** may be threaded, while the plunger member **51** may include a corresponding counterthreaded seat **58**.

In this way, it is possible to mount in a simple and fast manner the unitary assembly of the at least one end element **53**, the at least one control member **52** and the plunger member **51** on the single shaft **41** or on the second shaft **41'** without the aid of screws or similar fastening elements.

To allow the operator to control the unitary assembly between of the at least one end element **53**, the at least one control member **52** and the plunger member **51** once inserted within the second half-chamber **15**, in the embodiment shown in FIGs. 1 to 7c the end element **53** may include an elongated appendix **59** projecting from the free end **17**. In this way, the operator is extremely facilitated in its task.

Suitably, the elongated appendix **59** may have a volume substantially equal to the volume of working fluid that passes between the first variable volume compartment **18** and the second variable volume compartment **19**. In this way, it is possible to avoid imbalances and overpressure between the two compartments upon the passage of the fluid.

In a preferred but not exclusive embodiment, the second half-chamber **15** may be closed by a cap **15'**.

In this case, the elongated appendix **59** may be configured to pass through the cap **15'**, and may have a control end **59'** accessible by the operator to enable it mounting the unitary assembly of the end element **53**, the control member **52** and the plunger member **51** on the shaft **41** with the cap **15'** inserted within the second half-chamber **15**.

To do this, the cap **15'** may have a central through hole **15''** acting both as a seat for the elongated appendix **59** and as a guide for the sliding thereof along the axis **Y**. The control end **59'** may be accessible through the center hole **15''**.

In this embodiment, the unitary assembly may include a single end element **53** and a single control member **52** in addition to the plunger member **51**.

On the other hand, in the second embodiment shown in FIGs. 8 to 12d, the unitary assembly in addition to the plunger member **51** may include a pair of non-return valves with a pair of control members **52**, **52'** movable in respective seats **54**, **54'** and a pair of end elements **53**, **53'**. Among the latter

may be interposed a third variable volume compartment **19'**, the function of which will be clear later.

In this embodiment, the control members **52**, **52'** act in opposite directions, so that upon one of the opening or closing of the door one of the control members **52** opens and the other control member **52'** closes, so that the working fluid flows selectively through only one of them durinf both the opening or the closing of the door.

Moreover, in this embodiment the unitary assembly of the end elements **53**, **53'**, the control members **52**, **52'** and the plunger member **51** can be inserted within the second half-chamber **15** and controlled during coupling with the second shaft **41'** by means of the first shaft **41**, on which the unitary assembly is mounted in advance.

As mentioned above, upon opening of the door the working fluid may pass from the first compartment **18** to the second compartment **19**, while upon closing of the same door the working fluid may return from the second compartment **19** to the first compartment **18**.

In the first embodiment shown in FIGs. 1 to 7c, the two variable volume compartments **18** and **19** are adjacent. In this case, the working fluid during the opening can pass through a fluid connection line **55** passing through the plunger member **51**, while during the closing the working fluid may pass through another fluid line **70** different from the first one which passes through a channel made within the wall **11'** of the tubular element **11**.

As mentioned above, in the second embodiment shown in FIGs. 8 to 12d a third compartment **19'** may be interposed between the two variable volume compartments **18**, **19**. In this case, the working fluid may pass through the plunger member **51** and the fluid line **70** passing through the wall **11'** of the tubular element **11** both during opening and during closing of the door. In particular, the working fluid passes always through one of the control members **52**, **52'** and through the third compartment **19'**.

In any case, the fluid connection line **70** may include a pair of channels **71**, **72** passing through the wall **11'** of the tubular element **11** at the second half-chamber **15**.

To allow an easy understanding, in FIG. 6b the two channels **71**, **72** have been depicted with dotted lines.

To allow the connection between the two compartments **18**, **19**, the channels **71**, **72** may have a respective first and second opening **73**, **74** in the first compartment **18** or fluidically communicating therewith, and a third and fourth opening **75**, **75''** in the second compartment **19**. Both openings **75**, **75''** are placed along the same peripheral groove **175** of the second compartment **19**.

The channel **71** may be in fluid communication with the channel **72** through the peripheral groove **175**.

Suitably, the first opening **73** can be fluidically decoupled from the plunger member **51** during all the stroke thereof.

On the other hand, the second opening **74** may be fluidically coupled with the plunger member

51 for a first part of the stroke thereof and fluidically decoupled from the same plunger member 51 for a second part of the stroke thereof.

Therefore, upon closing of the closing element as the plunger member 51 moves the working fluid which is in the second compartment 19 passes through the third and fourth openings 75, 75'' in the channels 71 and 72. From the latter, the working fluid arrives in the first compartment 18 through the two openings 73, 74. In the preferred but not exclusive embodiment shown in FIGs. 8 to 12d, the two openings 73, 74 are placed at the third compartment 19', from which the working fluid reaches the first compartment 18 through the plunger member 51.

For the first part of the stroke of the plunger member 51, that is until the latter and the second opening 74 are fluidically coupled, the working fluid flows only through the first opening 73. For the second part of the stroke of the plunger member 51, that is when the latter and the second opening 74 are fluidically decoupled, the working fluid flows through both the first opening 73 and the second opening 74. Advantageously, the latter may be placed so as to remain fluidly decoupled from the plunger member 51 for a small part of the stroke thereof, corresponding to a residual rotation of the closing element of 10° - 20°.

The sudden flowing of a greater amount of working fluid in the first compartment 18 causes the snap-on forwarding of the plunger member 51, with consequent latch of the closing element towards the closed position.

To allow to adjust both the speed and the latch of the closing element, a pair of adjusting elements 76, 77 may be provided passing through the bottom wall 82 of the box-shaped element 12 and the wall 11' of the tubular element 11.

Each adjustment element 76, 77 may define a respective axis Z, Z' substantially parallel to the axis Y and perpendicular to the axis X, and may have a length sufficient to reach the respective channel 71, 72.

More particularly, each adjustment element 76, 77 may include a first operating end 78, 78' in correspondence of the respective channel 71, 72 to adjust the flow of the working fluid which flows through the same and a second control end 79, 79' at the bottom wall 82 of the box-shaped element 12 to allow a user to access thereon through the same box-shaped element 12.

In this way, it is possible to regulate the flow of the working fluid which flows through the channels 71, 72 according to need, even when the hinge 1 is mounted and the movable hinge body 10 is concealed within the door.

The adjustment element 76 which acts on the channel 71 adjusts the closing speed of the movable hinge body 10, while the adjustment element 77 regulates the latch of the movable hinge body 10 towards the door closed position.

In the second embodiment shown in FIGs. 8 to 12d, a third channel 72' may be further provided, shown particularly in FIGs. 12c and 12d, passing through the wall 11' of the tubular element 11 in

correspondence of the second half-chamber **15**.

The third channel **72'** may have a plurality of fifth openings **74'** in the first compartment **18** and one other opening **75'** fluidly communicating with the second compartment **19** through the third compartment **19'**.

In this way, during the opening of the door control member **52** may be in the closed position, so that the working fluid is forced to pass through openings **74'** within the channel **72'**. Hence, the working fluid flows in the third compartment **19'** through the opening **75'**. The control member **52'** can be open, so that the working fluid can pass through it in the second compartment **19**.

During the closing of the door the control member **52'** can pass in the closed position, so that the working fluid which lies in the second compartment **19** is forced to pass through the openings **75**, **75''** within the channels **71**, **72**. Hence the working fluid reaches the third compartment **19'** through the openings **73**, **74**, according to what has been described above. The control member **52** can be open, so that the working fluid can pass through it in the first compartment **18**.

Advantageously, a third adjustment element **77'** may be provided having a respective control end **79''** at the bottom wall **82** of the first box-shaped element **12** and an operating end **78'''** susceptible to selectively obstruct one or more of openings **74'**.

In this way, it is possible to hydraulically limit the opening angle of the door. Depending on the number of openings **74'** obstructed/free by the operating end **78'''** of the third adjustment element **77'**, it is possible to vary the opening angle of the door.

Depending on the configuration and/or the mutual distance between the openings **74'**, the adjustment is more or less fine. For example, the adjustment is by steps, for example of 10° for each opening **74'**.

Similarly to the other two adjustment elements, the third adjustment element **77'** may be accessible from the outside by a user, for example through a screwdriver.

It is understood that the hinge **1** in any hydraulic configuration may include only one of the channels **71**, **72** or **72'**, as well as couples thereof (**71** and **72**, **71** and **72'**, **72** and **72'**) without departing from the scope of protection of the appended claims. It is further understood that the working fluid can pass through the channels and/or the plunger member in the other direction (for example, it may pass through the channels **71**, **72** during opening and through the channel **72'** during closing of the closing element) without departing from the scope of protection of the appended claims.

As mentioned above, the connection assembly **30** is configured to lie within the first box-shaped element **12** when the movable hinge body **10** is in the closed door position and to extend therefrom when the same movable hinge body **10** is in the open door position.

To this end, the top wall **80** and the bottom one **81** of the box-shaped element **12** may include a pair of sliders **83**, **84** sliding in respective guides **85**, **86** substantially parallel to the axis **Y** facing to each

other. The first pin **32'**, in addition to mutually connect the first hook-shaped arm **31** with the shaft **41** via the connecting element **44**, may pivotally connect the first arm **31** to the sliders **83**, **84**, at a first end **33'** of the same first arm **31**. At the other end **33''** the first hook-shaped arm **31** may be pivotally connected with the second box-shaped element **22** by means of a second pin **32''**.

Advantageously, in the embodiment of the hinge **1** shown in the FIGs. 14 and 15 the first pin **32'** may pivotally connect the first arm **31** to the sliders **83**, **84** without connecting the same first hook-shaped arm **31** with the shaft **41**. Moreover, in this embodiment the first arm **31** may be defined by a couple of superimposed arms.

The connection assembly **30** may further include a second substantially "L"-shaped arm **34** having a first end **35'** pivotally connected to the box-shaped element **12** by means of a third pin **32'''**, a second end **35''** pivotally connected with a third arm **36** through a fourth pin **32''''** and a third intermediate point **35'''** is rotatably connected with the first arm **31** by means of a fifth pin **32'''''**.

Advantageously, the first arm **31** may include a recess **31'**, while the second arm **34** may include a recess **34'**.

The connection between the parts mentioned above may be effected in such a way that upon opening of the closing element the first end **33'** of the first hook-shaped arm **31** may slide through the sliders **83**, **84** along the guides **85**, **86** along the axis **Y** and rotate it around the first plug **32'** until the recess **31'** impacts against the third pin **32'''**. At the same time, the second arm **34** can rotate about the third pin **32'''** until the recess **34'** impacts against the second pin **32''**.

Depending on the configuration of the recess **34'**, the hinge **1** may have an opening angle greater or lesser. For example, the embodiments of the hinge **1** shown in FIGs. 2a to 4c can open of 180°.

Advantageously, the connection assembly **30** may further include a third substantially plate-shaped arm **36** having a first end **37'** pivotally connected to the box-shaped element **22** by means of a sixth pin **32''''''** and a second end **37''** pivotally connected with the second end **35''** of the second arm **34** by the fourth pin **32''''**.

The second arm **34** and third arm **36** may be connected to each other so that the rotation of the second arm **34** about the third pin **32'''** corresponds to the rotation of the third arm **36** about the fourth pin **32''''**.

In this way, the movable hinge body **10** can rotate about the first axis **X**.

In a preferred but not exclusive embodiment, the hinge **1** may have the opening angle which is mechanically adjustable.

To do this, the box-shaped element **12** may include a pair of adjusting screws **90**, **91**, which can have a respective control end **92'**, **92''** that is accessible by an operator at the front surface **87'**, **88'** of the plate-shaped elements **87**, **88** and a respective operating end **93'**, **93''** at the guides **85**, **86** to act as end stroke for sliders **83**, **84**.

Therefore, the operator by acting on the control end **92'**, **92''** moves axially, i.e. along a direction parallel to the axis **Y**, the screws **90**, **91**, by at the same moving the end stroke **93'**, **93''** of the sliders **83**, **84** and then the opening angle of the closing element.

Since, as particularly shown in FIG. 7a, the front surface **87'**, **88'** of the plate-shaped elements **87**, **88** is flush with the door and accessible, the operator may make such adjustment in a simple and rapid manner, by simply opening the door.

It is understood that the box-shaped element **12** may also include a single adjustment screw **90** without departing from the scope of the appended claims.

In a further preferred but not exclusive embodiment, the hinge **1** may have one or more stop dppr positions, such as the position of maximum opening, or the latter and an intermediate position.

To do this, in the first embodiment shown in FIGs. 1 to 7c the box-shaped element **12** may include a pair of releasable engagement elements adapted to engage in corresponding seats **97'**, **97''** formed on the sliders **83**, **84**.

More particularly, in the first embodiment shown in FIGs. 1 to 7c the releasable engagement means may be defined by a pair of balls **94**, **95** inserted transversely through the openings **96'**, **96''** passing through the side wall **82'** of the box-shaped element **12**.

To push the balls **94**, **95** into the seats **97'**, **97''** and at the same time to allow the disengagement of the former from the latter, elastic pushing means may be provided acting on the same balls **94**, **95**, for example springs **98'**, **98''**.

Therefore, once the sliders **83**, **84** during their sliding along the guides **85**, **86** reaches the balls **94**, **95**, the springs **98'**, **98''** pushes the latter to engage within the respective seats **97'**, **97''**, thus stopping the sliding of the sliders **83**, **84** and consequently blocking in this position the closing element.

To unblock the door, a user can act thereon to disengage the balls **94**, **95** from the corresponding seats **97'**, **97''**. To do this, the user has to overcome the force imparted by the springs **98'**, **98''**.

To allow presetting of such force, suitable adjustment screws **99'**, **99''** may act on the springs **98'**, **98''** inserted within the passing-through openings **96'**, **96''**.

In this way, by turning the adjusting screws **99'**, **99''** the operator can preset the blocking/unblocking force of the closing element, for example according to its weight or to the presence or absence of children in the house.

It is understood that the box-shaped element **12** may include more pairs of balls **94**, **95**, so as to block the door in several positions, for example in the closed position, the open one and in one or more intermediate positions.

It is further understood that it is also possible to use only one of the balls **94**, **95** without departing from the scope of the appended claims.

On the other hand, in the second embodiment shown in FIGs. 8 to 12d and the one shown in

FIGs. 14 and 15 the releasable engagement means may be defined by a pair of resilient arms **150'**, **150''** unitary with the sliders **83**, **84** suscetible to snap-engage in a groove **97'**, **97''** unitary with the first box-shaped element **12**.

More specifically, as particularly shown in FIG. 10b, the latter may have a pair of abutment elements **151'**, **151''** each comprising a respective groove **97'**, **97''**.

To allow a user to mechanically adjust the opening angle of the closing element, each of the abutment elements **151'**, **151''** may be slidably mounted in a respective seat **152'**, **152''**. In addition, each of the abutment elements **151'**, **151''** may include one end **153'**, **153''** accessible by a user to adjust the sliding thereof along the seats **152'**, **152''**, so as to adjust as needed the point where the resilient arms **150'**, **150''** and grooves **97'**, **97''** mutually engage.

In particular, the abutment elements **151'**, **151''** may be adjusting screws.

In the embodiment shown in FIGs. 8 to 12d the seats **152'**, **152''** may belong to respective support plates mounted on the the first box-shaped element **12** by suitable screws, whereas in the embodiment shown in FIGs. 14 and 15 the seats **152'**, **152''** may be made directly within the first box-shaped element **12**.

Suitably, regardless of the configuration, at least one of the at least one releasable engagement element **94**, **95** and at least one seat **97'**, **97''** may be removably fixed to the corresponding first box-shaped element **12**, or to the corresponding slider **83**, **84**. In this way, a user may remove the same to provide a hinge free of stopping points of the closing element, for example for fire doors.

From the above, it is apparent that the hinge according to the invention achieves the intended objects.

The hinge according to the invention is susceptible of numerous modifications and variations, all within the inventive concept expressed in the accompanying claims. All the details may be replaced with other technically equivalent elements, and the materials may be different according to requirements, without departing from the scope of the invention.

Even if the hinge has been described with particular reference to the accompanying figures, reference numbers used in the description and in the claims are merely used to improve the intelligence of the invention and do not constitute any limitation of the claimed scope.

CLAIMS

1. A concealed hinge for the rotatable movement of a closing element (**D**), such as a door, a window, a door or the like, which is fixed to a stationary support structure (**F**), such as a wall, a floor, a frame or the like, the hinge comprising:

- a fixed hinge body (**20**) anchorable to the stationary support structure (**F**);
- a movable hinge body (**10**) anchorable to the closing element (**D**);
- a connecting assembly (**30**) for mutual connection of said fixed hinge body (**20**) and movable hinge body (**10**) in such a manner that the latter (**10**) rotates with respect to the former (**20**) about a first longitudinal axis (**X**) between an open position and a closed position;

wherein one of said fixed hinge body (**20**) or said movable hinge body (**10**) includes a first box-shaped element (**12**) concealedly insertable within one of the closing element (**D**) and the stationary support structure (**F**), the other of said fixed hinge body (**20**) or said movable hinge body (**10**) comprising a second box-shaped element (**20**) concealedly insertable within the other of the closing element (**D**) and the stationary support structure (**F**), the one of the first box-shaped element (**12**) and the second box-shaped element (**20**) which is insertable within the stationary support structure (**F**) defining a second axis (**Y**) substantantally perpendicular to the first axis (**X**);

wherein said connecting assembly (**30**) protrudes from said first box-shaped element (**12**) in the open position of the movable element (**10**), said first box-shaped element (**12**) being susceptible to internally contain said connecting assembly (**30**) in the closed position of the movable element (**10**).

2. Hinge according to claim 1, wherein said second box-shaped element (**20**) includes a first outer element (**21**) anchored to said other of the closing element and the stationary support structure and a second element (**22**) placed within the former, said second inner element (**22**) being movable with respect to the first outer element (**21**), means being provided for blocking/unblocking the movement of the former with respect to the latter by mutual engagement.

3. Hinge according to the preceding claim, wherein said first outer element (**21**) includes first guide means for guiding the sliding of said second inner element (**22**) along a first direction (**d**) substantially perpendicular to said first axis (**X**) and said second axis (**Y**).

4. Hinge according to the preceding claim, wherein said first outer element (**21**) includes at least one first grooved surface (**121**) with a plurality of rows defining said first direction (**d**), said second inner element (**22**) including at least one corresponding second countershaped surface (**122**) engaged with said at least one first grooved surface (**121**), the latter defining said first guide means, said means for blocking/unblocking including said at least one first grooved surface (**121**) and said at least one second countershaped surface (**122**).

5. Hinge according to the preceding claim, wherein said blocking/unblocking means further comprise at least one screw element (**123'**, **123''**) to reciprocally engage/disengage said at least one first

grooved surface (**121**) and at least one second countershaped surface (**122**).

6. Hinge according to the preceding claim, wherein said at least one screw element (**123'**, **123''**) includes a screw (**124'**, **124''**) engageable into an engagement element (**125'**, **125''**) sliding in an elongated slot (**126'**, **126''**) which is substantially parallel to said first direction (**d**), said elongated slot (**126'**, **126''**) being placed on a surface (**127'**, **127''**) opposite to said second countershaped surface (**122**).

7. Hinge according to the preceding claim, wherein said screw (**124'**, **124''**) is inserted through a first passing-through hole (**129'**, **129''**) of said second inner element (**22**) and through a second passing-through hole (**130'**, **130''**) of said first outer element (**21**), said first passing-through hole (**129'**, **129''**) being an elongated slot substantially parallel to said first axis (**X**).

8. Hinge according to one or more of the preceding claims, wherein said first outer element (**21**) includes second guide means for guiding the sliding of said second inner element (**22**) along a second direction (**d'**) substantially parallel to said first axis (**X**) and perpendicular to both said second axis (**Y**) and said first direction (**d**).

9. Hinge according to the preceding claim, wherein said second guide means include two or more adjusting screws (**128'**, **128''**) placed on opposite sides of said second inner element (**22**).

10. Hinge according to the preceding claim, wherein said adjusting screws (**128'**, **128''**) are inserted through said first outer element (**21**) to interact with said second inner element (**22**).

11. Hinge according to the preceding claim, wherein said first outer element (**21**) and/or said second inner element (**22**) includes two or more front apertures (**131'**, **131''**) in correspondences of said adjusting screws (**128'**, **128''**) to allow an operator to access on the latter when the second box-shaped element (**20**) is concealedly inserted within said other of the closing element and the stationary support structure.

12. Hinge according to the preceding claim, wherein each of said adjusting screws (**128'**, **128''**) includes one or more seats (**132'**, **132''**) to be engaged by a suitable adjusting tool operated by an operator through said front apertures (**131'**, **131''**).

13. Hinge according to one or more of claims 8 to 12, wherein said second guide means are operateable by an operator upon mutual disengagement of said at least one first grooved surface (**121**) and said at least one second countershaped surface (**122**), the latter being to be mutually reengaged after operation on said guide means.

14. Hinge according to one or more of the preceding claims, wherein said first box-shaped element (**12**) includes one pair of sliders (**83**, **84**) sliding in respective guides (**85**, **86**) substantially perpendicular to said first axis (**X**) facing each other and placed in correspondence of an upper wall (**80**) and a lower wall (**81**) of said first box-shaped element (**12**).

15. Hinge according to preceding claim, wherein said first box-shaped element (**12**) includes at least one first adjusting screw (**90**, **91**) having a working end (**93'**, **93''**) in correspondence of the

respective guide (**85**, **86**) to act as end-stroke abutment for the corresponding slider (**83**, **84**) and a operateable end (**92'**, **92''**) accessible from the outside by an operator so as to adjust the opening angle of the closing element.

16. Hinge according to the preceding claim, wherein said first box-shaped element (**12**) includes one pair of plate-shaped elements (**87**, **88**) having a front surface (**87'**, **88'**) susceptible to remain at sight flush to the wall once said fixed hinge body (**10**) is concealed in the stationary support structure, said operateable end (**92'**, **92''**) of said at least one first adjusting screw (**90**, **91**) being positioned in correspondence of said front surface (**87'**, **88'**) of said plate-shaped elements (**87**, **88**).

17. Hinge according to one or more of claims 14 to 16, wherein one of said first box-shaped element (**12**) and said sliders (**83**, **84**) includes at least one releasable engagement member (**94**, **95**, **98'**, **98''**, **150'**, **150''**) engageable with a corresponding seat (**97'**, **97''**) of the other of said first box-shaped element (**12**) and said sliders (**83**, **84**), so as to block the door in a removable manner in one or more predetermined stop positions.

18. Hinge according to the preceding claim, wherein at least one of said at least one releasable engagement member (**94**, **95**, **98'**, **98''**, **150'**, **150''**) or at least one seat (**97'**, **97''**) is removably fixed to the corresponding first box-shaped element (**12**) or to the corresponding sliders (**83**, **84**) so as to allow a user to remove it in such a manner to provide a hinge free of stopping points of the closing element.

19. Hinge according to the preceding claim, wherein said at least one releasable engagement member (**94**, **95**, **98'**, **98''**, **150'**, **150''**) acts transversely with respect to both said first and second axis (**X**, **Y**).

20. Hinge according to claim 17, 18 or 19, wherein said at least one releasable engagement member (**94**, **95**, **98'**, **98''**) comprises a spherical element (**94**, **95**, **98'**, **98''**) susceptible to be selectively inserted in said seat (**97'**, **97''**) pushed by a corresponding elastic pushing element (**98'**, **98''**) so as to block the door in the corresponding predetermined stop position, the user acting on the door to counteract the force imparted by the elastic pushing element (**98'**, **98''**) so as to unblock the closing element.

21. Hinge according to the preceding claim, wherein one of said sliders (**83**, **84**) includes said seat (**97'**, **97''**), said at least one releasable engagement member (**94**, **95**, **98'**, **98''**) being transversely inserted in a corresponding opening (**96'**, **96''**) passing through a side wall (**82'**) of said first box-shaped element (**12**), at least one second adjusting screw (**99'**, **99''**) being provided inserted into said passing-through opening (**96'**, **96''**) to act on said elastic pushing element (**98'**, **98''**), so as to allow an operator to preset the force of blocking/unblocking of the closing element.

22. Hinge according to claim 17 or 18, wherein said at least one releasable engagement member comprises a pair of resilient arms (**150'**, **150''**) susceptible to snap-engage in a groove defining said at least one seat (**97'**, **97''**).

23. Hinge according to the preceding claim, wherein each of said sliders (**83**, **84**) includes a

respective pair of said resilient arms (**150'**, **150''**), said first box-shaped element (**12**) including a pair of abutment elements (**151'**, **151''**) each comprising a respective groove defining said at least one seat (**97'**, **97''**).

24. Hinge according to the preceding claim, wherein each of said abutment elements (**151'**, **151''**) is slidably mounted in a respective seat (**152'**, **152''**), each of said abutment elements (**151'**, **151''**) further including an end (**153'**, **153''**) accessible by a user to adjust the sliding thereof in said seat (**152'**, **152''**), so as to mechanically adjust the opening or closing angle of the closing element.

25. Hinge according to one or more of the preceding claims, wherein said first box-shaped element (**12**) comprises a first outer element (**12'**) anchorable to one of the closing element and the stationary support structure and a second element (**12''**) placed within the former and coupled thereto, the second inner element (**12''**) being movable relative to the first outer element (**12'**).

26. Hinge according to the preceding claim, wherein said first box-shaped element (**12**) comprises means for adjusting the sliding of the second inner element (**12''**) with respect to the first outer element (**12'**) along a plane substantially parallel to said first axis (**X**) and said second axis (**Y**), so as to adjust the distance and/or the inclination of the closing element relative to the wall.

27. Hinge according to the preceding claim, wherein said adjusting means includes a pair of actuator elements (**212'**, **212''**) controllable by a user located in correspondence of opposite end portions (**213'**, **213''**) of said second inner element (**12''**), each of said actuator elements (**212'**, **212''**) being configured so that the rotation thereof imparted by the user corresponds to the sliding of the relative end portion (**213'**, **213''**) along a first direction (**d''**) substantially parallel to said second axis (**Y**).

28. Hinge according to the preceding claim, wherein each of said actuator elements (**212'**, **212''**) includes a pin (**214**) having a first threaded portion (**215'**) engaged in a corresponding counterthreaded seat (**12'''**) of said first outer element (**12'**) and a second portion (**215''**) integrally coupled with a control element (**216**) rotationally controllable from the outside by a user so that the rotation of the same control element (**216**) corresponds to the rotation of said pin (**214**), said second portion (**215''**) of said pin (**214**) including a flange element (**215'''**), the corresponding end portion (**213'**, **213''**) of said second inner element (**12''**) being interposed between said flange element (**215'''**) and said control element (**216**).

29. Hinge according to the preceding claim, wherein said control element (**216**) and said pin (**214**) are rotationally blocked relative to each other and mutually coupled by means of a blocking element (**217**) susceptible to mutually block said first threaded portion (**215'**) of said pin (**214**), said end portion (**213'**, **213''**) of said second inner element (**12''**) and said control element (**216**).

30. Hinge according to the one or more of the preceding claims, wherein said connection assembly (**30**) includes a first substantially hook-shaped arm (**31**) having a first end (**33'**) rotatably coupled with said sliders (**83**, **84**) by said first pin (**32'**) to slide therewith along said guides (**85**, **86**) and a second end (**33''**) rotatably coupled with said movable body hinge (**20**) by a second pin (**32''**).

31. Hinge according to the preceding claim, wherein said connection assembly (**30**) further includes a second substantially "L"-shaped arm (**34**) having a first end (**35'**) rotatably coupled with said first box-shaped element (**12**) by a third pin (**32'''**), a second end (**35''**) rotatably coupled with said movable hinge body (**20**) by a fourth pin (**32''''**) and a third intermediate point (**35'''**) rotatably coupled with said first arm (**31**) by a fifth pin (**32'''''**).

32. Hinge according to the preceding claim, wherein said first arm (**31**) includes a first recess (**31'**) susceptible to impact against said third pin (**32'''**) upon the rotation of the movable hinge body (**20**) around said first axis (**X**), said second arm (**34**) including a second recess (**34'**) susceptible to impact against said second pin (**32''**) upon the same rotation, said first box-shaped element (**12**), the first arm (**31**), the second arm (**34**) and the movable hinge body (**20**) being mutually connected so that upon opening of the door said first end (**33'**) of said first arm (**31**) slides by said sliders (**83**, **84**) through said guides (**85**, **86**) along said second axis (**Y**) and rotates about said first pin (**32'**) until said first recess (**31'**) impacts against said third pin (**32'''**), said second arm (**34**) rotating around said third pin (**32'''**) until said second recess (**34'**) impacts against said second pin (**32''**).

33. Hinge according to the preceding claim, wherein said connection assembly (**30**) further includes a third substantially plate-shaped arm (**36**) having a first end (**37'**) rotatably coupled with said movable hinge body (**20**) by a sixth pin (**32''''''**) and a second end (**37''**) rotatably coupled with said second end (**35''**) of said second arm (**34**) by said fourth pin (**32''''**), said second arm (**34**) and third arm (**36**) being mutually connected so that the rotation of the second arm (**34**) around said third pin (**32'''**) corresponds to the rotation of said third arm (**36**) around said fourth pin (**32''''**), so that said movable hinge body (**20**) is rotatable about said first axis (**X**).

34. Hinge according to one or more of the preceding claims, wherein said first box-shaped element (**12**) includes a bottom wall (**82**) which is substantially parallel to said first axis (**X**).

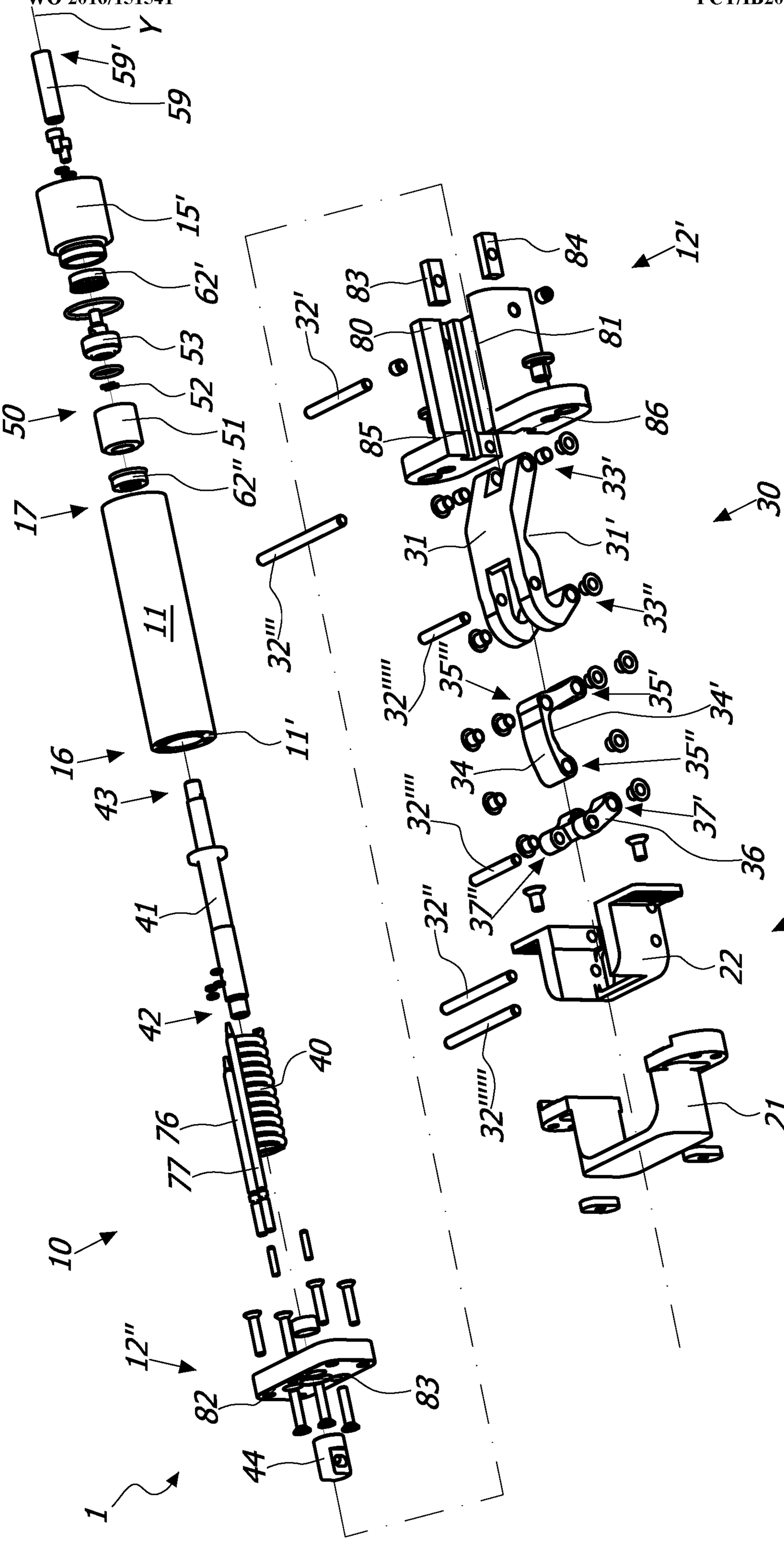

Y
59'
59
15'
62'
53
52
50
51
62"
17
11
11'
16
43
41
42
40
76
77
10
12"
82
83
44
1
84
12'
32'
80
83
81
85
86
33'
30
31
31'
32'''
33"
32'''''
35'''
35'
34'
34
35"
32''''''
37'
36
32"
37"
22
20
32''''''
21

FIG. 1

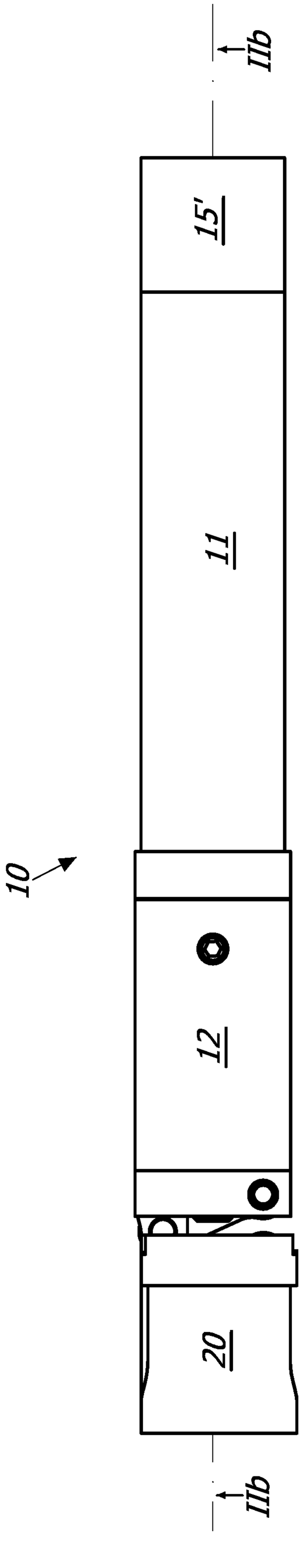

IIb
15'
11
10
12
20
IIb

FIG. 2a

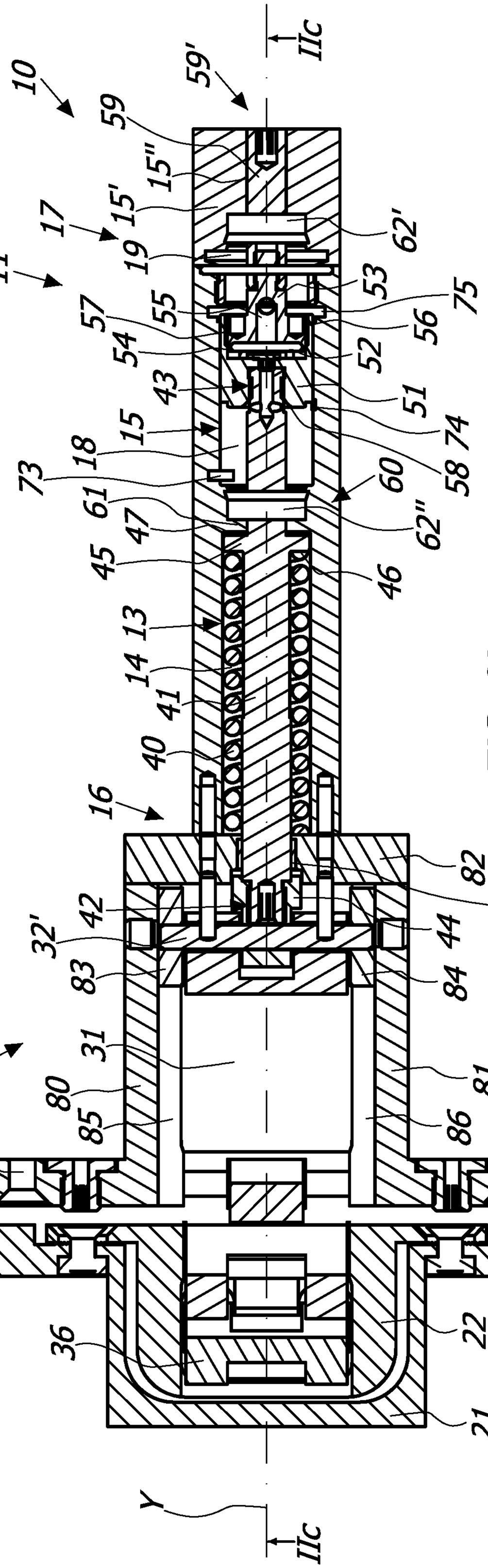

IIc
10
59'
59
15"
15'
17
62'
19
11
53
57
55
75
56
54
52
43
51
15
74
18
58
73
60
61
47
62"
45
46
13
14
41
40
16
82
83
42
44
32'
84
83
31
12
81
89"
80
86
88
85
89'
87
36
22
21
20
Y
IIc

FIG. 2b

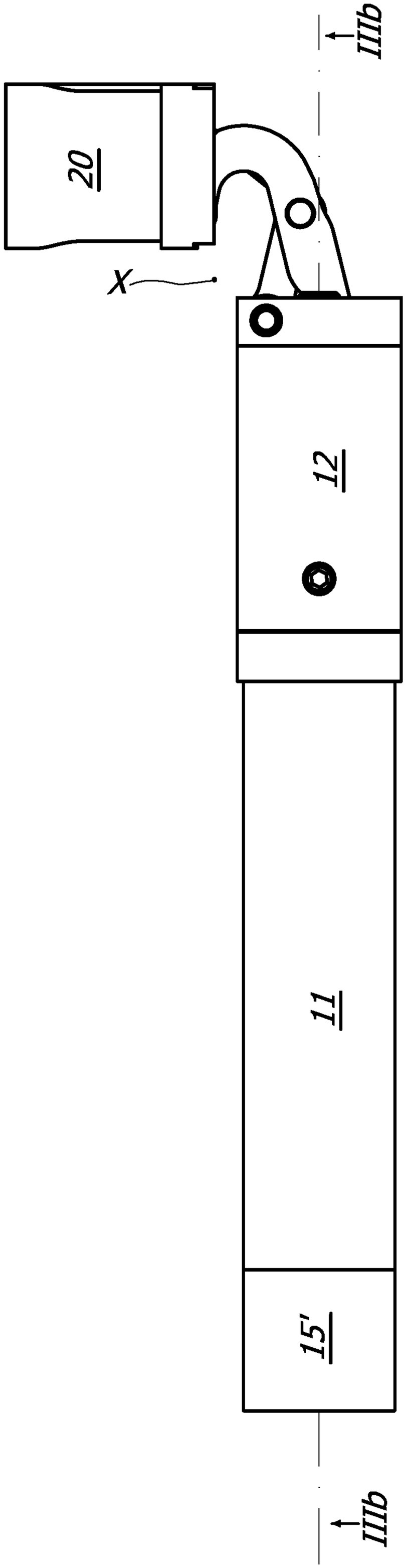

IIIb
20
X
12
11
15'
IIIb

FIG. 3a

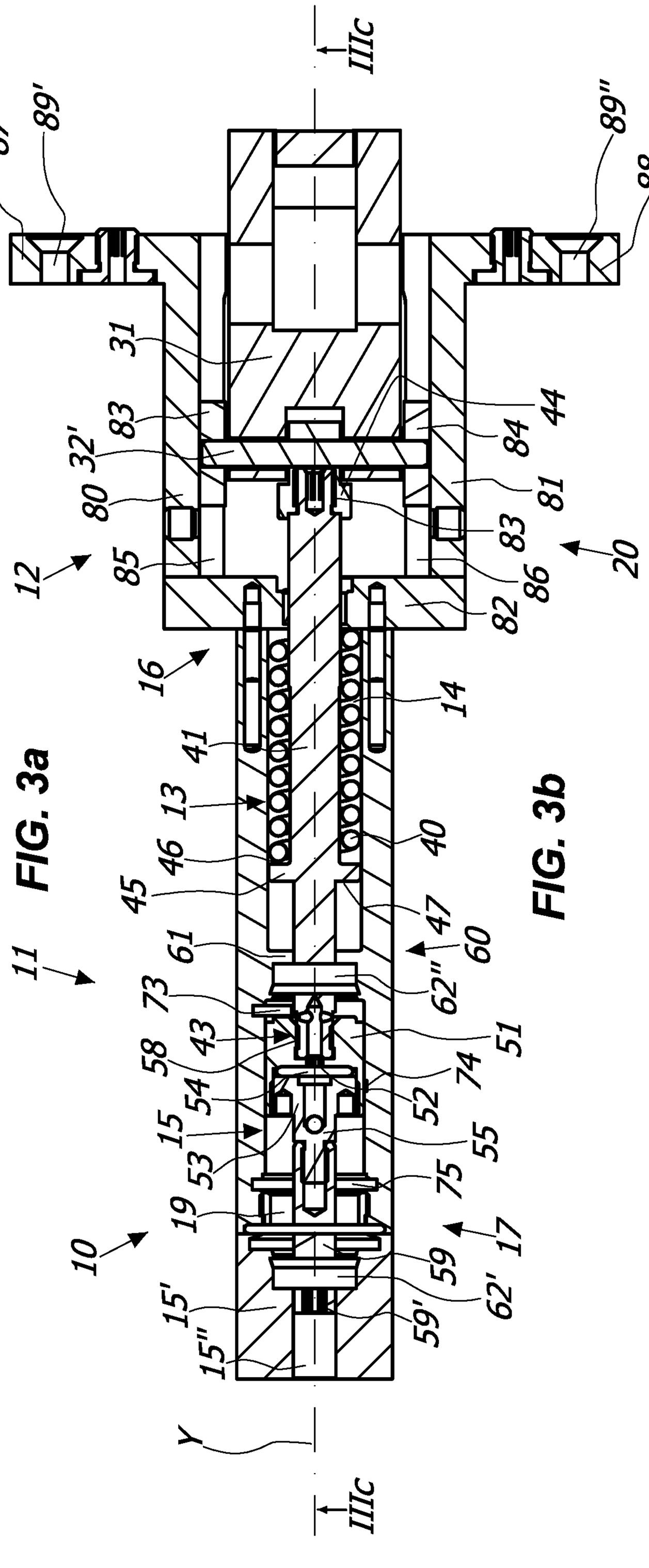

IIIc
87
89'
89"
88
31
83
32'
80
44
84
81
83
20
12
85
86
82
16
14
41
13
46
45
40
61
47
60
62"
73
43
58
54
51
74
52
15
53
55
19
75
10
17
59
15'
62'
59'
15"
Y
IIIc

FIG. 3b

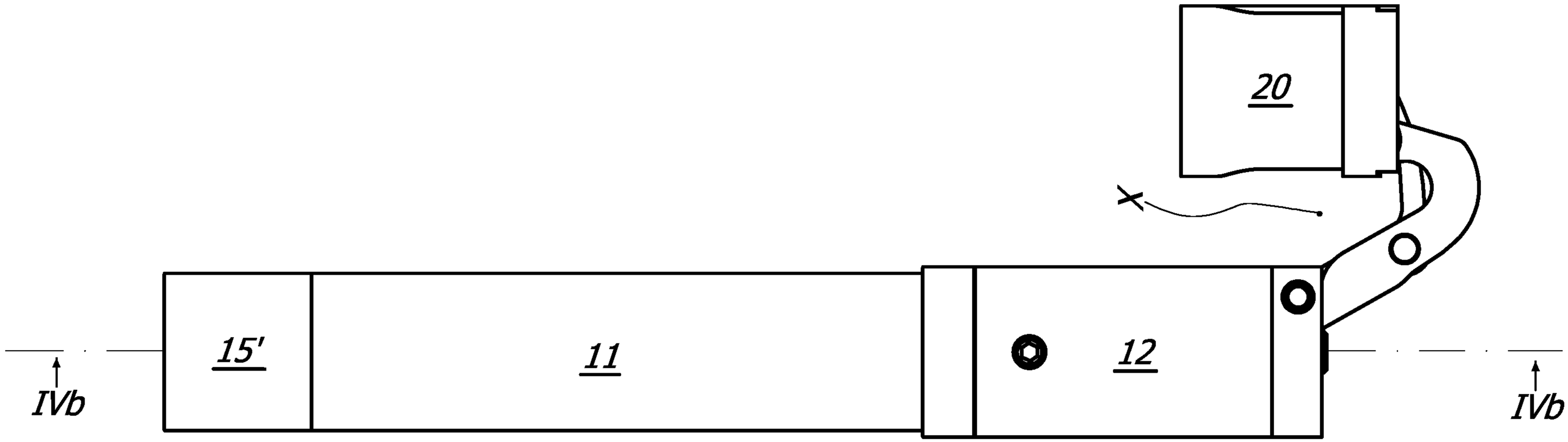


FIG. 4a

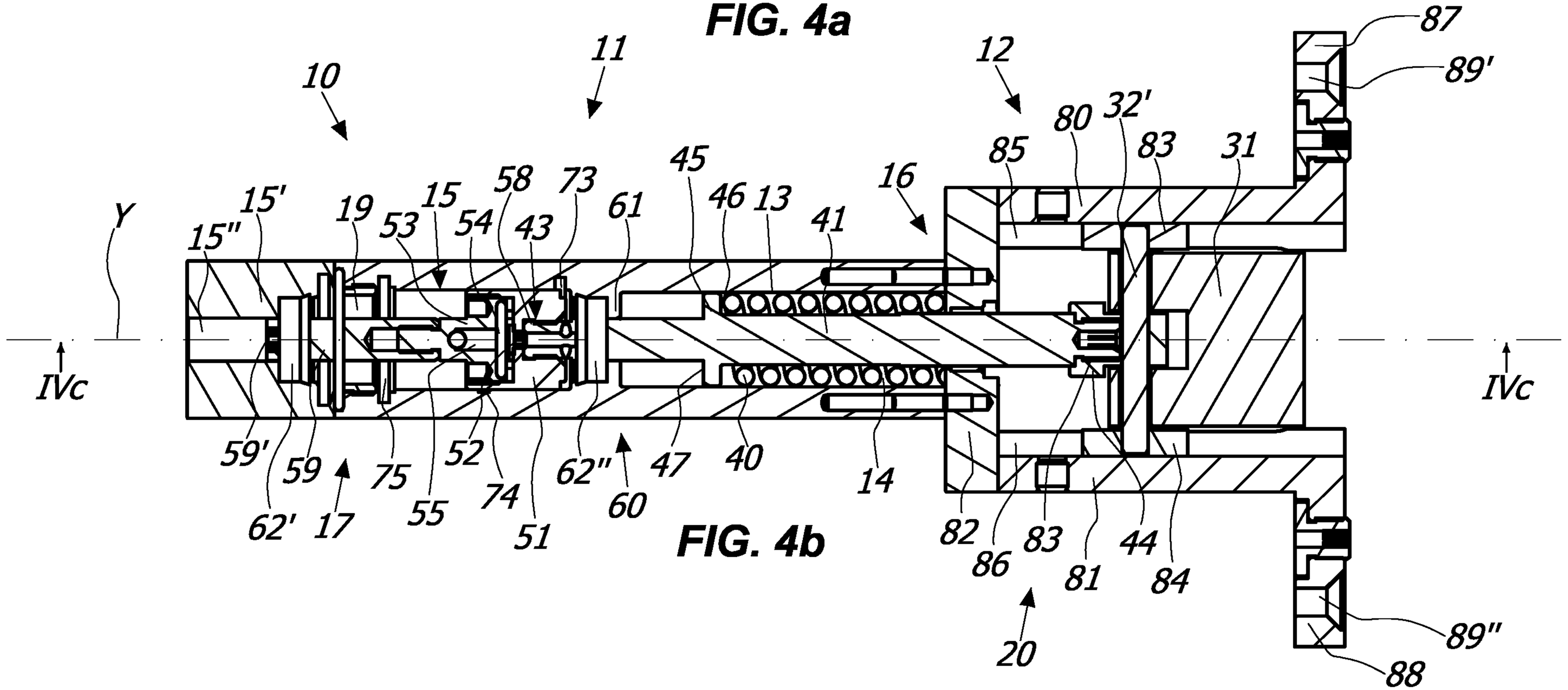


FIG. 4b

CA 02980516 2017-09-21

PCT/IB2016/051708

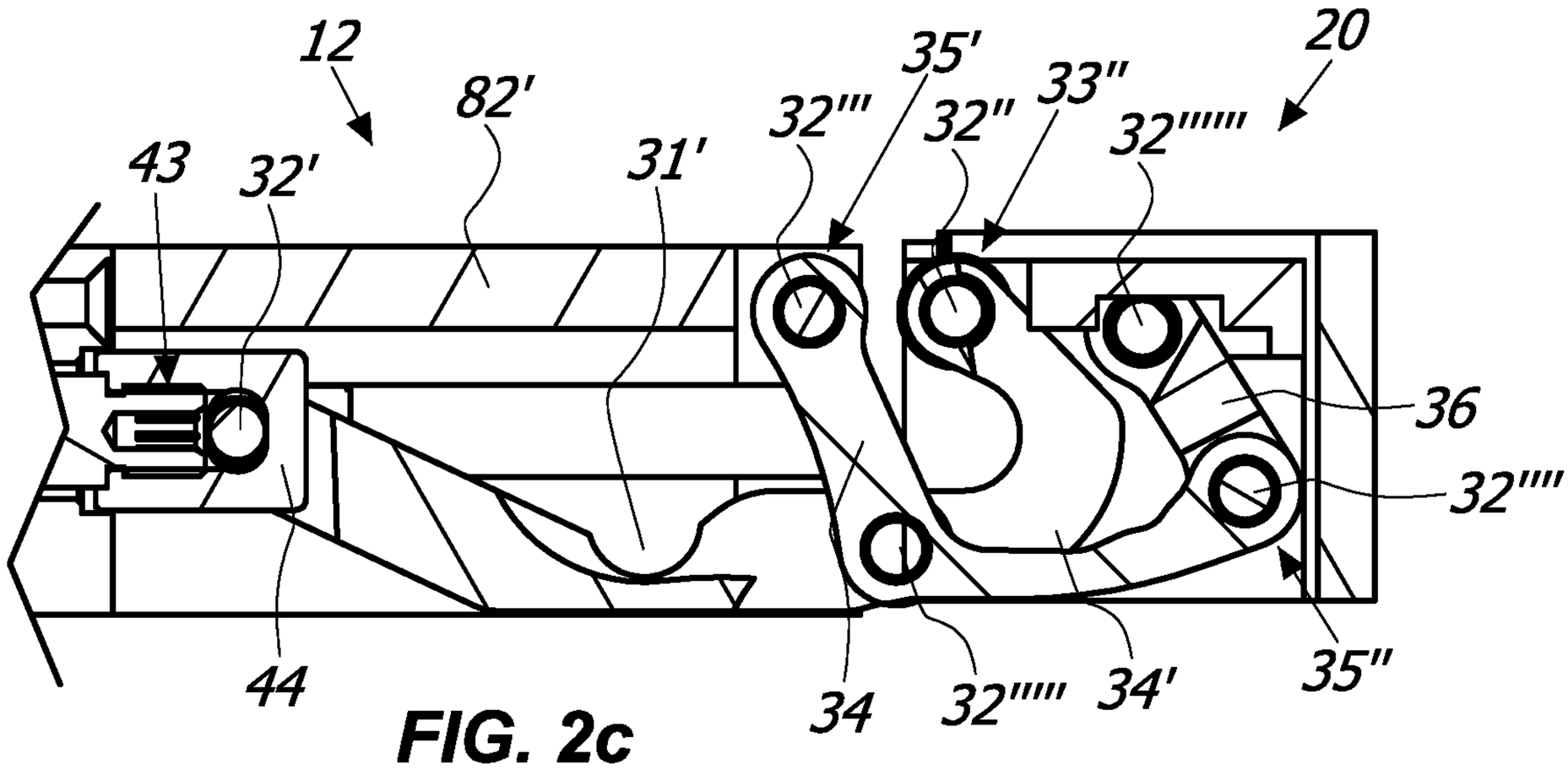


FIG. 2c

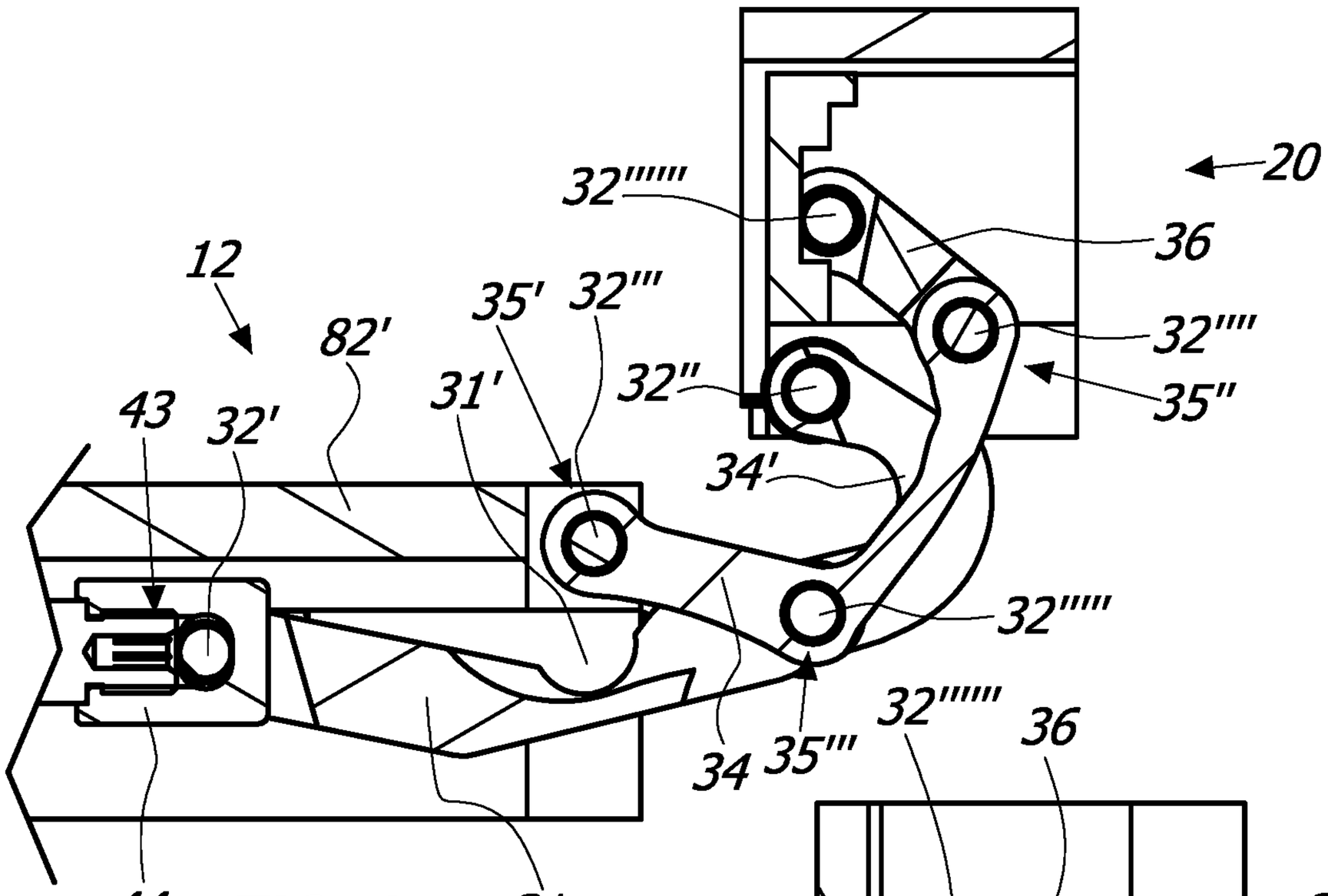


FIG. 3c

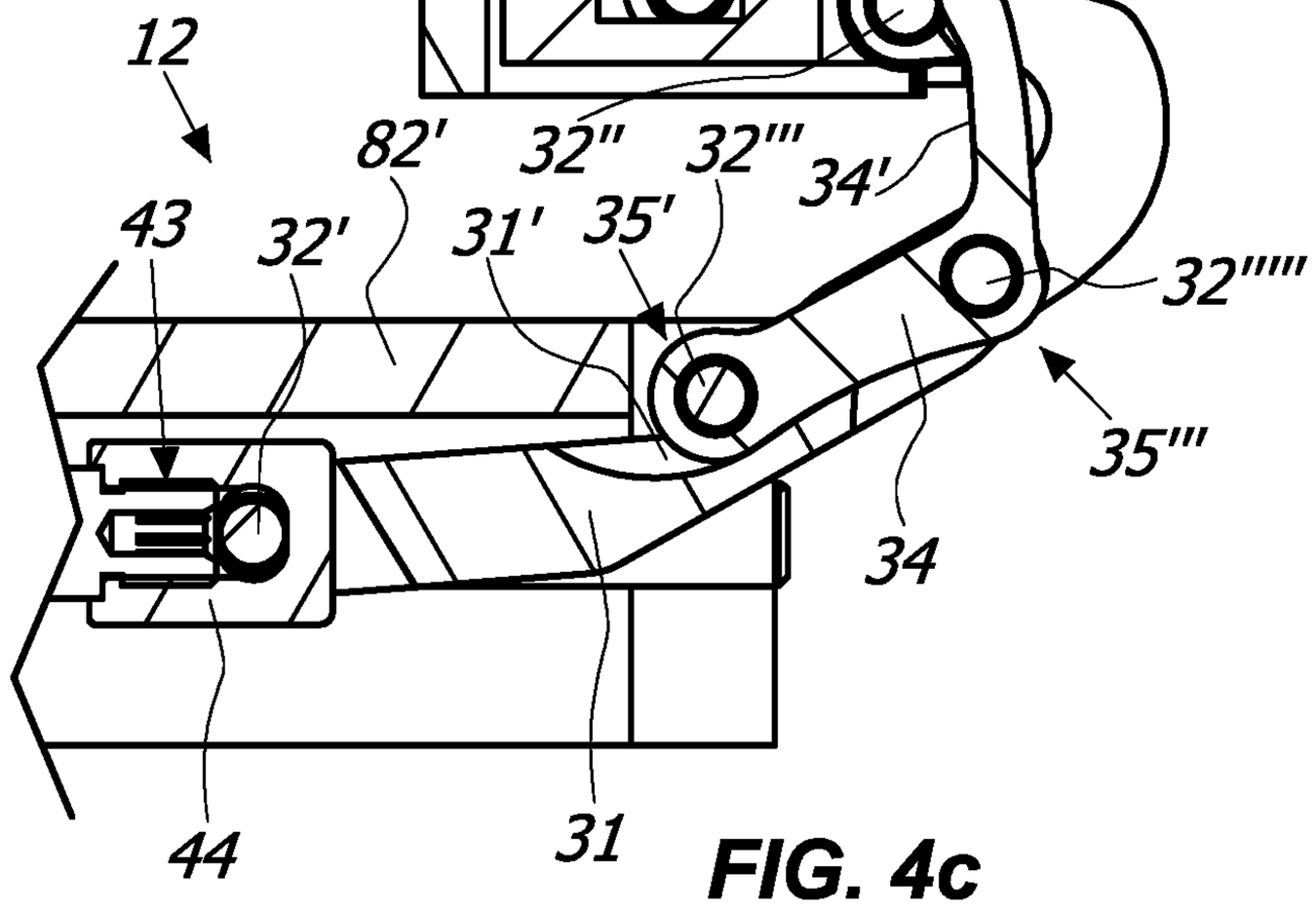


FIG. 4c

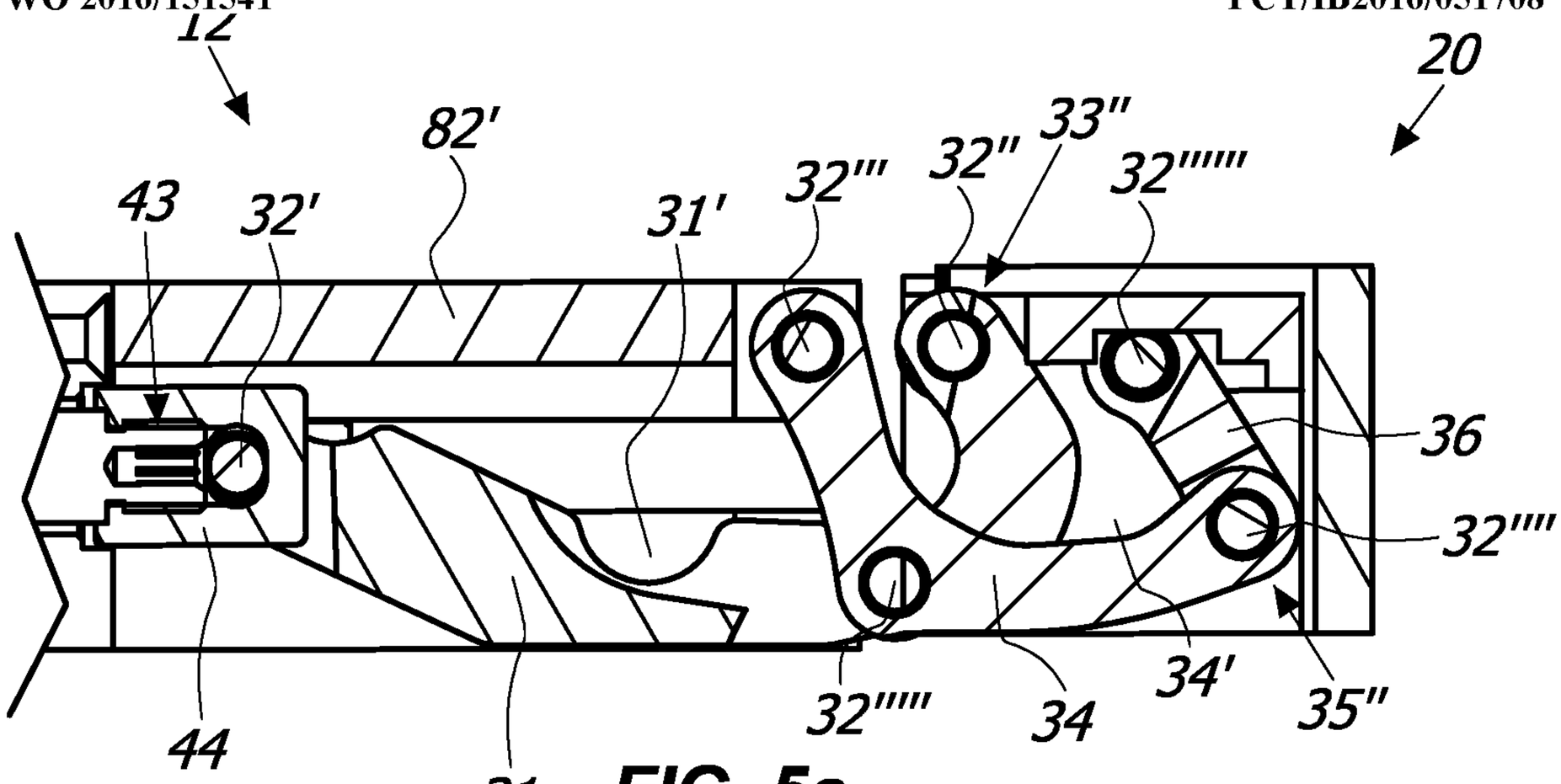


FIG. 5a

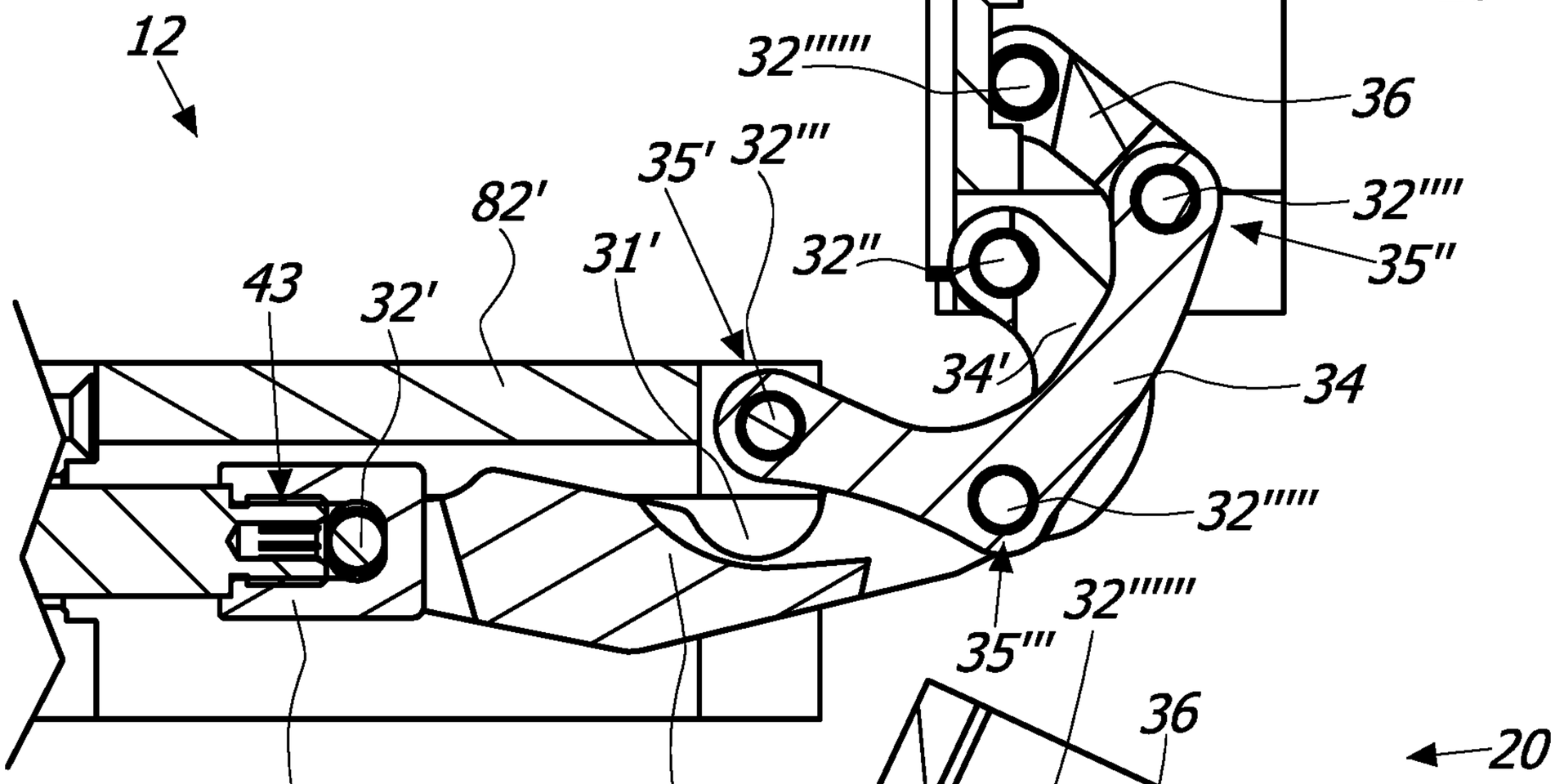


FIG. 5b

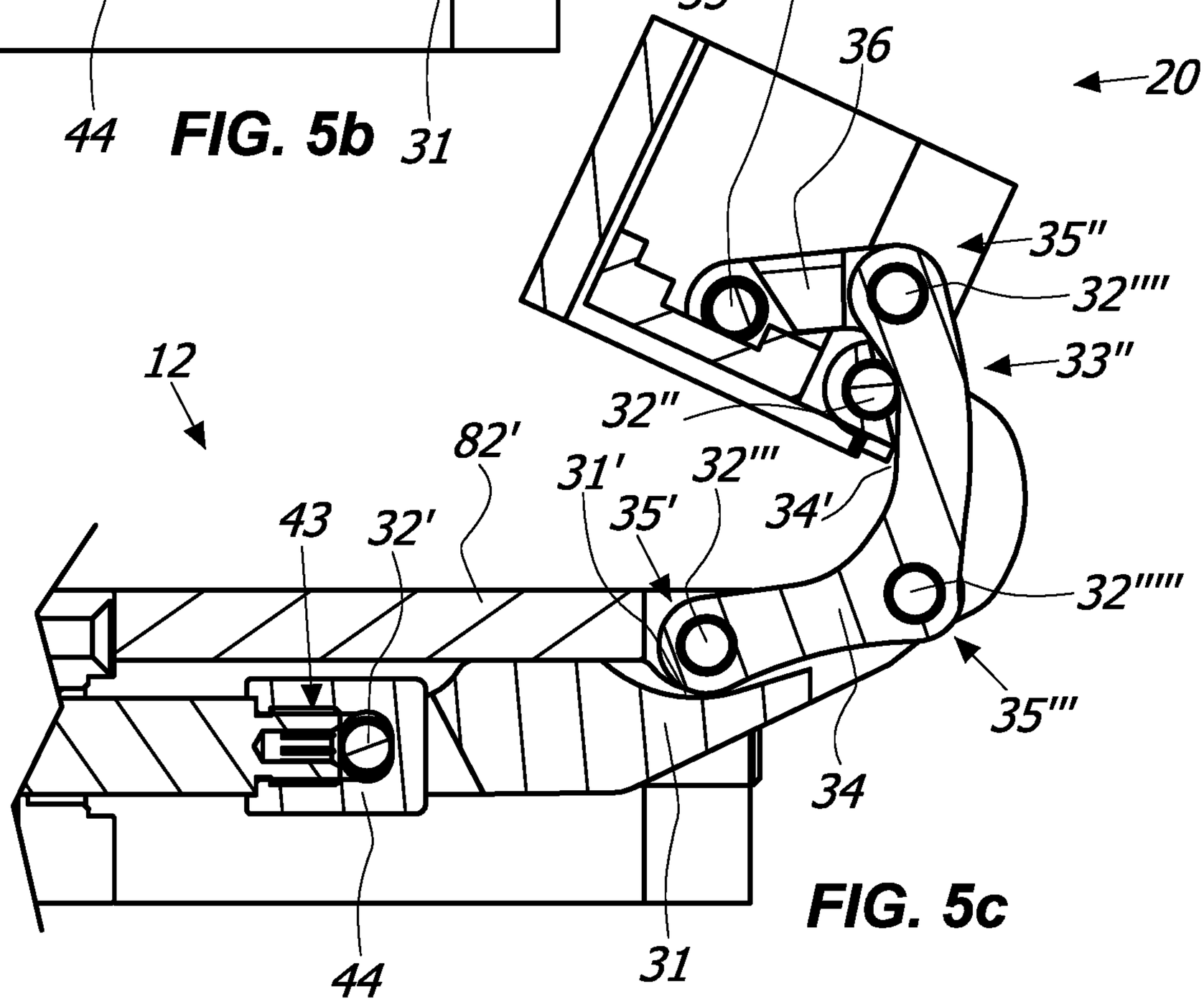


FIG. 5c

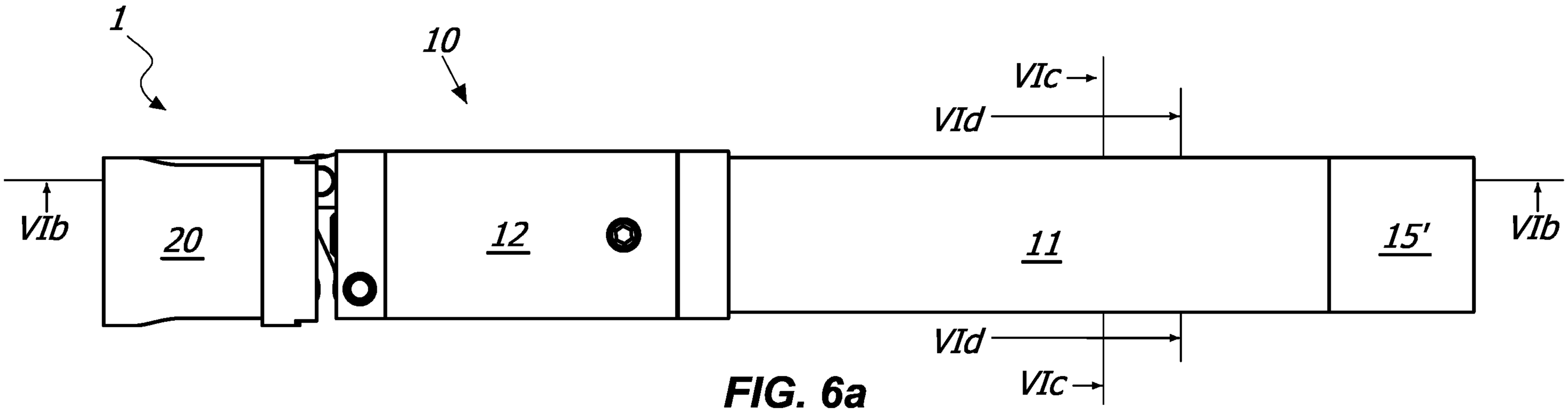


FIG. 6a

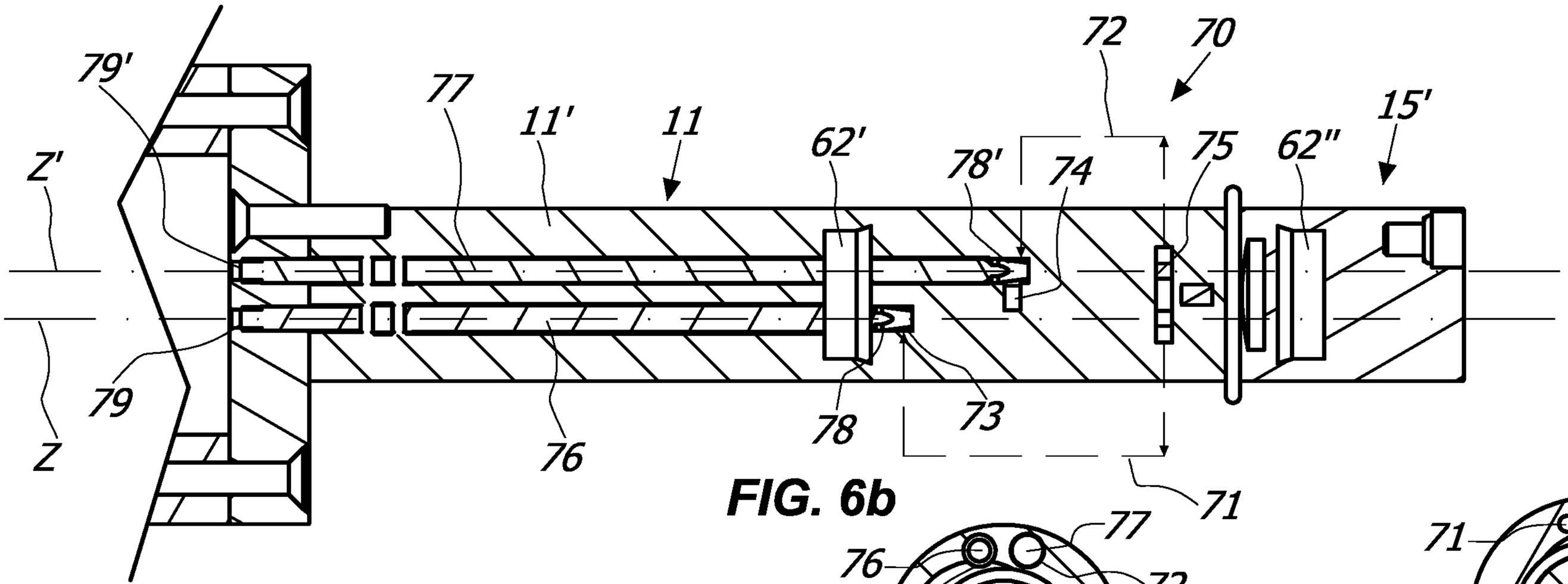


FIG. 6b

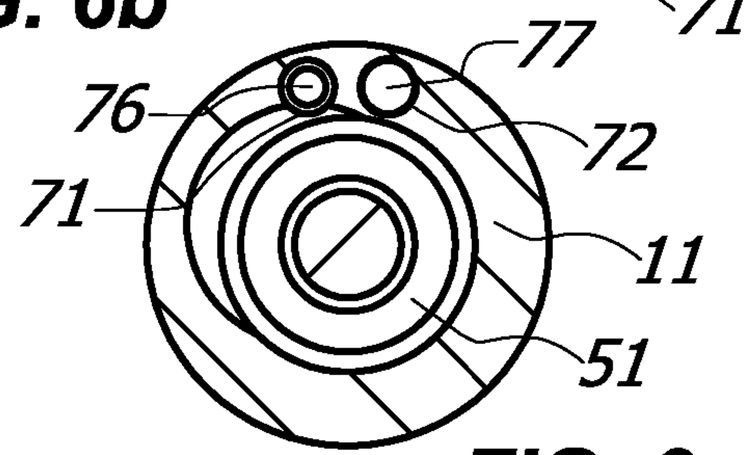


FIG. 6c

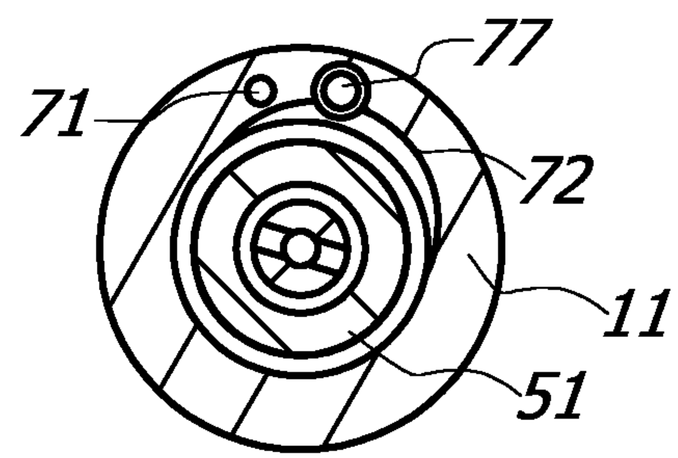


FIG. 6d

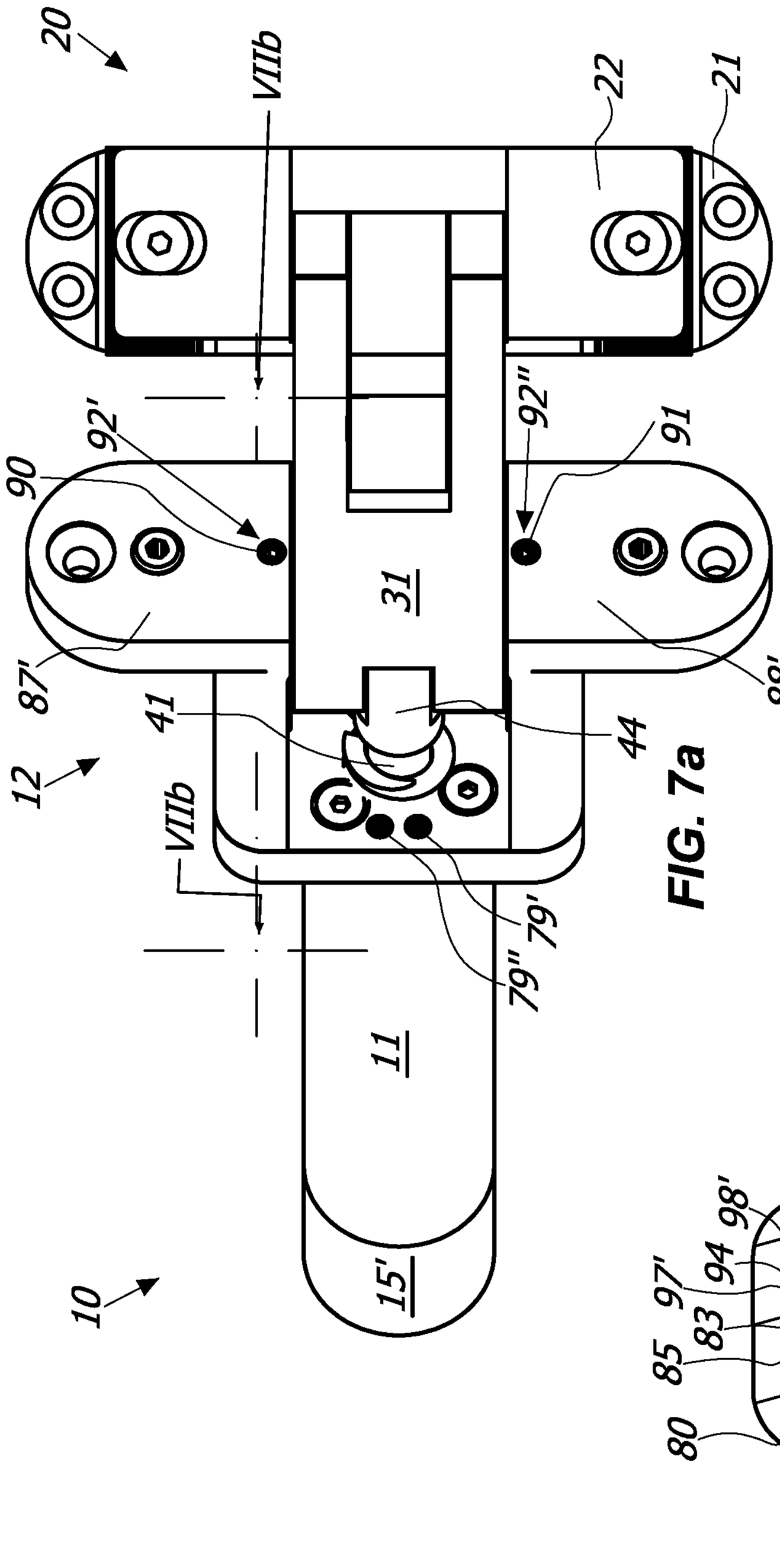


FIG. 7a

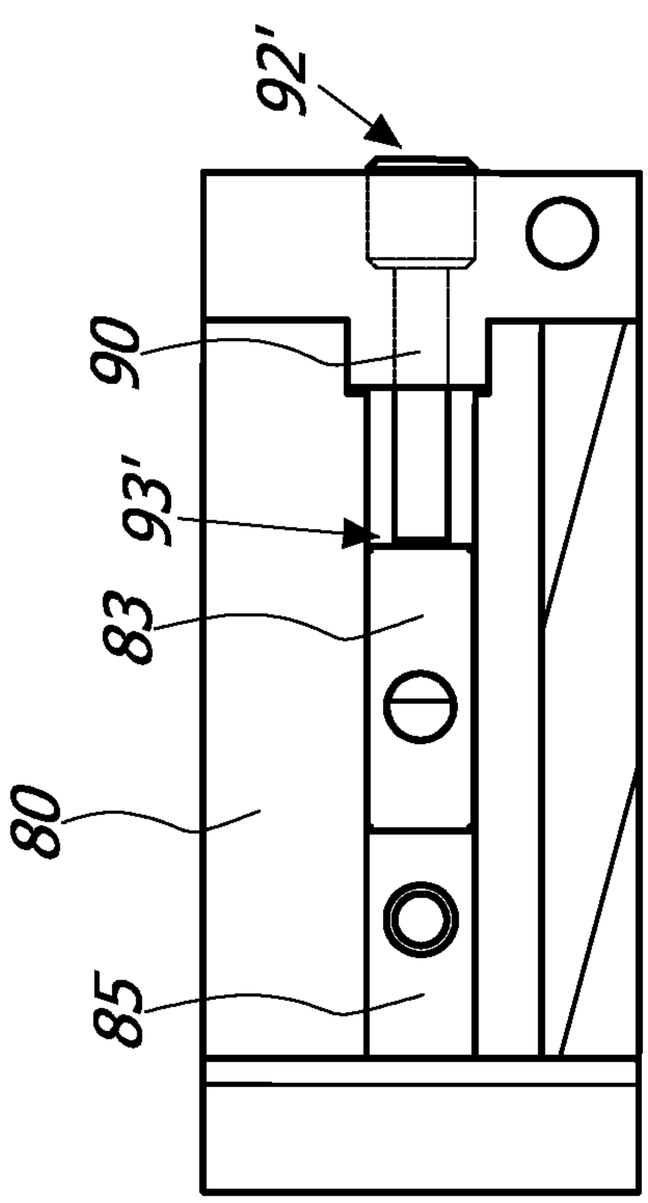


FIG. 7c

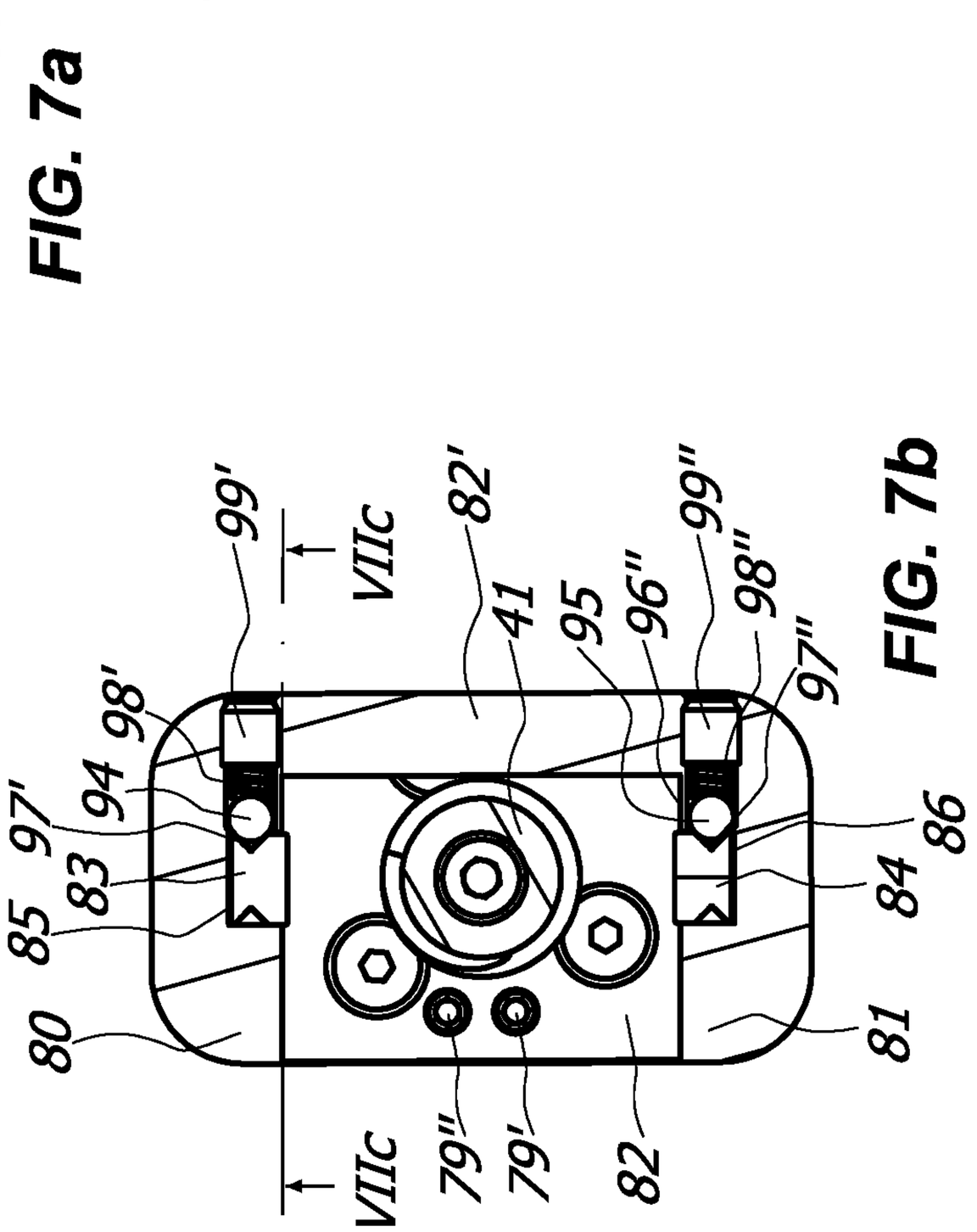
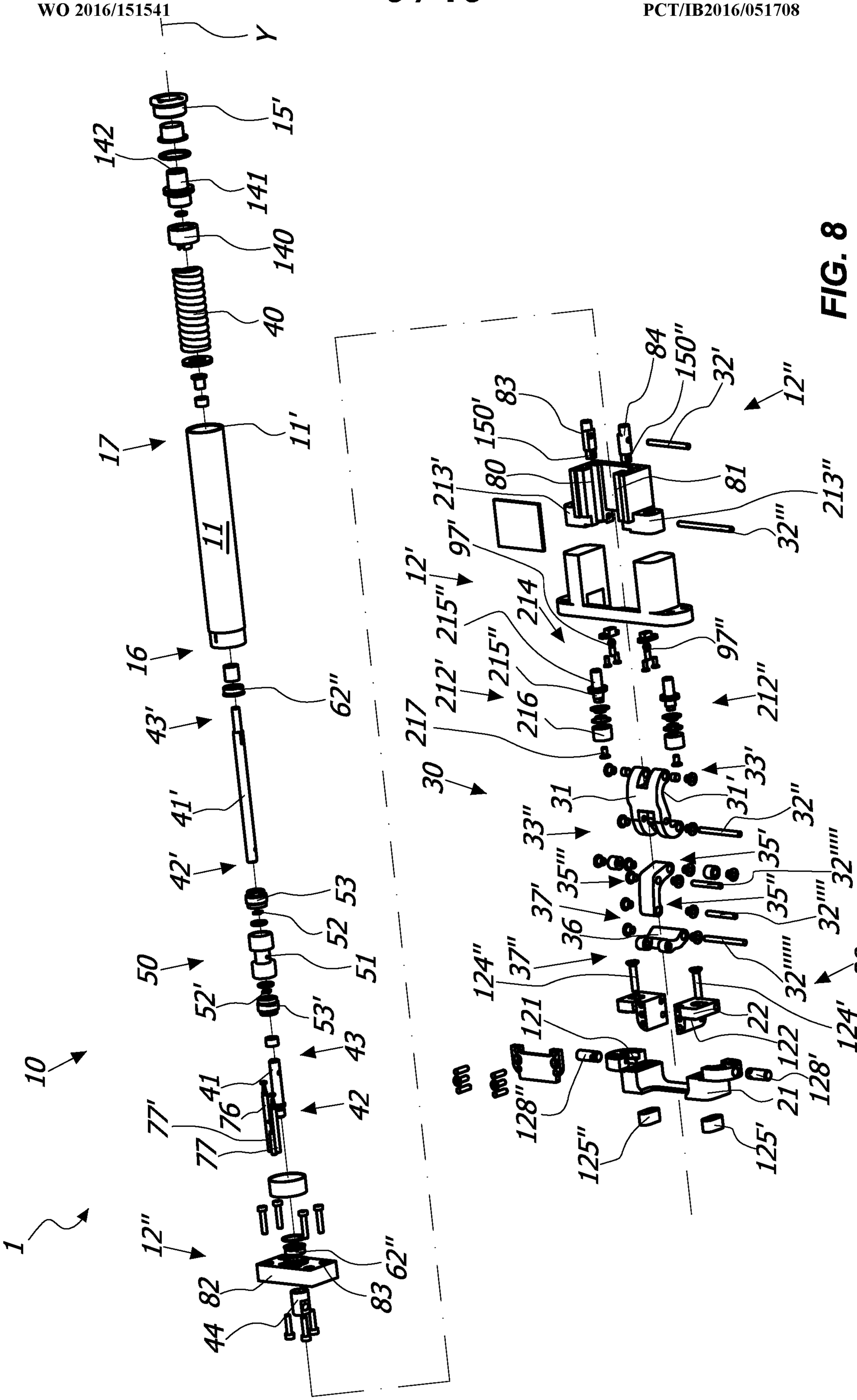


FIG. 7b


Y
15'
142
141
140
40
11'
17
11
16
62"
43'
41'
42'
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51
50
52'
53'
43
10
77'
41
76
77
42
1
12"
82
44
62"
83
12'
97'
213'
80
150'
83
84
150"
32'
12"
81
213"
32'''
215"
214
212'
215'
216
217
97"
212"
30
33"
31
31'
33'
32"
37'
35'''
35'
36
35"
32''''
32'''''
124"
37"
32'''''
20
121
22
124'
128"
125"
21
122
128'
125'

FIG. 8

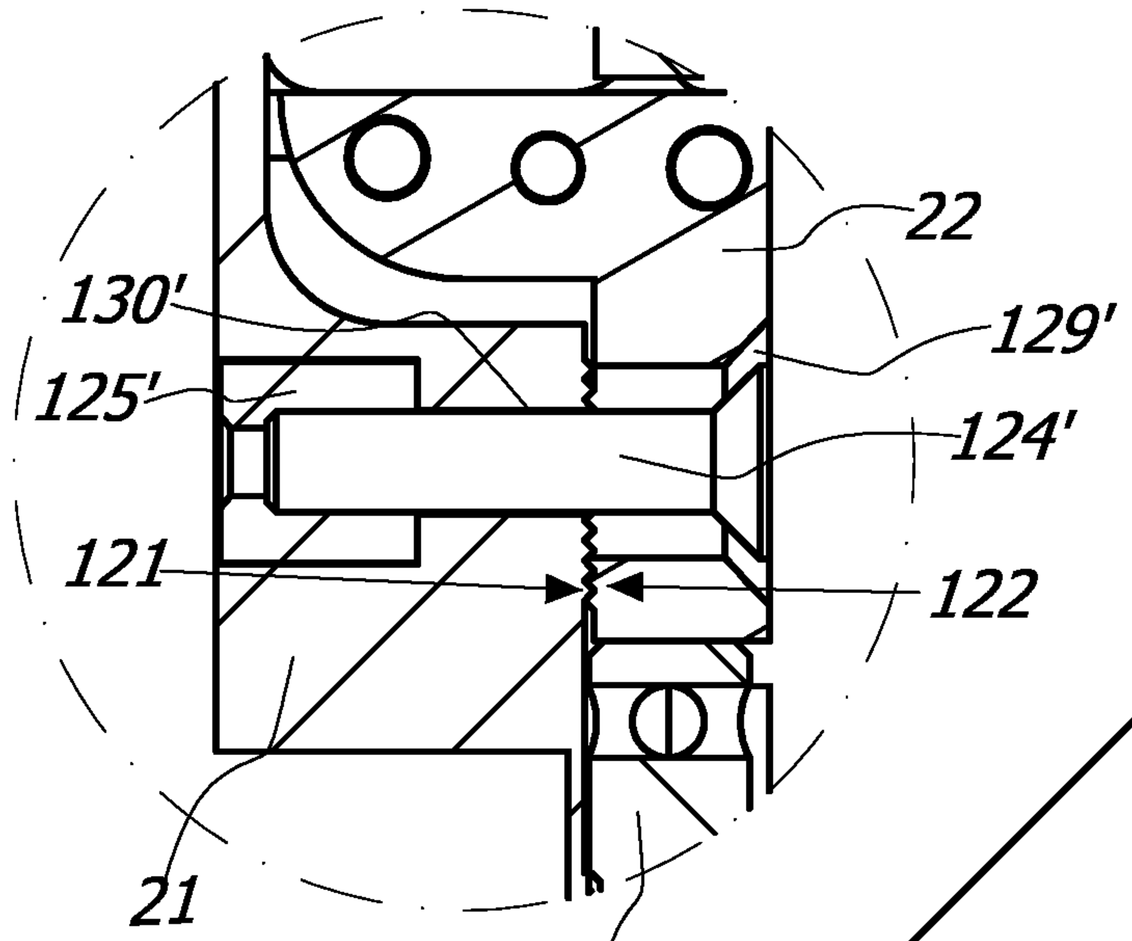


FIG. 9d

FIG. 9a

FIG. 9b

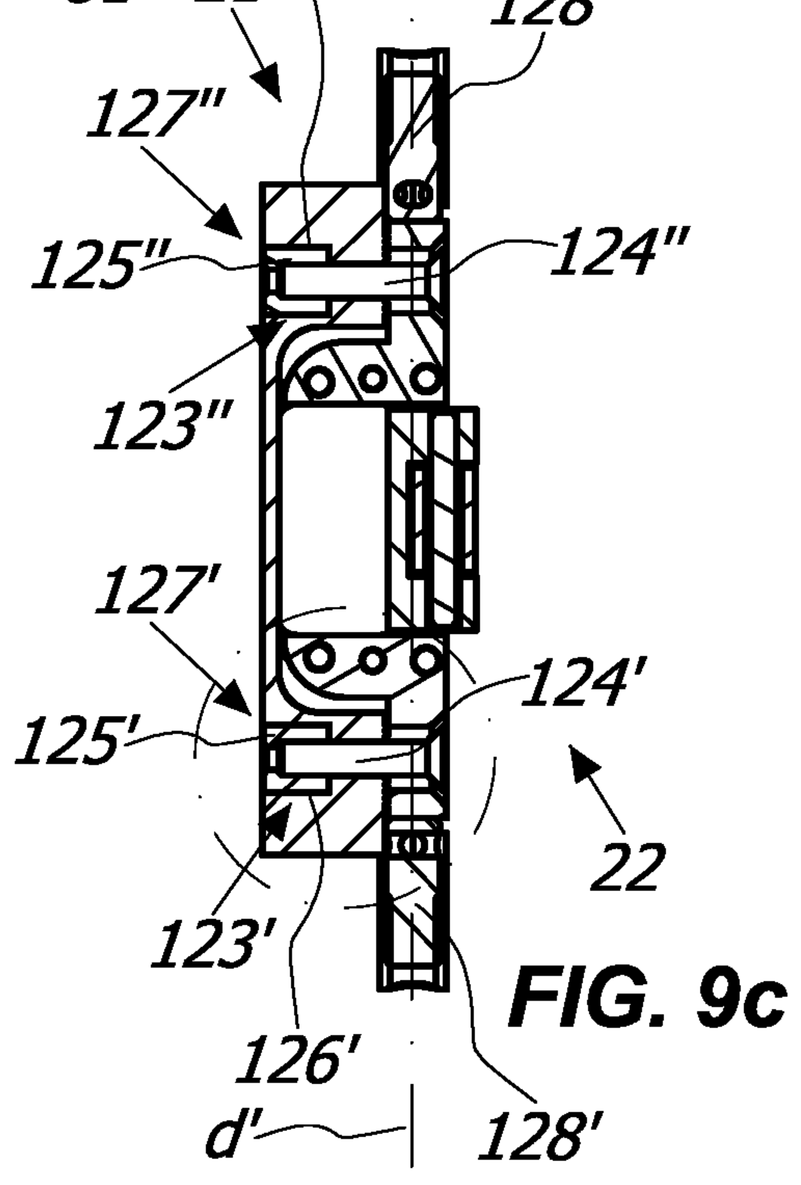


FIG. 9c

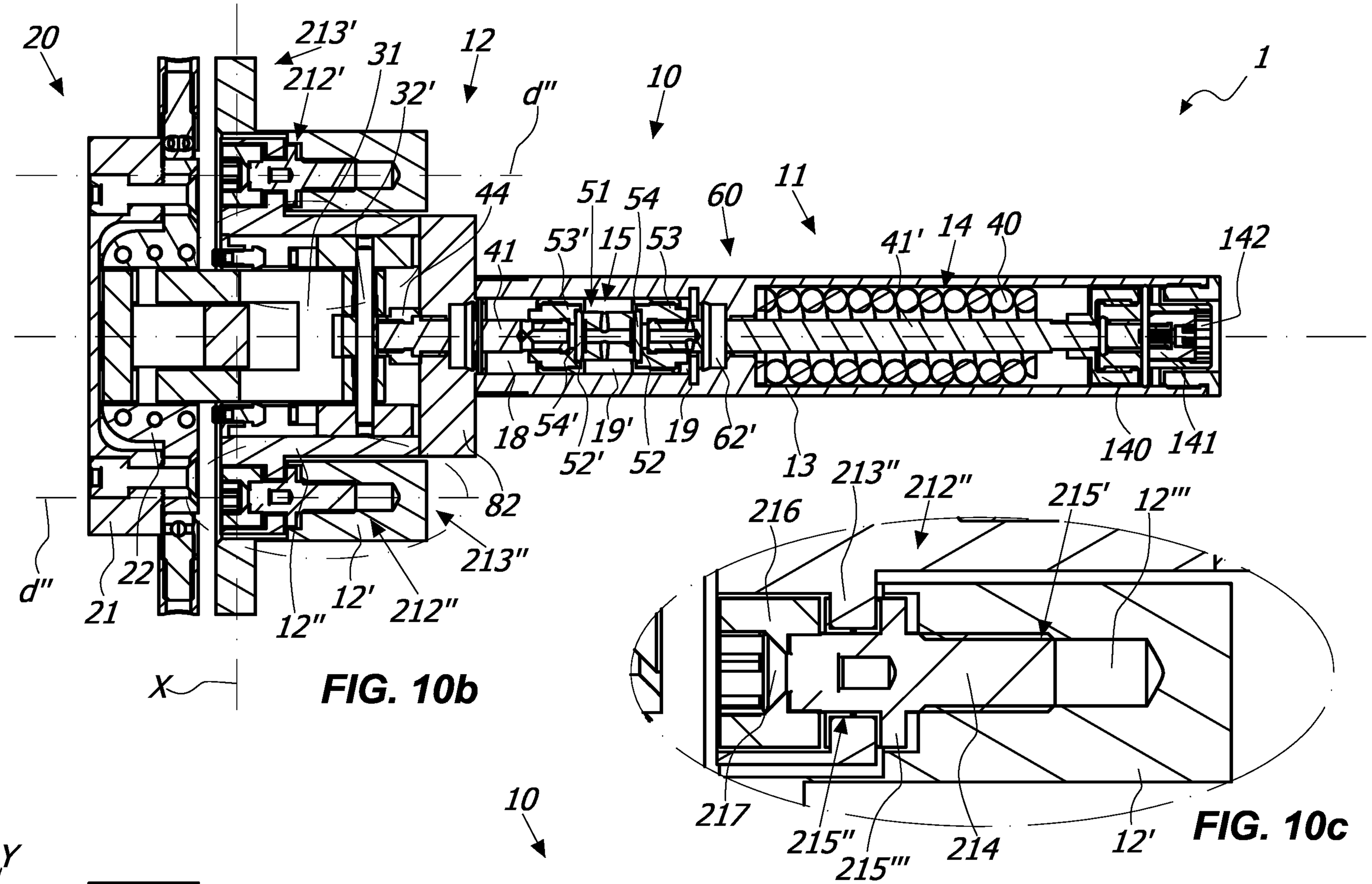


FIG. 10b

FIG. 10c

FIG. 10a

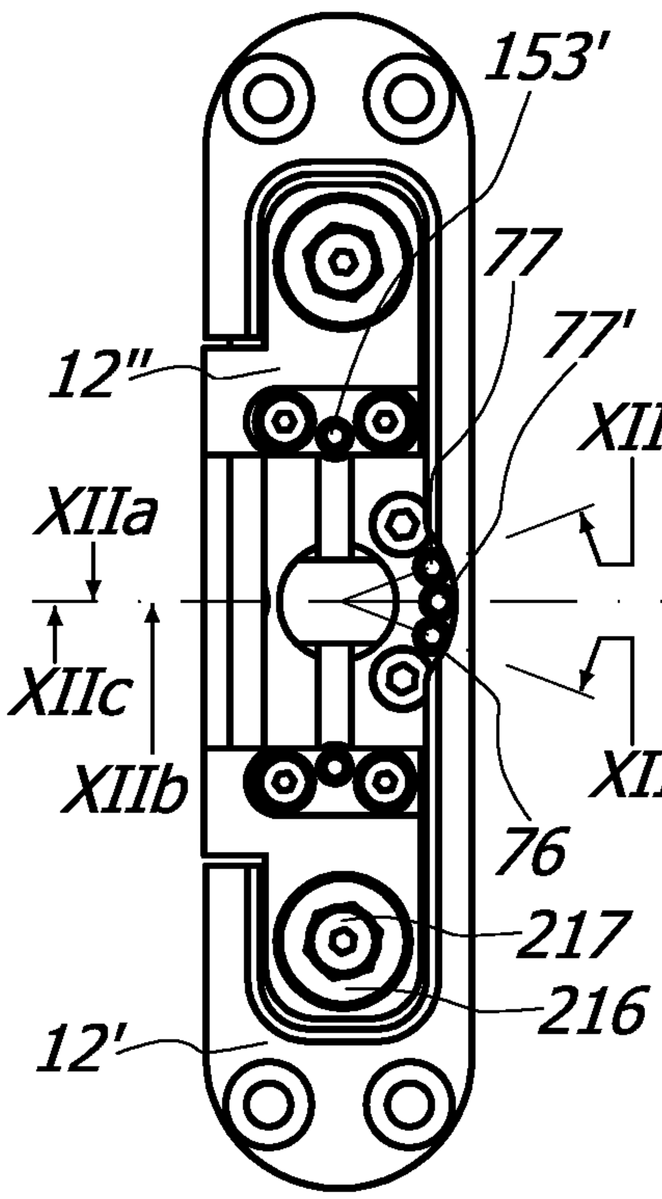


FIG. 11

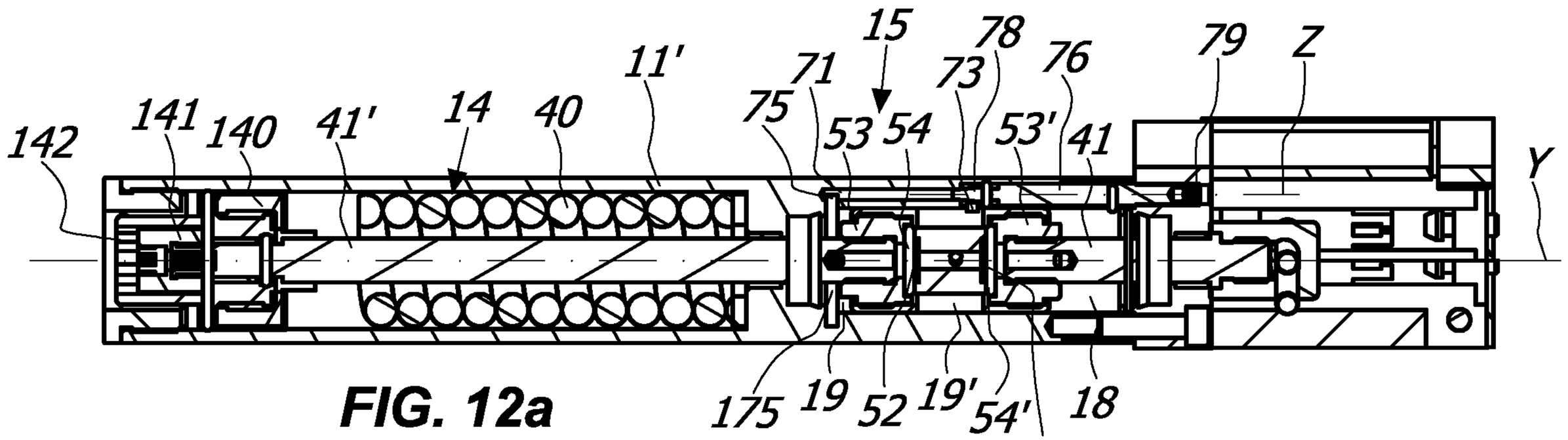


FIG. 12a

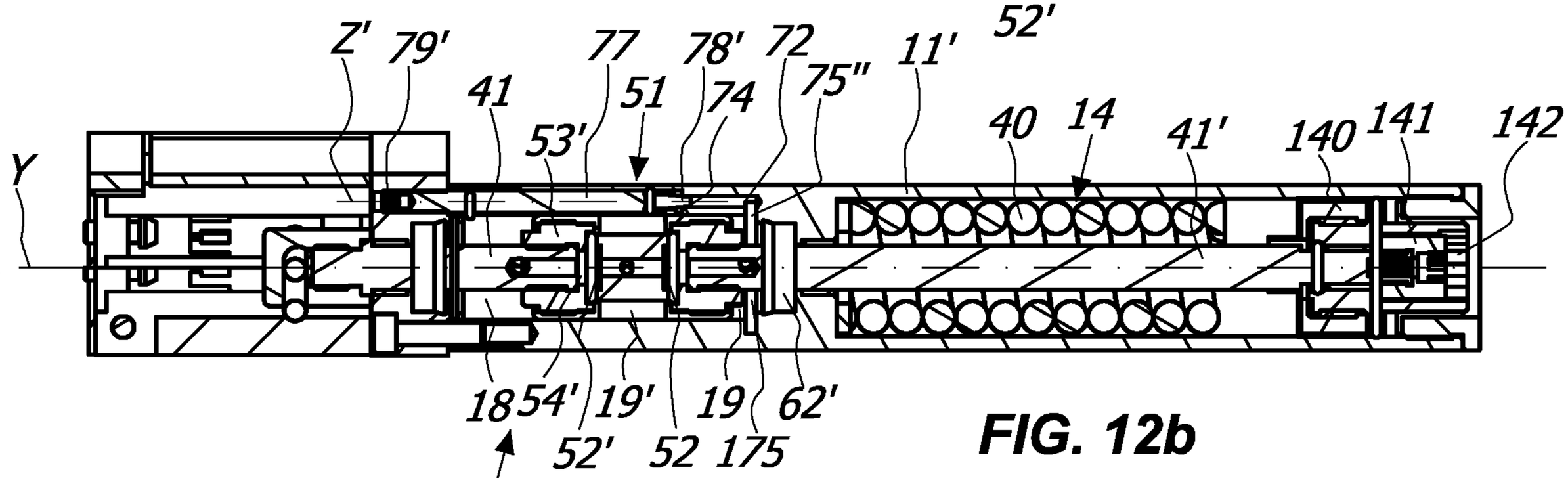


FIG. 12b

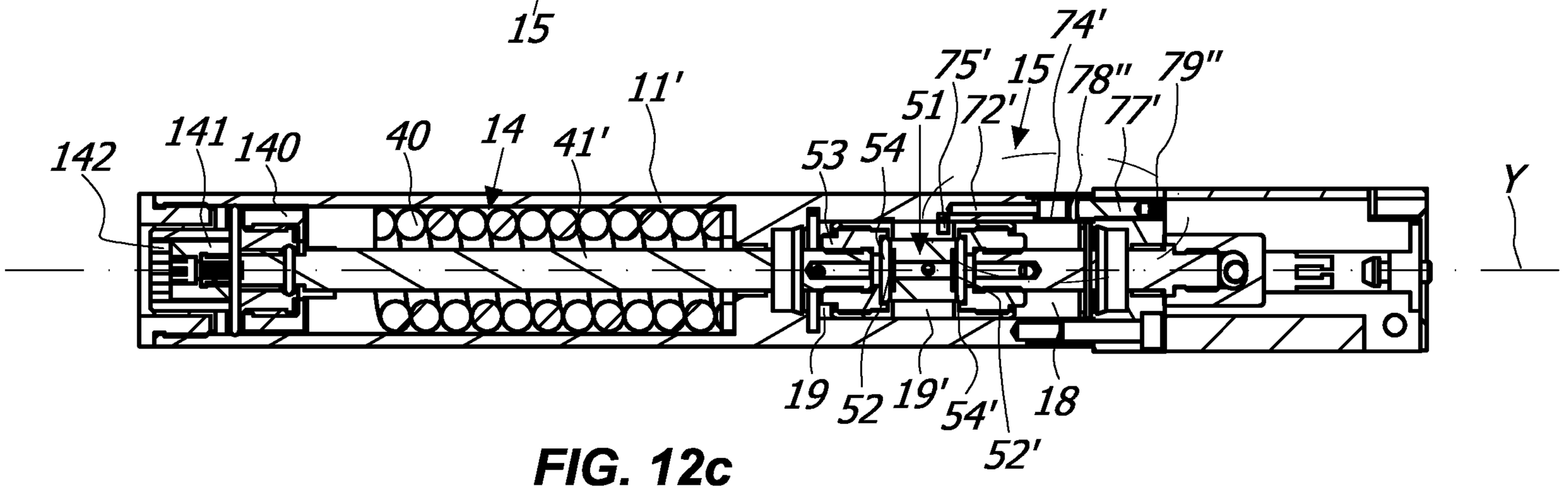


FIG. 12c

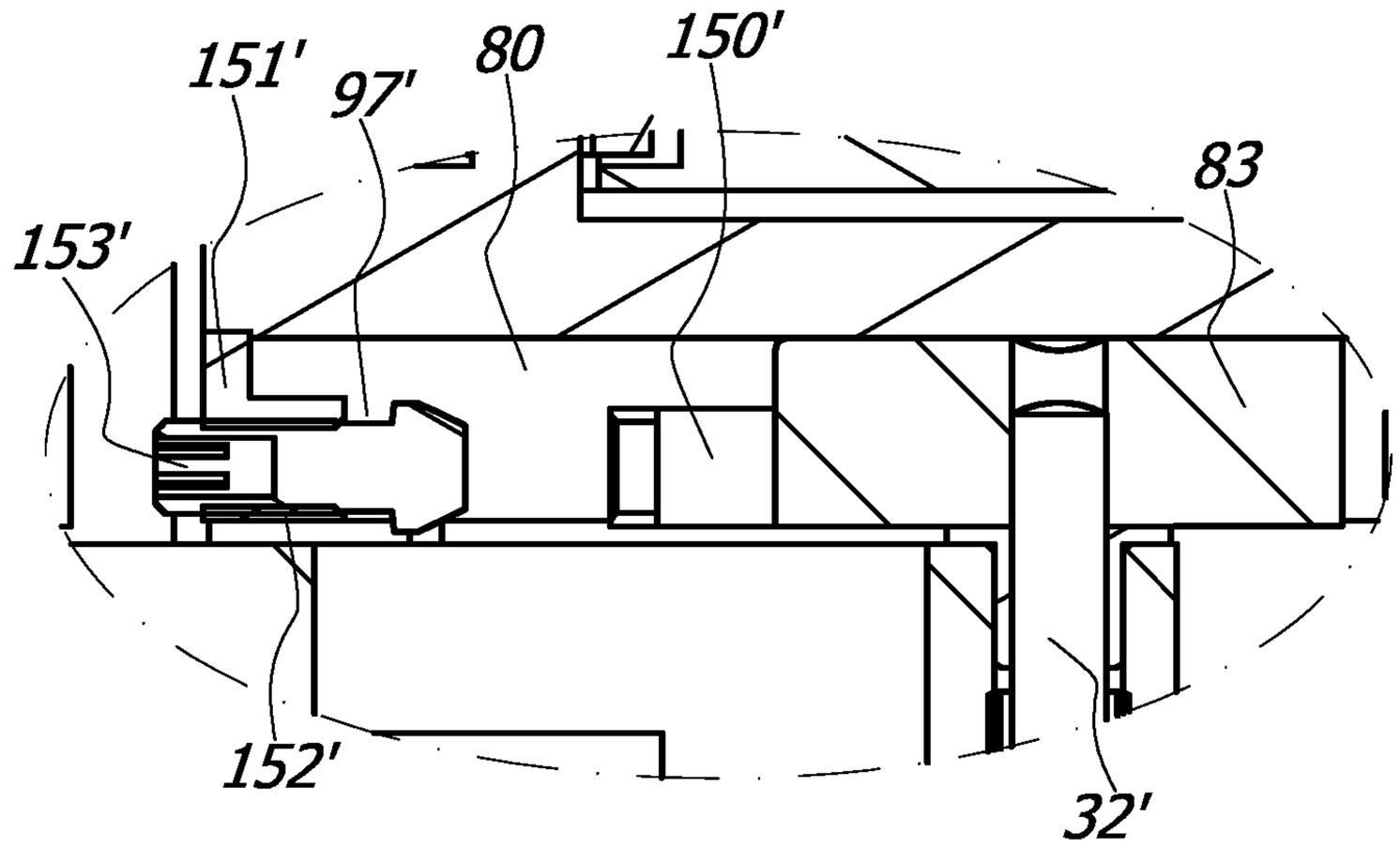


FIG. 10d

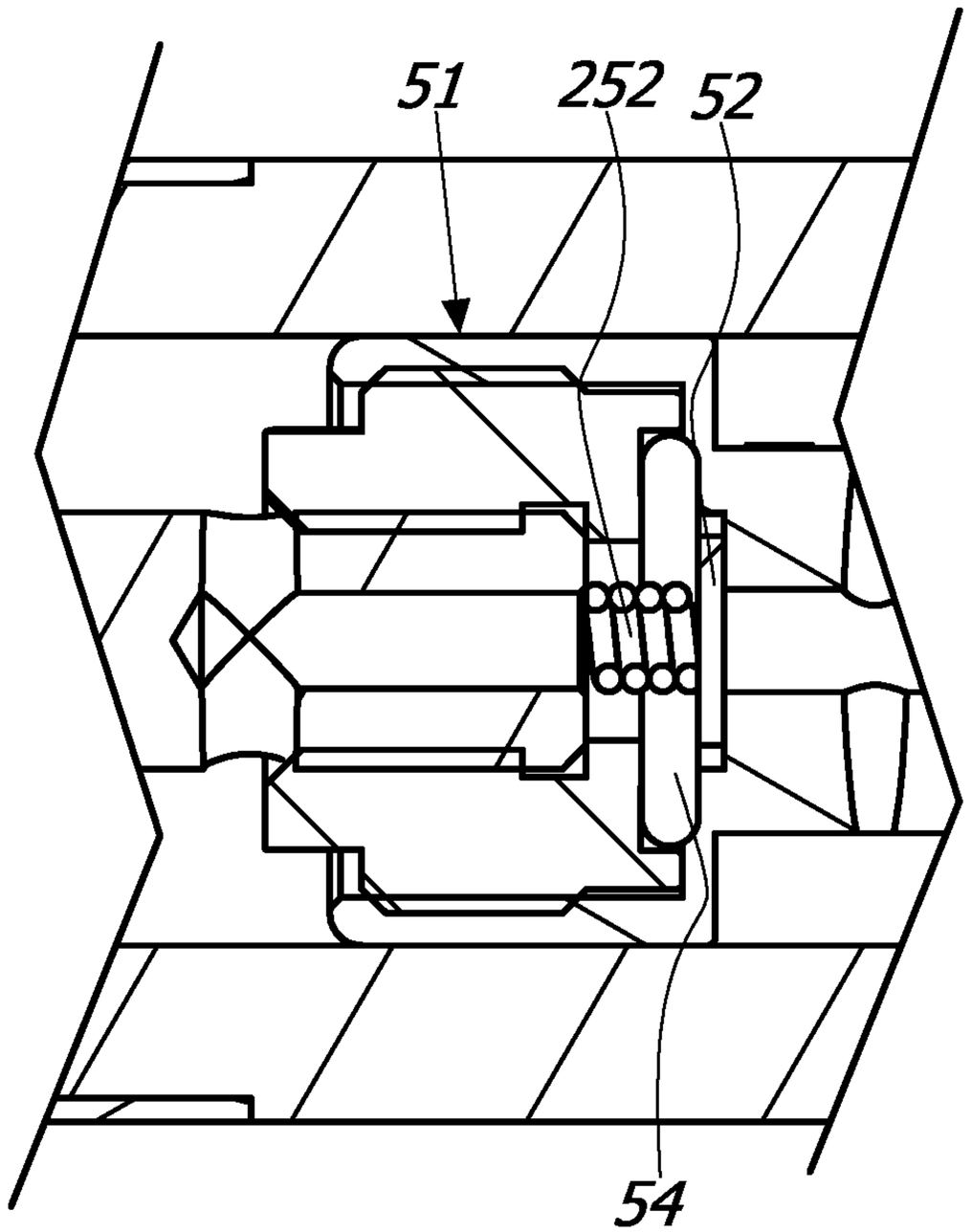


FIG. 13

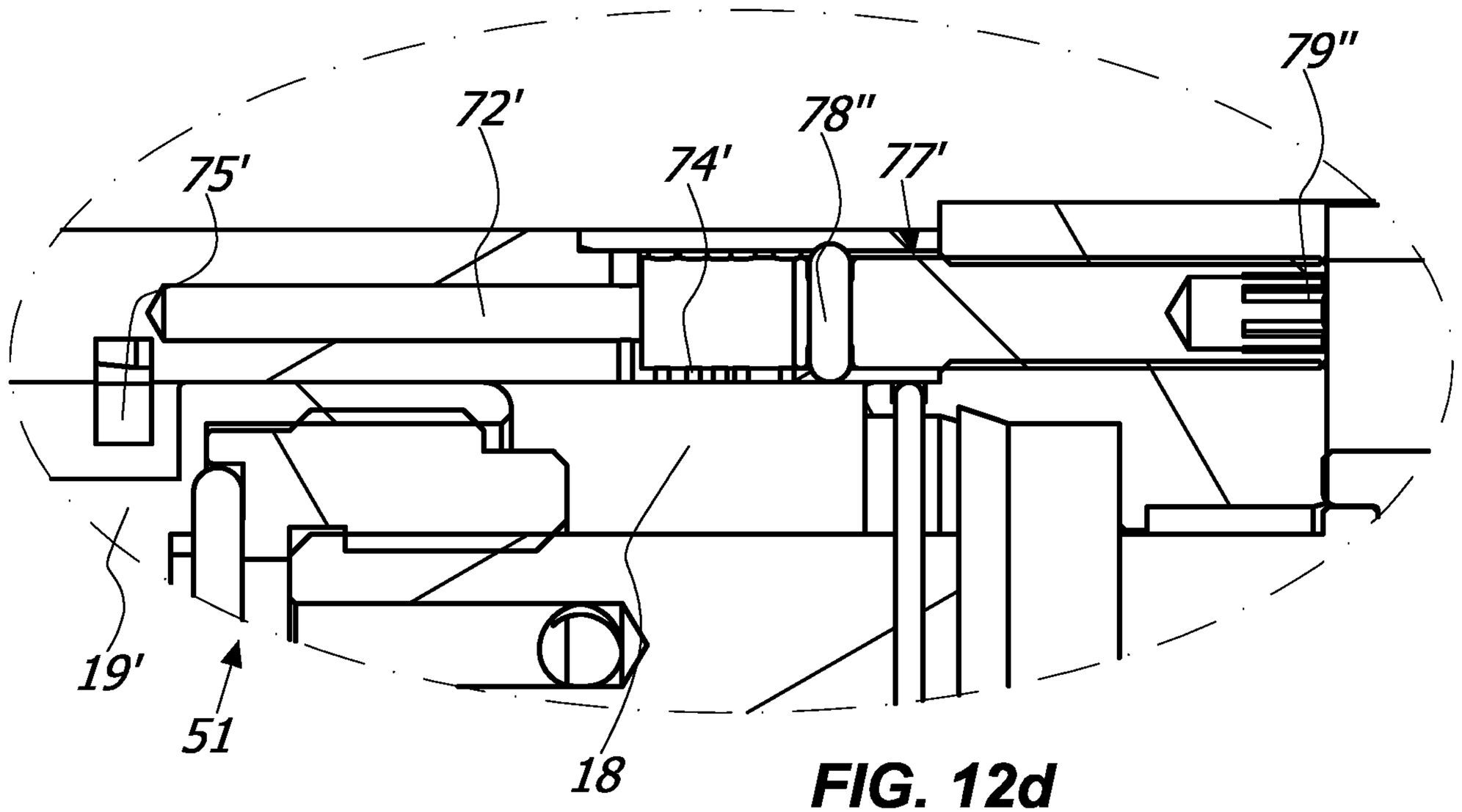


FIG. 12d

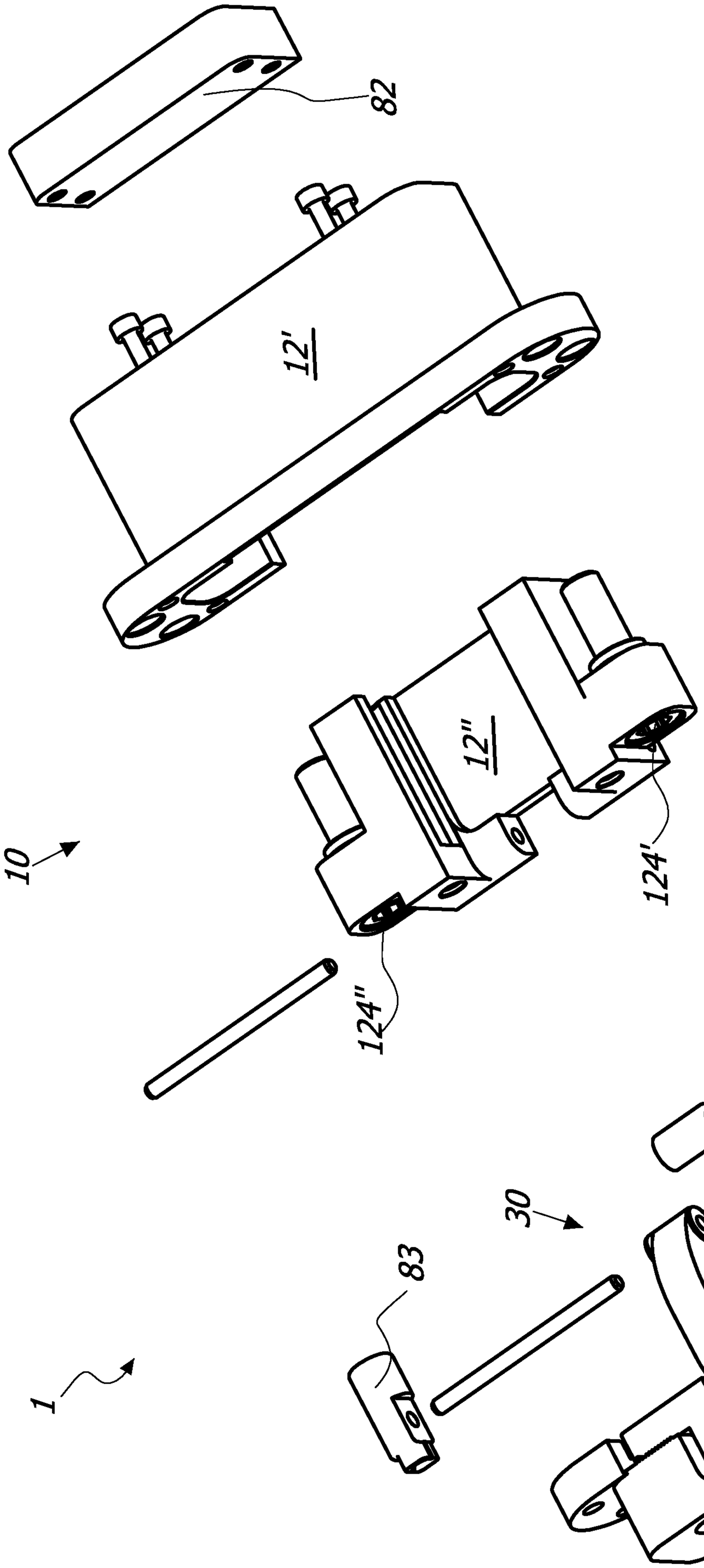


FIG. 14

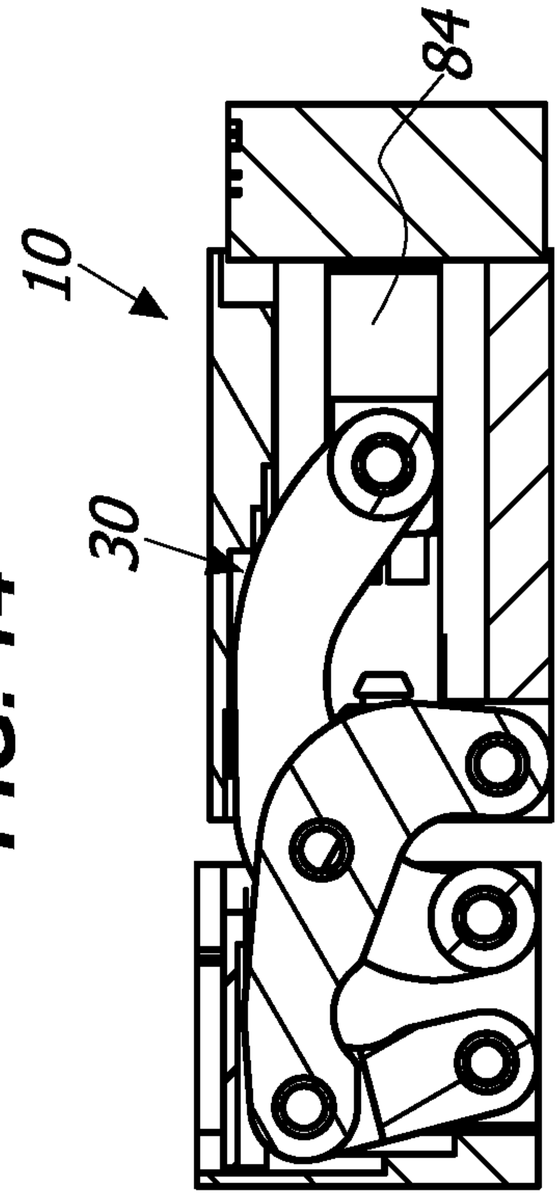


FIG. 15

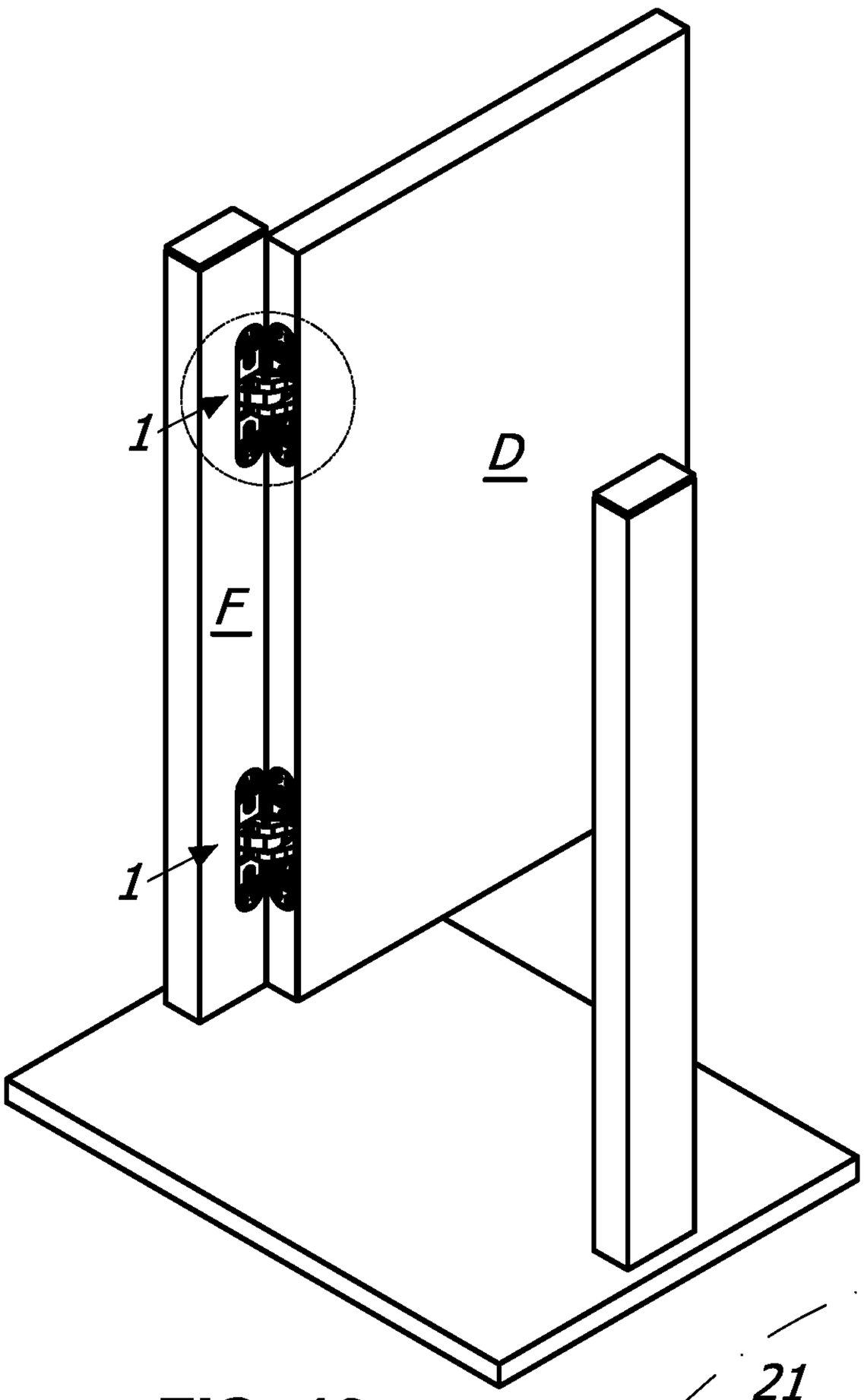


FIG. 16

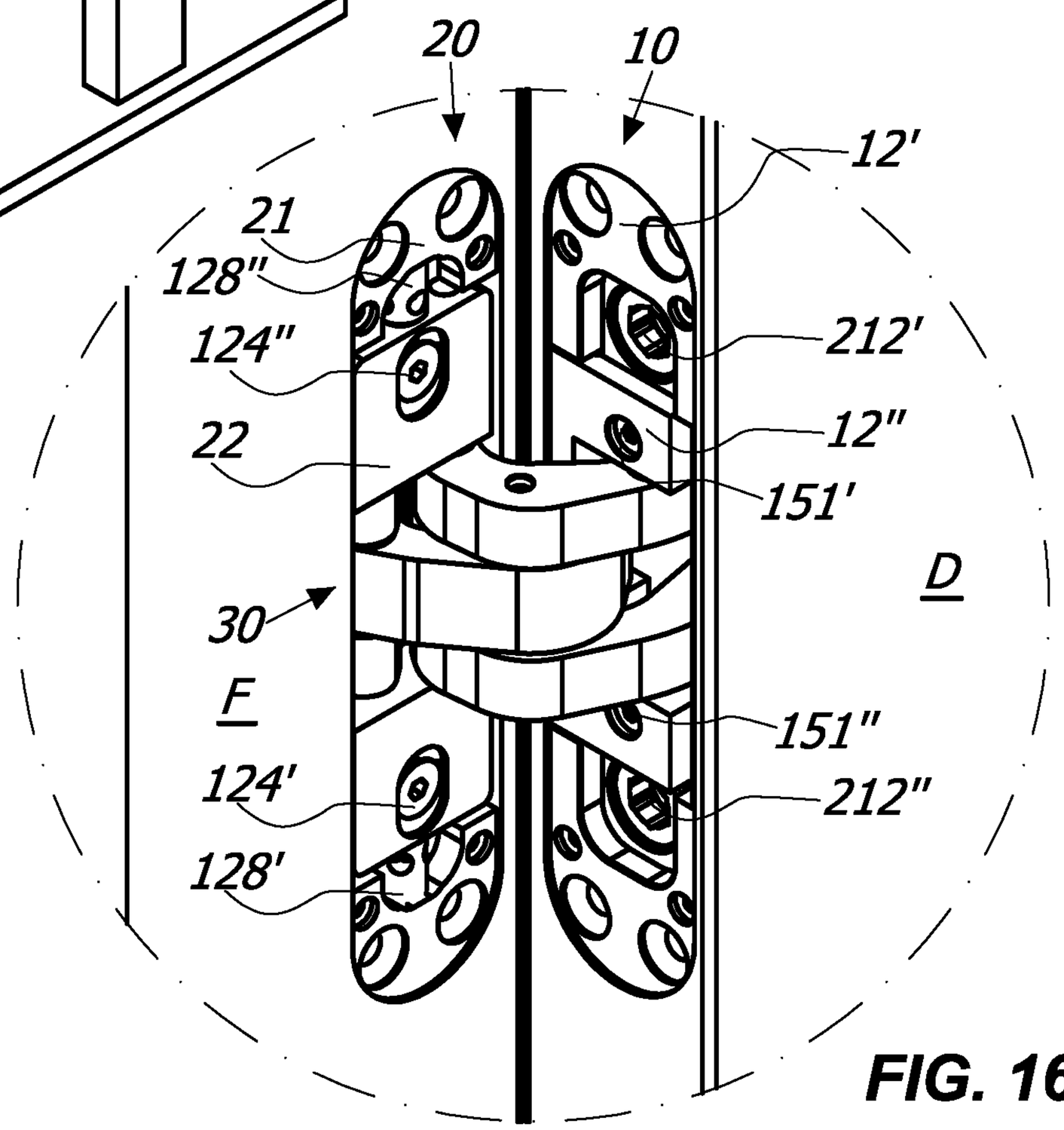


FIG. 16a

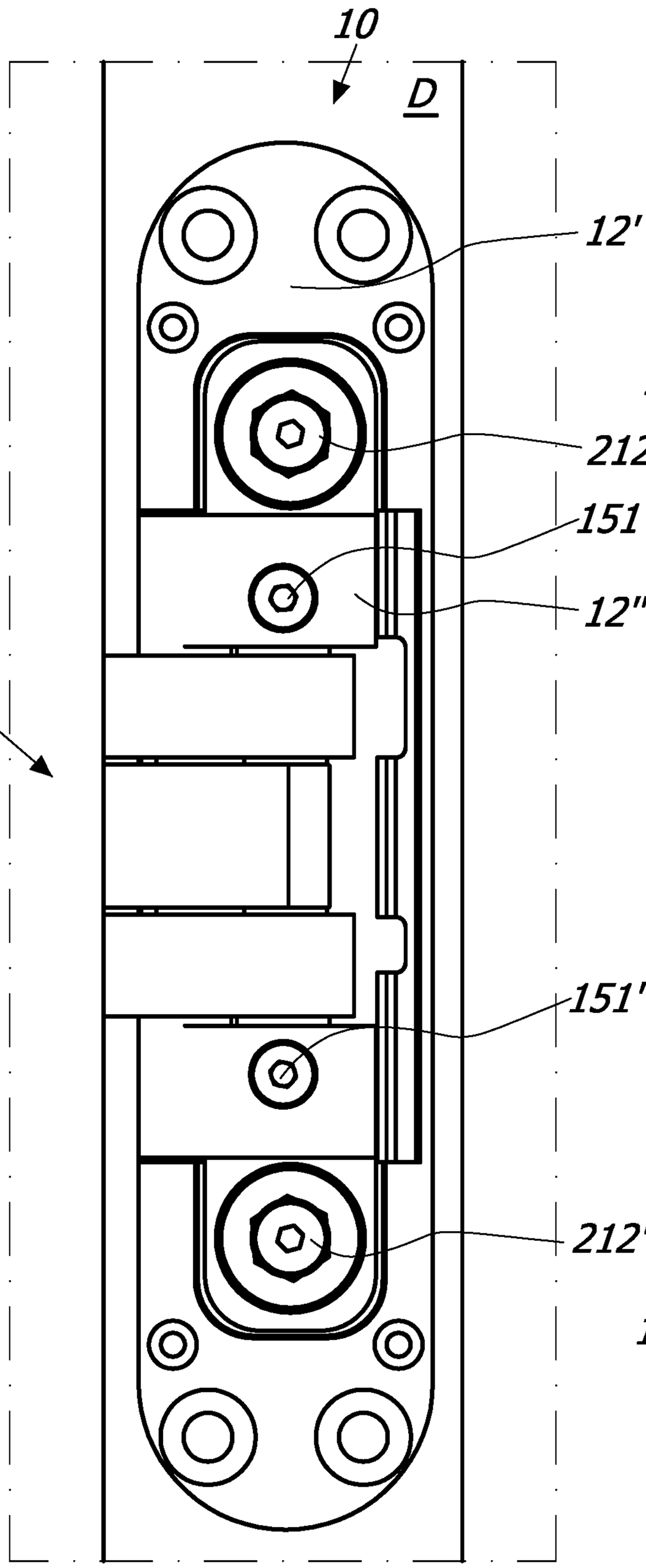


FIG. 17a

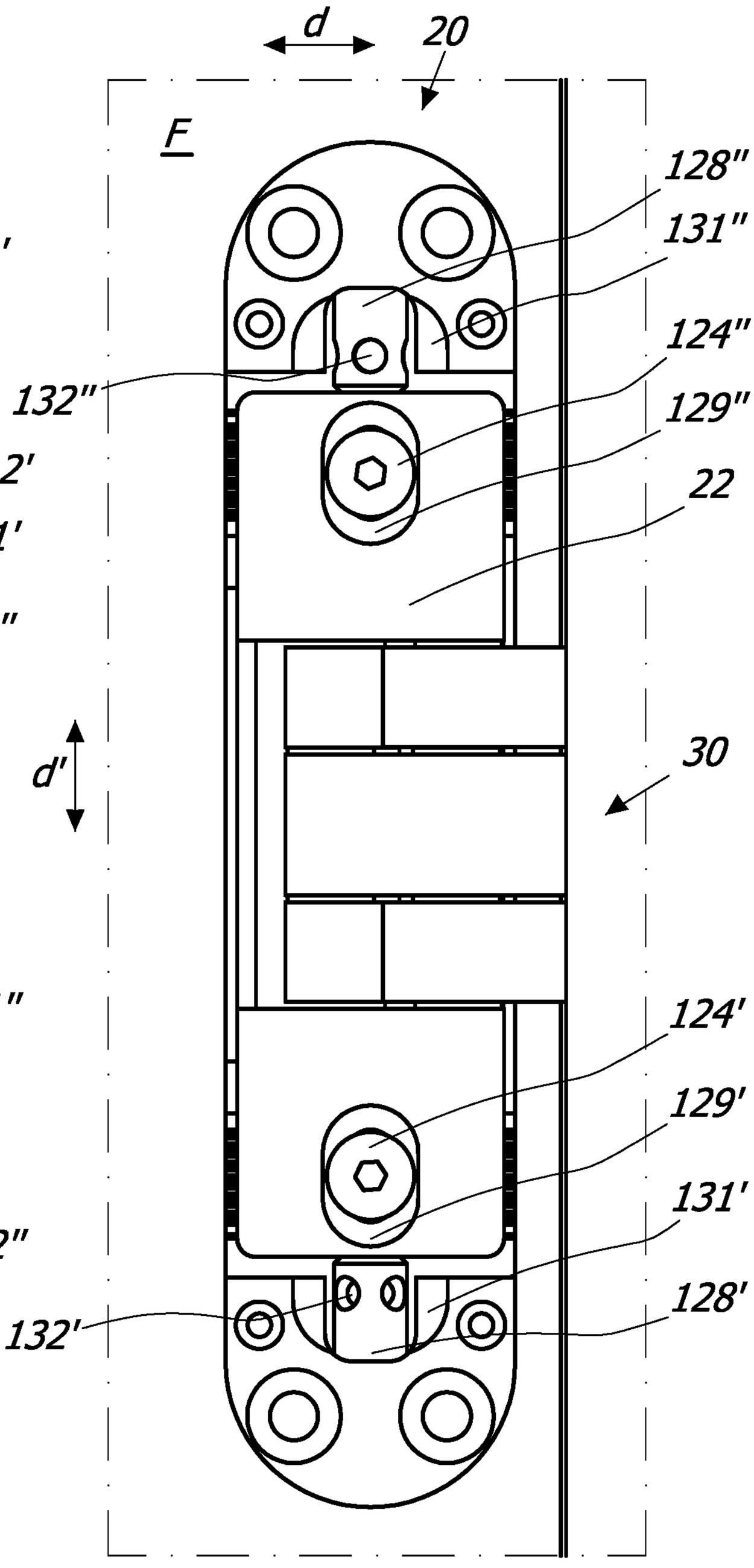
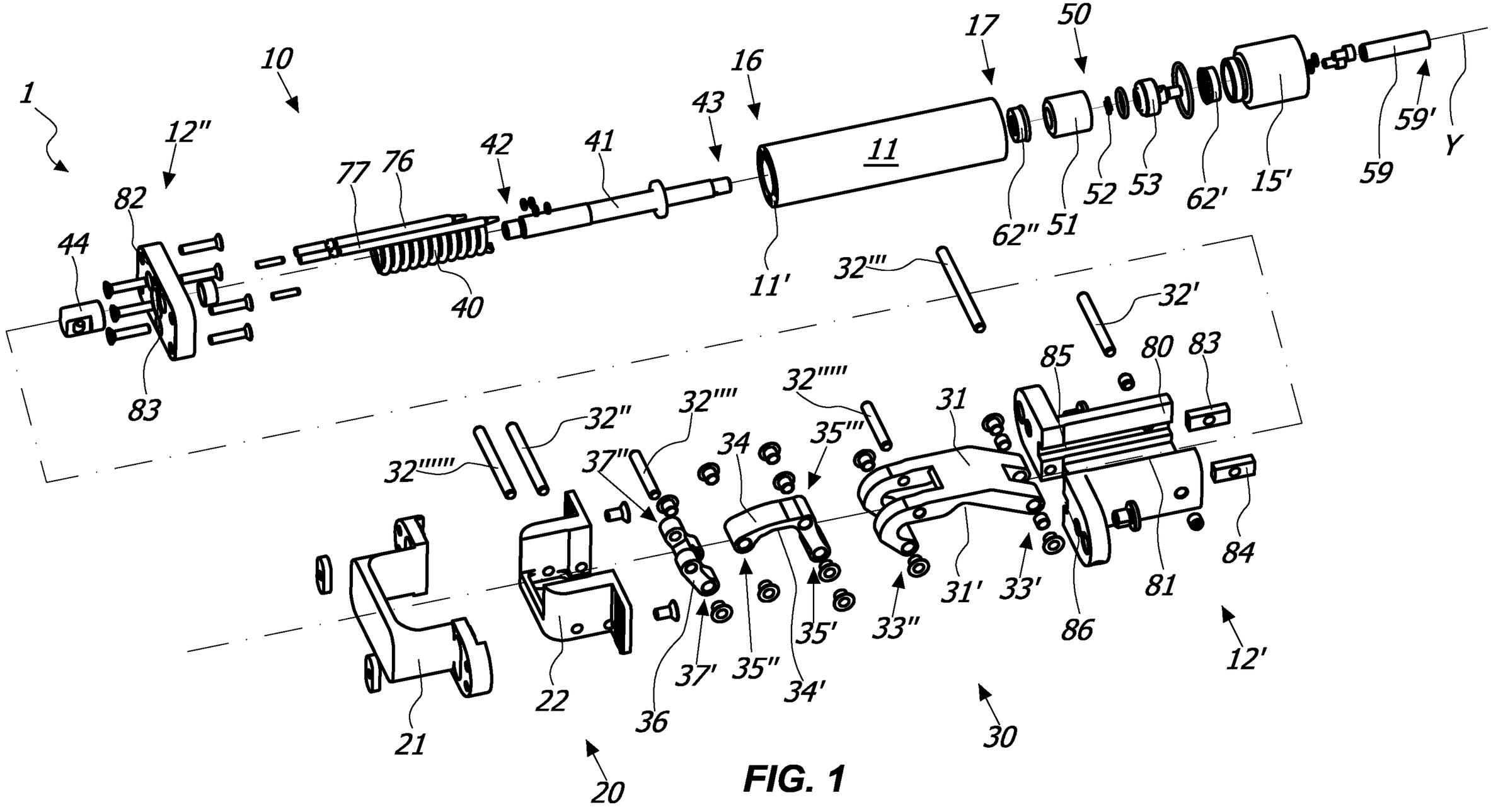


FIG. 17b


1
10
12"
82
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11'
17
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62"
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62'
15'
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59'
Y
32'''
32'
85
80
83
32'''''
32''''
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34'
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20
30

FIG. 1