Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2963453 A1 2016/04/14

(21) 2 963 453

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2015/10/06
(87) Date publication PCT/PCT Publication Date: 2016/04/14
(85) Entrée phase nationale/National Entry: 2017/04/03
(86) N° demande PCT/PCT Application No.: IB 2015/057625
(87) N° publication PCT/PCT Publication No.: 2016/055929
(30) Priorités/Priorities: 2014/10/06 (IT VI2014A000257);
2014/10/06 (IT VI2014A000256)

(51) Cl.Int./Int.Cl. *E05F 3/20* (2006.01),
E05D 3/02 (2006.01), *E05F 3/10* (2006.01),
E05F 3/12 (2006.01)

(71) Demandeur/Applicant:
IN & TEC S.R.L., IT

(72) Inventeur/Inventor:
BACCHETTI, LUCIANO, IT

(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : DISPOSITIF DE CHARNIERE POUR PORTES, VOLETS OU ANALOGUE
(54) Title: HINGE DEVICE FOR DOORS, SHUTTERS OR THE LIKE

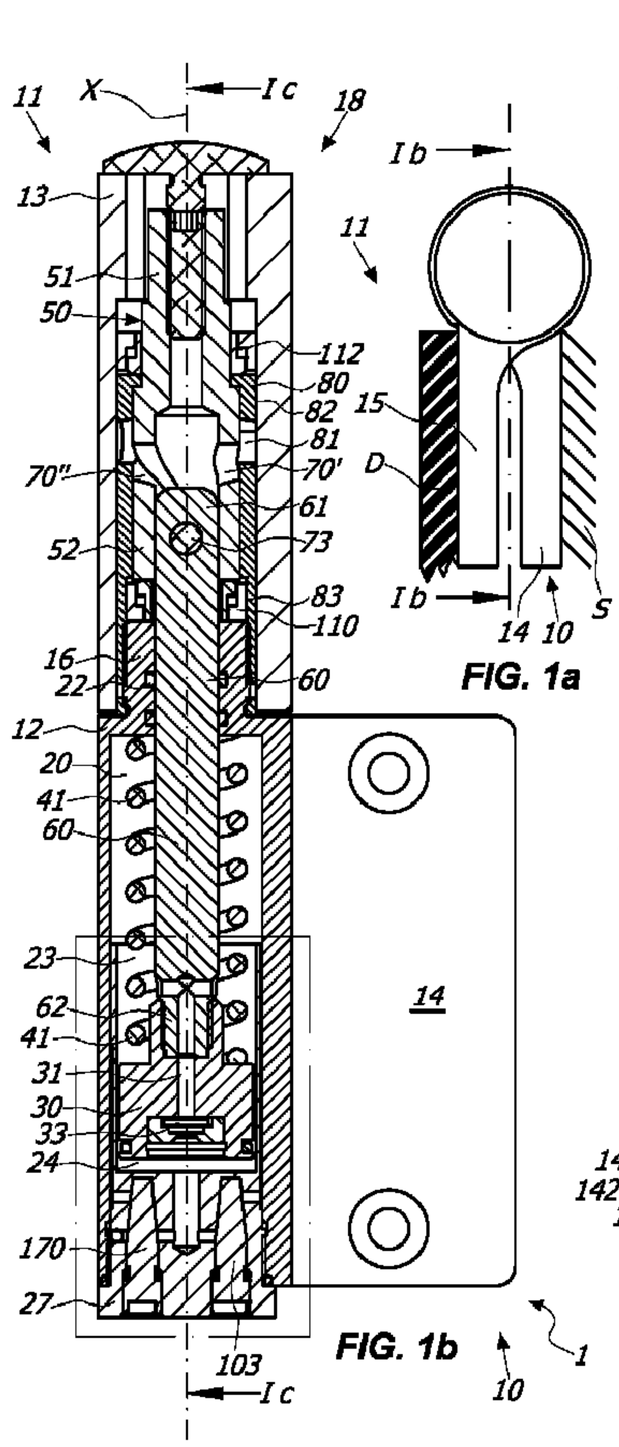


FIG. 1a

FIG. 1b

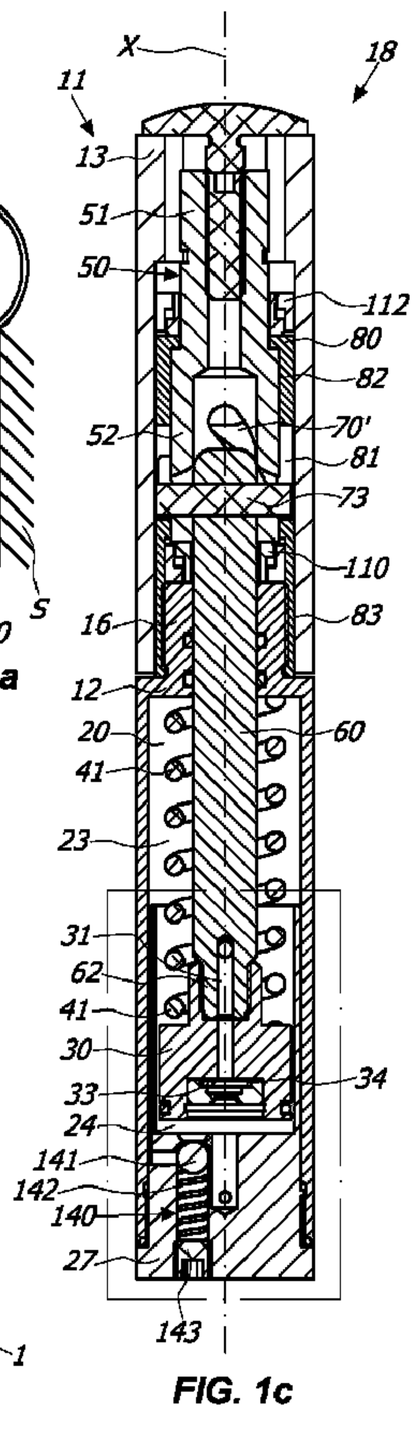


FIG. 1c

(57) Abrégé/Abstract:
Hinge device comprising a fixed element (10), a movable element (11) and a slider (30, 60). One of the fixed element (10) and the movable element (11) comprises a working chamber (20) to slidingly house the slider (30, 60), the other of the fixed element (10)

(21) 2 963 453

(13) A1

(57) Abrégé(suite)/Abstract(continued):
and movable element (11) comprising a pivot (50) reciprocally coupled with the slider (30, 60) so as the rotation of the movable element (11) corresponds to the sliding of the slider (30, 60) and vice versa. The working chamber (20) includes an end cap (27) and a working fluid. The slider (30, 60) includes a plunger member (30) that divides the working chamber (20) into a first and a second variable volume compartment (23, 24) fluidly communicating therebetween and preferably adjacent. The plunger member (30) comprises first valve means (32). The hydraulic circuit (100) includes a first duct (120) passing through the end cap (27) in fluid communication with both the first and the second compartment (23, 24). The end cap (27) includes an elongated tubular wall (28) extending within the working chamber (20). The hydraulic circuit (100) includes the interspace between the working chamber (20) and the elongated tubular wall (28). The latter is tightly inserted in the working chamber (20). The plunger member (30) is tightly inserted in the elongated tubular wall (28). The latter includes a first peripheral conduit (107) having a first port (102) in one of the first compartment (23) and the second compartment (24) and a second port (108) in fluid communication with the other of the first compartment (23) and the second compartment (24) through the first duct (120).

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 April 2016 (14.04.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/055929 A1

(51) **International Patent Classification**:
E05D 3/02 (2006.01) ***E05F 3/20*** (2006.01)
E05F 3/12 (2006.01)

(21) **International Application Number**:
PCT/IB2015/057625

(22) **International Filing Date**:
6 October 2015 (06.10.2015)

(25) **Filing Language**: Italian

(26) **Publication Language**: English

(30) **Priority Data**:
VI2014A000256 6 October 2014 (06.10.2014) IT
VI2014A000257 6 October 2014 (06.10.2014) IT

(71) **Applicant**: **IN & TEC S.R.L.** [IT/IT]; Via Guglielmo Oberdan 1/A, I-25128 Brescia (IT).

(72) **Inventor**: **BACCHETTI, Luciano**; Via Della Fonte, 9/c, I-25075 Nave (bs) (IT).

(74) **Agents**: **AUTUORI, Angelo** et al.; Borgo Santa Lucia, 31, I-36100 Vicenza (VI) (IT).

(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

[Continued on next page]

(54) **Title**: HINGE DEVICE FOR DOORS, SHUTTERS OR THE LIKE

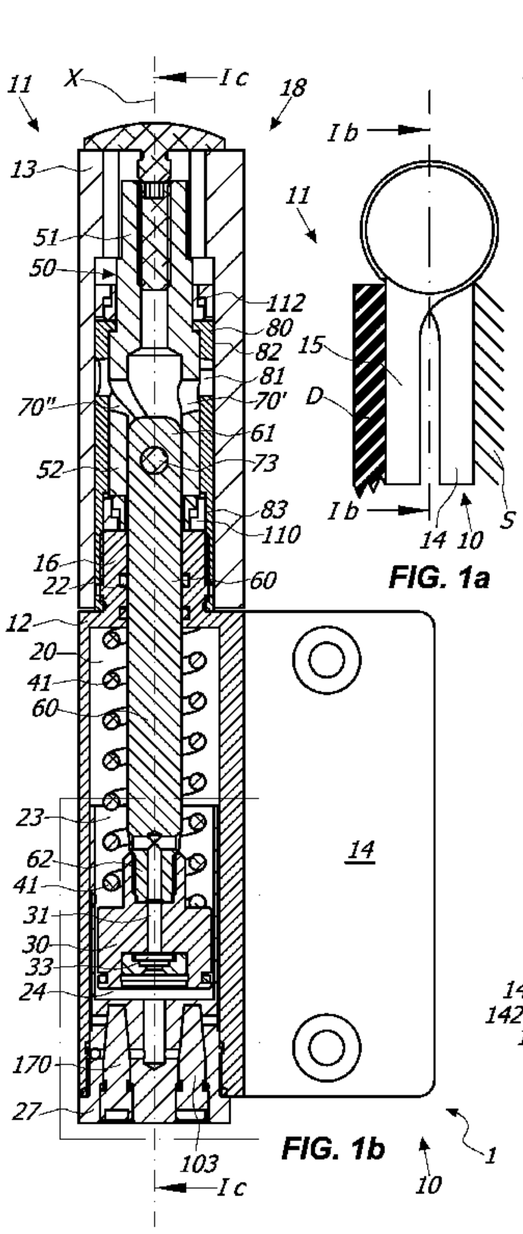


FIG. 1a

FIG. 1b

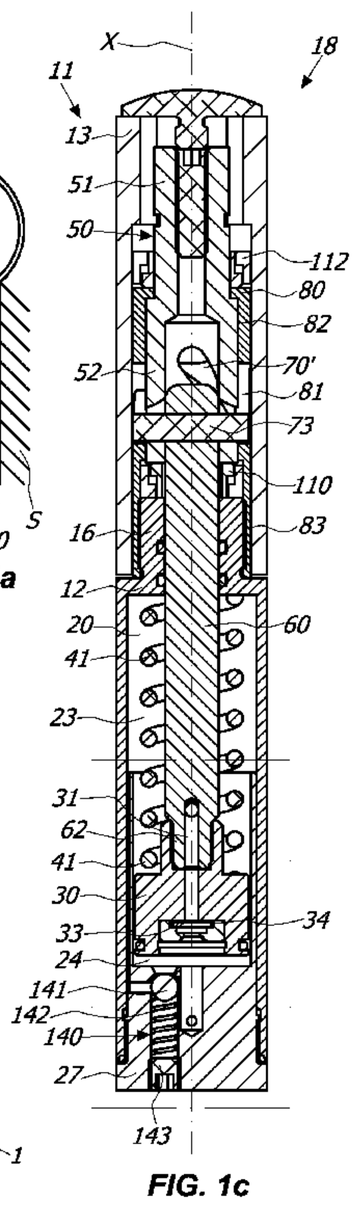


FIG. 1c

(57) **Abstract**: Hinge device comprising a fixed element (10), a movable element (11) and a slider (30, 60). One of the fixed element (10) and the movable element (11) comprises a working chamber (20) to slidingly house the slider (30, 60), the other of the fixed element (10) and movable element (11) comprising a pivot (50) reciprocally coupled with the slider (30, 60) so as the rotation of the movable element (11) corresponds to the sliding of the slider (30, 60) and vice versa. The working chamber (20) includes an end cap (27) and a working fluid. The slider (30, 60) includes a plunger member (30) that divides the working chamber (20) into a first and a second variable volume compartment (23, 24) fluidly communicating therebetween and preferably adjacent. The plunger member (30) comprises first valve means (32). The hydraulic circuit (100) includes a first duct (120) passing through the end cap (27) in fluid communication with both the first and the second compartment (23, 24). The end cap (27) includes an elongated tubular wall (28) extending within the working chamber (20). The hydraulic circuit (100) includes the interspace between the working chamber (20) and the elongated tubular wall (28). The latter is tightly inserted in the working chamber (20). The plunger member (30) is tightly inserted in the elongated tubular wall (28). The latter includes a first peripheral conduit (107) having a first port (102) in one of the first compartment (23) and the second compartment (24) and a second port (108) in fluid communication with the other of the first compartment (23) and the second compartment (24) through the first duct (120).

WO 2016/055929 A1

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

HINGE DEVICE FOR DOORS, SHUTTERS OR THE LIKE

DESCRIPTION

Field of Invention

The present invention is generally applicable to the technical field of closing and / or checking hinges for doors, shutters or similar closing elements, and it particularly relates to a hinge device for rotatably moving and / or checking during the opening and / or closing a closing element, such as a door, a shutter or the like, anchored to a stationary support structure, such as a wall or a frame.

Background of the Invention

As known, hinges generally comprise a movable element, usually anchored to a door, a shutter or the like, hinged on a fixed element, usually anchored to the support frame thereof, or to a wall and / or a floor.

From documents US7305797, US2004/206007 and EP1997994 hinges are known wherein the action of the closing means that ensure the return of the shutter in the closed position is undisputed. From document EP0407150 a door closing is known that includes hydraulic damping means to counteract the action of the closing means.

Such known devices are more or less high-bulkiness and, consequently, they have an unpleasant visual impact. Moreover, they do not allow the adjustment of the closing speed and / or the snap-fit closing of the door, or, nevertheless, they do not allow a simple and fast adjustment.

Furthermore, such known devices have a large number of constructing parts, being both difficult to manufacture and relatively expensive, besides requiring frequent maintenance.

Other hinges are known from documents GB19477, US1423784, GB401858, WO03/067011, US2009/241289, EP0255781, WO2008/50989, EP2241708, CN101705775, GB1516622, US20110041285, WO200713776, WO200636044, WO2006025663 and US20040250377.

Furthermore, from documents GB396673, WO2011/ 41880 and EP0215264 hydraulic hinges are known wherein the hydraulic circuit is at least partially contained in the end cap of the hinge thereof.

Such known hinges may be ameliorated in terms of bulkiness and / or reliability and /

or performance.

Summary of the invention

Object of the present invention is to at least partially overcome the above mentioned drawbacks, by providing a hinge device of high functionality, constructing simplicity and low cost.

Another object of the invention is to provide a hydraulic hinge device extremely easy to manufacture.

Another object of the invention is to provide an extremely safe hinge device.

Another object of the invention is to provide a low-bulkiness hinge device.

Another object of the invention is to provide a hinge device that ensures the checked movement of the door to which it is coupled, upon the opening phase and / or the closing phase.

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

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

Another object of the invention is to provide a hinge device that may be assembled on the closing elements having opening both towards the right and the left.

Such objects, as well as other that will appear more clearly hereinafter, are fulfilled by a hinge device having one or more of the features herein described and / or claimed and / or shown.

The hinge device is particularly useful for rotatably moving and / or checking during the opening and / or closing a closing element, such as a door, a shutter or the like. The closing element may be anchored to a stationary support structure, such as a wall or a frame.

The device includes a fixed element anchorable to the stationary support structure and a movable element anchorable to the closing element.

The movable element and the fixed element are reciprocally coupled to rotate around a longitudinal axis between an open position and a closed position.

Furthermore, the device includes at least one slider movable along another axis between a first end-stroke position, corresponding to one of the open and closed positions of the movable element, and a second end-stroke position, corresponding to the other of

the open and closed positions of the movable element. The sliding axis of the at least one slider may be parallel to, perpendicular to, or coincident with the axis of rotation of the movable element with respect to the fixed one.

Suitably, one of the fixed element and the movable element comprises at least one working chamber defining the sliding axis of the at least one slider, while the other of the fixed element and the movable element comprises a pivot defining the above mentioned axis of rotation. The at least one working chamber is closed through at least one end cap.

The pivot and the at least one slider are reciprocally coupled so as the rotation of the movable element corresponds to the at least partial sliding of the at least one slider and vice versa.

The working chamber includes a working fluid acting upon the at least one slider to hydraulically counteract the action thereof.

The at least one slider includes a plunger member susceptible to divide the at least one working chamber in at least one first and one second variable volume compartment fluidly communicating therebetween and preferably adjacent.

The plunger member comprises a passing-through opening to put in fluid communication the first and the second variable volume compartment and the valve means interacting therewith to allow the passage of the working fluid between the first compartment and the second compartment during one of the opening or closing of the closing element and to prevent the passage thereof during the other of the opening or closing thereof.

Furthermore, a hydraulic circuit is provided to allow the passage of the working fluid between the first compartment and the second compartment during the other of the opening or closing of the closing element.

Suitably, the hydraulic circuit may include at least one first channel with a first opening in one of the first compartment and the second compartment and at least one first duct passing through the at least one end cap, the at least one first duct may include at least one first opening fluidly communicating with the first outlet of the at least one first channel and at least one first outlet fluidly communicating with the other of the first compartment and the second compartment.

Advantageously, the hydraulic circuit may further include at least one second duct

passing through the at least one end cap to put in fluid communication the first compartment and the second compartment.

In a preferred but not exclusive embodiment, the at least one end cap may further include valve means acting upon the at least one second duct to selectively open upon the passage of the working fluid through the at least one channel when the pressure in the at least one working chamber exceeds a predetermined threshold value.

In this way, the hinge device is extremely safe. In fact, in case of overpressures, the valve means open thus preventing the breakage or unhinging of the closing element.

To do the object, the above mentioned threshold value may be calibrated so as to avoid the unhinging of the closing element by a user that forces the opening and / or closing thereof.

Preferably, the valve means may be closed when the pressure in the at least one working chamber is below the predetermined threshold value, so as to force the passage of the working fluid through the at least one first duct.

Irrespective of the presence or absence of the overpressure valve means described above, the at least one end cap may include an elongated tubular wall extending within the working chamber.

Suitably, the hydraulic circuit may include the interspace between the working chamber and the elongated tubular wall.

Advantageously, the elongated tubular wall may include at least one first peripheral conduit having a first port in one of the first compartment and the second compartment and a second port in fluid communication with other of the first compartment and the second compartment through the at least one first duct.

Furthermore, the end cap may include at least one first adjusting member having a first end interacting with the at least one first duct and a second end controllable from the outside by a user to adjust the passage section of the working fluid passing therethrough.

Furthermore, one of the fixed element and the movable element comprises a hinge body that includes the one working chamber. The elongated tubular wall may be monolithically coupled with the at least one end cap so as the coupling of the latter with the hinge body defines the hydraulic circuit.

In this way, the hydraulic circuit consists exclusively of the interspace between the

working chamber and the elongated tubular wall and the at least one first duct passing through the at least one end cap.

Consequently, the hinge body is free of channels or ducts, which implies that it may be manifactured in a simple and cheap way, for example by extrusion.

In fact, the hydraulic circuit is entirely defined by the end cap. When it is not coupled with the cap, the hinge body is free of the hydraulic circuit.

For the aforementioned, the hinge device, while ensuring the checked movement of the door to which it is coupled, is extremely low-bulkiness and it has a minimum number of constituent parts.

Advantageous embodiments of the invention are defined in accordance with 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 some preferred but not exclusive embodiments of a hinge device **1**, that are shown as a non-limiting example with the help of the annexed drawings, wherein:

FIG. **1a** is a top view of a first embodiment of the hinge device **1** in the completely closed position, with in **FIG**. **1b** and **FIG**. **1c** section views taken along respective planes *I b - I b* and *I c - I c*;

FIG. **2a** is a top view of the embodiment of the hinge device **1** of FIG. 1a in the completely open position, with in **FIG**. **2b** a section view taken along a plane *IIb - IIb*;

FIG. **3a** is a top view of the embodiment of the hinge device **1** of FIG. 1a in a position near to the closed one, with in **FIG**. **3b** a section view taken along a plane *IIIb - IIIb*;

FIG. **4** is an exploded axonometric view of a further embodiment of the hinge device **1**;

FIG. **5a** is a top view of the embodiment of the hinge device **1** of FIG. 4 in the completely closed position, with in **FIG**. **5b** and **FIG**. **5c** section views taken along respective planes *V b - V b* and *V c - V c*;

FIG. **6a** is a top view of the embodiment of the hinge device **1** of FIG. 4 in the completely open position, with in **FIG**. **6b** a section view taken along a plane *VI b - VI b*;

FIG. **7a** is a top view of the embodiment of the hinge device **1** of FIG. 4 in a position

near to the closed one, with in **FIG**. **7b** a section view taken along a plane *VII b - VII b*;

FIG. 8 is an enlarged view of the details enclosed in the closed dotted line of FIG. 1c;

FIG. **9** is an axonometric view of an embodiment of an end cap **27** that is cross sectioned to highlight the second overpressure valve means **140**;

FIG. **10** is an enlarged view of the details enclosed in the closed dotted line of FIG. 1b;

FIGs. **11a** and **11b** are axonometric views of the embodiment of the end cap **27** of FIG. 9 that are cross sectioned to highlight the ducts **120** and **150** passing therethrough.

Detailed description of some preferred embodiments

With reference to the above mentioned figures, the hinge device **1** is particularly useful for rotatably moving and / or checking of a closing element **D**, such as a door, a shutter, a gate or the like, that may be anchored to a stationary support structure **S**, such as a wall and / or a frame of a door or of a window and / or a support column and / or the floor.

The hinge device **1** is of hydraulic type. Depending on the configuration, and in particular on the presence or absence of the elastic counteracting means **40**, the hinge device **1** may exclusively allow the checking upon the opening and / or closing of the closing element **D** to which it is coupled, or the latter action and the automatically closing of the closing element **D** thereof from the open position.

In the latter case, the elastic means **40** may include a thrust spring of relatively high power. However, the elastic means **40**, although present, may include a counteracting spring of relatively low power, the power thereof not allowing the automatic closing action.

In general, the hinge device **1** may include a fixed element **10** anchorable to the stationary support structure **S** and a movable element **11** that may be anchorable to the closing element **D**.

Preferably, the hinge device **1** may be configured according to the teachings of one or more of the patent applications PCT/IB2012/051707, PCT/IB2013/059120, PCT/IB2013/059121 and VI2013A000245, all in the name of applicant thereof.

In particular, in a preferred but not exclusive embodiment, the fixed **10** and movable **11** elements of the hinge device **1** may include a hinge body **18** with a respective first and second tubular half-shell **12**, **13** reciprocally coupled to rotate around a longitudinal axis **X** between an open position, shown for example in FIGs. 2a and 6a, and a closed position, shown for example in FIGs. 1a and 5a.

Suitably, the fixed **10** and movable **11** elements may include a respective first and second fastening wing **14**, **15** respectively connected to the first and second tubular half-shell **12**, **13** for the anchorage to the stationary support structure **S** and to the closing element **D**.

Preferably, the hinge device **1** may be configured as a hinge of "*anuba*" type.

Advantageously, with the exception of the fastening wings **14**, **15**, all other components of the hinge device **1** may be included within the first and second tubular half-shell **12**, **13**.

In particular, the first fixed tubular half-shell **12** may include a working chamber **20** defining the axis **X** and a plunger member **30** sliding therein. Suitably, the working chamber **20** may be closed at the bottom with an end cap **27** inserted in the tubular half-shell **12**.

Moreover, the first fixed tubular half-shell **12** may include a working fluid, generally oil, acting upon the plunger member **30** to hydraulically counteract the action thereof. Preferably, moreover, the first fixed tubular half-shell **12** may comprise elastic counteracting means **40**, for example a compressing helical spring **41**, acting upon the plunger member thereof **30**.

Suitably, externally to the working chamber **20** and coaxially therewith a pivot **50** may be provided, that may advantageously act as an actuator, the pivot **50** may include an end portion **51** and a tubular body **52**.

In the preferred but not exclusive embodiment shown in FIGs. 1a to 3b, the pivot **50** may be supported by the end portion **16** of the first fixed tubular half-shell **12**. On the other hand, in the preferred but not exclusive embodiment shown in FIGs. 4 to 11b, the pivot **50** may be supported by a support portion **84** manufactured in correspondence of the inner wall **83** of a bushing **80**, as explained hereinafter.

The end portion **51** of the pivot **50** allows the coaxial coupling, preferably of removable type, between the pivot **50** thereof and the second movable tubular half-shell **13**, so as the latter and the pivot **50** integrally rotate between the open and closed positions of the second movable tubular half-shell **13**.

Suitably, the plunger member **30** and the pivot **50** may be operatively connected therebetween through the cylindrical elongated element **60**, so as the rotation of the former around the axis **X** corresponds to the sliding of the latter along the axis **X** thereof and vice

versa.

To the object, the cylindrical elongated element **60** may include a first end portion **61** reciprocally connected to the plunger member **30** and a second end portion **62** sliding within the tubular body **52** of the pivot **50**.

The connection between the cylindrical elongated element **60** and the plunger member **30** may be susceptible to make the elements thereof integral, so as the same elements may define a slider movable along the axis **X**.

Therefore, the cylindrical elongated element **60** may be slidable along the axis **X** integrally with the plunger member **30**. Suitably, the cylindrical elongated element **60** and the pivot **50** may be coupled in a telescopic manner.

Furthermore, the cylindrical elongated element **60** with the relative plunger member **30** may or may not be rotatably blocked in the working chamber **20** to avoid rotations around the axis **X** during its sliding along the latter. This happens depending on the configuration of the guide cam slots **81** of the bushing **80**.

Therefore, with respect to the pivot **50**, the plunger member **30** may slide along the axis **X** between an end-stroke position proximal thereto, corresponding to a one of the open and closed positions of the second movable tubular half-shell **13**, and an end-stroke position distal from the pivot **50**, corresponding to the other of the open and closed positions of the second movable tubular half-shell **13**.

To allow the reciprocal movement between the plunger member **30** and the pivot **50**, the tubular body **52** of the latter may include at least one pair of grooves **70'**, **70''** identical to each other angularly spaced by 180°, each one comprising at least one helical portion wound around the axis **X**. The grooves **70'**, **70''** may be communicating with each other to define a single passing-through actuator element **72**.

Suitably, the at least one helical portion may have any angle, and may have right-handed trend, respectively left-handed trend. Preferably, the at least one helical portion may develop for at least 90° around the axis **X**, and even more preferably for at least 180°.

In a preferred but not exclusive embodiment, each one of the grooves **70'**, **70''** may consists of a single helical portion, possibly with constant inclination or helical pitch.

Suitably, the actuator element **72** may be closed at both ends so as to define a closed path having two blocking end points for the pin **73** sliding therethrough, the closed path

being defined by the grooves **70'**, **70"**.

Irrespective of its position or configuration, the passing-through actuator element **72** rotating around the axis **X** allows the reciprocal movement between the pivot **50** and the plunger member **30**.

To guide such a rotation, a tubular guide bushing **80** may be provided coaxially placed outside the tubular body **52** of the pivot **50**. The guide bushing **80** may include a pair of cam slots **81** angularly spaced by 180°.

To allow the reciprocal connection between the pivot **50**, the elongated element **60** and the guide bushing **80**, the second end portion **62** of the elongated element **60** may include a pin **73** inserted in the passing-through actuator element **72** and in the cam slots **81** to slide therein.

Therefore, the length of the pin **73** may be such as to allow this function. Therefore, upon the rotation of the passing-through actuator element **72**, the pin **73** is driven by the latter and guided by the cam slots **81**.

Irrespective of the shape of the cam slots **81**, the latter may be closed at both ends so as to define a closed path having two blocking end points for the pin **73** sliding therethrough.

In order to minimize the friction between the moving parts, at least one anti-friction element may be provided, such as an annular bearing **110**, interposed between the pivot **50** and the end portion **16** of the first tubular half-shell **12** or between the pivot **50** thereof and the support portion **84** of the bushing **80**.

In fact, as above mentioned, thanks to the above configuration the pin **73** is pulled downwards, dragging therewith the pivot **50** that, therefore, rotates around the axis **X** on the bearing **110** with the minimum friction.

Furthermore, at least one further anti-friction element may be provided, for example a further annular bearing **112**, interposed between the bushing **80** and the second tubular half-shell **13**, in such a way that the latter rotates around the axis **X** on the bearing **112**.

Therefore, the bearing **112** rests on the upper portion of the bushing **80**, so as the pivot **50** is not affected by the weight of the closing element during its rotation around the axis **X**.

Preferably, moreover, the bushing **80** and the second tubular half-shell **13** may be in a reciprocal spatial relationship such that the second tubular half-shell **13** once coupled with

the bushing **80** remains spaced from the first tubular half-shell **12**, for example at a distance equal to few tenths of a millimetre.

As above mentioned, the hinge device **1** may include a working fluid, for example oil.

Advantageously, one or more sealing elements **22** may be provided to avoid the discharge thereof, for example one or more o-rings.

The plunger member **30** may be susceptible to divide the working chamber **20** in at least one first and one second variable volume compartment **23**, **24** fluidly communicating therebetween and preferably adjacent. Suitably, when present, the elastic counteracting means **40** may be inserted in the first compartment **23**.

In a first preferred but not exclusive embodiment, the elastic counteracting means **40** may be interposed between the pivot **50** and the plunger member **30**. For example, the elastic counteracting means **40** may include a spring fitted over the elongated element **60**.

To allow the passage of the working fluid between the first and the second compartment **23**, **24**, the plunger member **30** may comprise a passing-through opening **31** and valve means, that may include a disk **33** inserted with minimal play in a suitable house **34** to axially move along axis **X**. The assembly disk **33** - house **34** defines a non-return valve susceptible to intercept the working fluid.

Depending on the direction to which the non-return valve is assembled, it may open upon the opening or closing of the closing element **D**, so as to allow the passage of the working fluid between the first compartment **23** and the second compartment **24** during one of the opening or closing of the closing element **D** and to prevent the backflow thereof during the other of the opening or closing thereof.

For the controlled backflow of the working fluid between the first compartment **23** and the second compartment **24** during the other of the opening or closing of the closing element **D**, a suitable hydraulic circuit **100** may be provided.

Suitably, the plunger member **30** may include, respectively consist of, a cylindrical body tightly inserted in the working chamber **20** and faced to the inner side wall **25** thereof.

In general, the hydraulic circuit **100** may include a channel **107** with an opening **102** in the first compartment **23**.

Furthermore, the hydraulic circuit **100** may include a duct **120** passing through the end cap **27** that includes an opening **121** fluidly communicating with the opening **102** and an

opening **122** fluidly communicating with the second compartment **24**.

Moreover, the hydraulic circuit **100** may further include a duct **150** passing through the end cap **27** that, as better explained hereinafter, is fluidly connected with the duct **120**.

Furthermore, the hydraulic circuit **100** may include a duct **130** passing through the end cap **27** thereof to put in fluid communication the first compartment **23** and the second compartment **24**.

Suitably, the end cap **27** may further include valve means **140** acting upon the duct **130** to selectively open upon the passage of the working fluid through the channel **107** when the pressure **PC** in the working chamber **20** exceeds a predetermined threshold value **PT**.

To protect the entirety of the closing element **D** that assembles the hinge device **1**, the threshold pressure value **PT** may be calibrated in order to avoid the unhinging of the closing element **D** thereof by a user that forces the opening and / or closing.

From the constructive point of view, the valve means **140** may include a shutter element **141** acting upon the duct **130**, and more precisely upon the outlet **135** thereof, and elastic means **142** acting thereon. Both the shutter element **141** and the elastic means **142** may be inserted in the duct **130** and closed by the grub screw **143**.

Advantageously, the elastic means **142** may be selected to provide the threshold pressure value **PT**.

On the other hand, the screw **143** may be one adjusting screw movable from outside by a user to act upon the second elastic means **142**, so as to vary the action thereof on said shutter element **141** thus adjusting the predetermined threshold pressure value **PT**.

From an operational point of view, the valve means **140** may be closed when the pressure **PC** in the working chamber **20** is below the threshold value **PT** to prevent the passage of the working fluid through the duct **130**, so as to force the passage thereof through the duct **120**.

Advantageously, the threshold pressure value **PT** may be greater than the maximum pressure **PCmax** imparted in the working chamber **20** by the elastic counteracting means **40**. Preferably, the threshold pressure value **PT** is greater than the maximum pressure **PCmax** of a percentage of 15% to 30%.

In a preferred but not exclusive embodiment, the end cap **27** may include an elongated tubular wall **28** extending within the working chamber **20**. In such a case, the hydraulic

circuit **100** may include the interspace between the working chamber **20** and the elongated tubular wall **28** of the end cap **27**.

Suitably, the elongated tubular wall **28** may be tightly inserted in the working chamber **20**, while the plunger member **30** may be tightly inserted in the elongated tubular wall **28**.

Preferably, the length of the latter may be equal to or greater than the stroke of the plunger member, so as the second compartment **24** is defined within the elongated tubular wall **28**. More particularly, the second compartment **24** may have an upper wall defined by the plunger member **30**, a bottom wall defined by the cap **27** and a side wall defined by the elongated tubular wall **28** of the cap **27** thereof.

Preferably, the elongated tubular wall **28** may be monolithically coupled with the end cap **27** so as the screwing of the latter in the hinge body **18** defines the hydraulic circuit **100**, so as the latter consists exclusively of the interspace between the working chamber **20** and the elongated tubular wall **28** and of the ducts **120**, **130** and **150**.

The elongated tubular wall **28** of the end cap **27** may include a peripheral conduit defining the channel **107**, a peripheral conduit defining a further channel **131** and a further conduit **160**.

Suitably, both conduits **107** and **131** are open conduits, while the conduit **160** is a blind conduit.

The conduit **107** may have a port defining the opening **102** and a port **108** in fluid communication with the opening **121**, and, therefore, with the variable volume compartment **24** through the duct **120**. More particularly, the latter may include two branches **121** and **123**, whereof the first **121** in fluid communication with the port **108** and the second **123** in fluid communication with the compartment **24** through the collector **122**, whose function is better explained hereinafter.

The conduit **131** may have a port **132** in the first variable volume compartment **23** and a port **133** in fluid communication with the variable volume compartment **24** through the duct **130**. The latter may have a branch **134** and an opening **135**, wherebetween the valve means **140** may be placed.

The conduit **160** may have a port **161** and a port **162** in fluid communication with the variable volume compartment **24** through the duct **150**. More particularly, the latter may include two branches **151** and **152**, whereof the first **151** in fluid communication with the

port **162** and the second **152** in fluid communication with the compartment **24** through the collector **122**.

As above mentioned, the duct **130** in cooperation with the valve means **140** defines a overpressure valve.

On the other hand, in the ducts **120** and **150** respective adjusting members **103**, **170** may be inserted having one end **104**, **171** interacting with the ducts **120** and **150** thereof and one end **105**, **172** controlled from outside by a user to adjust the passage section of the working fluid passing therethrough.

Advantageously, the ends **104**, **171** have a substantially frustoconical shape.

Since the plunger member **30**, the elongated tubular wall **28** and the working chamber **20** are tightly inserted one inside the other, the assemblies conduit **107** - duct **120**, conduit **130** - duct **131** and conduit **160** – duct **150** define respective hydraulic circuits independent between them.

Although in the annexed figures the two adjusting members are substantially parallel to the axis **X**, they may also be substantially perpendicular thereto without departing from the scope of the appended claims.

In case the valve means **32** are configured to open upon the passage of the working fluid from the first compartment **23** to the second compartment **24** and to close upon the opposite passage so as to force the working fluid to pass through the hydraulic circuit **100**, the branches **121** and **151** define inlet branches of the working fluid in the ducts **120** and **150**, while the branches **123** and **152** define outlet branches therefrom. It is obvious that the working fluid passing through the outlet branches **123** and **152** comes out through the ports **108** and **162**, goes back up through the conduits **107** and **160** and flows out in the variable volume compartment **23** through the ports **102** and **161**.

When the working chamber **20** is pressurized, for example during the opening of the door, the valve means **32** open to let the working fluid flow from the first compartment **23** to the second compartment **24**. On the other hand, during the closing of the door the valve means **23** close, forcing the working fluid from the compartment **24** to the central collector **122**, and here-hence to the inlet branches **121** and **151** mentioned above.

Therefore, the central collector **122** collects the working fluid coming from the compartment **24** and distributes it to the two branches **121** and **151**. Advantageously,

therefore, the central collector **122** may be placed along the axis **X**, while the adjusting members **103** and **170** may be placed on opposite sides with respect to a median plane **πM** passing through the axis **X**.

Moreover, the duct **130** may be misaligned with respect to the two ducts **120**, **150**.

This allows to have the two adjusting members **103**, **170** and the overpressure valve means **140** in a extremely reduced space.

Suitably, the inlet branches **121** and **151** may be faced to a portion of the ends **104**, **171** of the adjusting members **103**, **170** having a section greater than the one to which the outlet branches **123** and **152** are faced, so as to minimize or eliminate variations of flow of the working fluid through the respective ducts **120** and **150**.

In a preferred but not exclusive embodiment, the plunger member **30**, the conduit **107** and the conduit **160** may be reciprocally configured so as the port **102** remains fluidly free throughout the stroke of the plunger member **30** and so as the port **161** remains fluidly blocked for a part of the stroke of the plunger member **30** and fluidly free for a second part of the stroke thereof near the open or closed position of the closing element **D**, so as the latter snap fits towards the open or closed position thereof.

Therefore, the adjusting member **103** may be susceptible to adjust the speed upon the closing or opening of the closing element **D**, while the adjusting member **170** may be susceptible to adjust the force of the snap-fit of the closing element **D** towards the closed or open position.

For the aforementioned, the end cap **27** allows to provide an extremely safe hinge device thanks to the overpressure valve means **140** and easily adjustable both in speed and in snap-fit thanks to the adjusting members **103**, **170**, all in a very reduced space .

From the above description, it is evident that the invention fulfils the intended objects.

The invention is susceptible of numerous modifications and variations, all falling within the inventive concept expressed in the accompanying claims. All particulars 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 defined by the appended claims.

CLAIMS

1. Hinge device for rotatably moving and / or checking during the opening and / or closing a closing element (**D**), such as a door, a shutter or the like, anchored to a stationary support structure (**S**), such as a wall or a frame, the device including:

- a fixed element (**10**) anchorable to the stationary support structure (**S**);

- a movable element (**11**) anchorable to the closing element (**D**), said movable element (**11**) and said fixed element (**10**) being reciprocally coupled to rotate around a first longitudinal axis (**X**) between an open position and a closed position;

- at least one slider (**30**, **60**) movable along a second axis (**X**) between a first end-stroke position, corresponding to one of said open and closed positions, and a second end-stroke position, corresponding to the other of said open and closed positions;

wherein one of said fixed element (**10**) and said movable element (**11**) comprises at least one working chamber (**20**) defining said second longitudinal axis (**X**) to slidably house said at least one slider (**30**, **60**), the other of said fixed element (**10**) and said movable element (**11**) comprising a pivot (**50**) defining said first axis (**X**), said pivot (**50**) and said at least one slider (**30**, **60**) being reciprocally coupled so as the rotation of the movable element (**11**) around said first axis (**X**) corresponds to the at least partial sliding of the at least one slider (**30**, **60**) along said second axis (**X**) and vice-versa, said at least one working chamber (**20**) including at least one end cap (**27**);

wherein said at least one working chamber (**20**) includes a working fluid acting upon said at least one slider (**30**, **60**) to hydraulically counteract the action thereof, said at least one slider (**30**, **60**) including a plunger member (**30**) susceptible to divide said working chamber (**20**) in at least one first and one second variable volume compartments (**23**, **24**) fluidly communicating therebetween and preferably adjacent to each other, said plunger member (**30**) comprising first valve means (**32**) to allow the passage of the working fluid between said first compartment (**23**) and said second compartment (**24**) during one of the opening or closing of the closing element (**D**) and to prevent the passage thereof during the other of the opening or closing thereof, a hydraulic circuit (**100**) being further provided to allow the passage of the working fluid between said first compartment (**23**) and said second compartment (**24**) during the other of the opening or closing of the closing element (**D**).

2. Device according to claim 1, wherein said hydraulic circuit (**100**) includes at least

one first duct (**120**) passing through said at least one end cap (**27**) in fluid communication with both said first compartment (**23**) and said second compartment (**24**).

3. Device according to claim 1 or 2, wherein said at least one end cap (**27**) includes an elongated tubular wall (**28**) extending within said at least one working chamber (**20**), said hydraulic circuit (**100**) including the interspace between said working chamber (**20**) and said elongated tubular wall (**28**).

4. Device according to the preceding claim, wherein said elongated tubular wall (**28**) is tightly inserted in said at least one working chamber (**20**), said plunger member (**30**) being tightly inserted into said elongated tubular wall (**28**), the latter including at least one first peripheral conduit (**107**) having a first port (**102**) in one of said first compartment (**23**) and said second compartment (**24**) and a second port (**108**) in fluid communication with the other of said first compartment (**23**) and said second compartment (**24**) through said at least one first duct (**120**).

5. Device according to any one of the preceding claims, wherein said at least one end cap (**27**) further includes at least one first adjusting member (**103**) having a first end (**104**) interacting with said at least one first duct (**120**) and a second end (**105**) controllable from the outside by a user to adjust the passage section of the working fluid passing therethrough.

6. Device according to any one of the preceding claims, wherein said elongated tubular wall (**28**) is monolithically coupled with said at least one end cap (**27**) so as the coupling of the latter with said at least one working chamber (**20**) defines said hydraulic circuit (**100**), so as the latter consists exclusively of said interspace between said working chamber (**20**) and said elongated tubular wall (**28**) and of said at least one first duct (**120**) passing through said at least one end cap (**27**).

7. Device according to any one of the preceding claims, wherein said first valve means (**32**) are configured to open upon the passage of the working fluid from said first compartment (**23**) to said second compartment (**24**) and to close upon the passage thereof from said second compartment (**24**) to said first compartment (**23**) so as to force the working fluid to flow through said hydraulic circuit (**100**).

8. Device according to the preceding claim, wherein said first end (**104**) of said at least one first adjusting member (**103**) has a substantially frustoconical shape, said at least

one first duct (**120**) including a first inlet branch (**121**) and a first outlet branch (**123**) both faced to said first end (**104**) of said at least one first adjusting member (**103**), said first inlet branch (**121**) being faced to a portion of said first end (**104**) of said at least one first adjusting member (**103**) having a section greater than the one to which said first outlet branch is faced so as to minimize or eliminate variations in the flow of said working fluid.

9. Device according to the preceding claim, wherein said at least one plunger member (**30**) and said first conduit (**107**) are reciprocally configured so as said first port (**102**) remains fluidly free for the entire stroke of said at least one plunger member (**30**), so as said at least one first adjusting member (**103**) is susceptible to adjust the speed upon the closing or opening of said closing element (**D**).

10. Device according to any one of the preceding claims, wherein said hydraulic circuit (**100**) includes a second duct (**150**) passing through said at least one end cap (**27**) in fluid communication with both said first compartment (**23**) and said second compartment (**24**), said at least one end cap (**27**) further including at least one second adjusting member (**170**) having a third end (**171**) interacting with said at least one second duct (**150**) and a fourth end (**172**) controllable from the outside by a user to adjust the passage section of the working fluid passing therethrough.

11. Device according to the preceding claim, wherein said at least one first duct (**120**) and second duct (**150**) are in fluid communication with a single central collector (**122**) placed along said first axis (**X**), said at least one first adjusting member (**103**) and at least one second adjusting member (**170**) being placed on opposite sides with respect to a median plane (**πM**) passing through said first axis (**X**).

12. Device according to claim 10 or 11, wherein said elongated tubular wall (**28**) includes a second peripheral conduit (**160**) having a third port (**161**) in said one of said first compartment (**23**) and said second compartment (**24**) and a fourth port (**162**) in fluid communication with the other of said first compartment (**23**) and said second compartment (**24**) through said at least one second duct (**150**).

13. Device according to the preceding claim, wherein said at least one plunger member (**30**) and said second peripheral conduit (**160**) are reciprocally configured so as said third port (**161**) remains fluidly blocked for a part of the stroke of said at least one plunger member (**30**) and fluidly free for a second part of the stroke thereof, said third port (**161**)

being in a spatial relationship with said plunger member so as to remain fluidly free near the open or closed position of the closing element (**D**) so as the latter snap-fits towards the open or closed position thereof, so as said second adjustment member (**170**) is susceptible to adjust the force of the snap-fit of said closing element (**D**) towards the closed or open position.

14. Device according to claim 10, 11, 12 or 13, wherein said third end (**171**) of said at least one second adjusting member (**170**) has a substantially frustoconical shape, said at least one second duct (**150**) including a second inlet branch (**151**) and a second outlet branch (**152**) both faced to said third end (**171**) of said at least one second adjusting member (**170**), said second inlet branch (**151**) being faced to a portion of said third end (**171**) of said at least one second adjusting member (**170**) having a section greater than the one to which said second outlet branch (**152**) is faced so as to minimize or eliminate variations in the flow of said working fluid.

15. Device according to the preceding claim, wherein said first and second inlet branch (**121**, **151**), respectively said first and second outlet branch (**123**, **152**), are reciprocally faced to merge in said single central collector (**122**) susceptible to put the same branches in fluid communication with said other of said first compartment (**23**) and said second compartment (**24**), said first and second outlet branch (**123**, **152**), respectively said first and second inlet branch (**121**, **151**), being both in fluid communication with said one of said first compartment (**23**) and said second compartment (**24**).

16. Device according to any one of the preceding claims, wherein said hydraulic circuit (**100**) further includes a third duct (**130**) passing through said at least one end cap (**27**) in fluid communication with both said first compartment (**23**) and said second compartment (**24**), said elongated tubular wall (**28**) including a third peripheral conduit (**131**) having a fifth port (**132**) in one of said first compartment (**23**) and said second compartment (**24**) and a sixth port (**133**) in fluid communication with the other of said first compartment (**23**) and said second compartment (**24**) through said third duct (**130**), said at least one end cap (**27**) further including second valve means (**140**) acting upon said third duct (**130**) to selectively open upon the passage of the working fluid through said at least one first peripheral conduit (**107**) when the pressure (**PC**) in said at least one working chamber (**20**) exceeds a predetermined threshold value (**PT**), said third duct (**130**) being misaligned with respect to

said at least one first duct (**120**) and second duct (**150**).

17. Device according to any one of the preceding claims, wherein said hydraulic circuit (**100**) includes at least one first channel (**107**) with a first opening (**102**) in one of said first compartment (**23**) and said second compartment (**24**), said hydraulic circuit (**100**) further including at least one first duct (**120**) passing through said at least one end cap (**27**) that includes at least one second opening (**121**) fluidly communicating with said first opening (**102**) and at least one third opening (**122**) fluidly communicating with the other of said first compartment (**23**) and said second compartment (**24**).

18. Device according to any one of the preceding claims, wherein said hydraulic circuit (**100**) further includes at least one second duct (**130**) passing through said at least one end cap (**27**) to put in fluid communication said first compartment (**23**) and said second compartment (**24**), said at least one end cap (**27**) further including second valve means (**140**) acting upon said at least one second duct (**130**) to selectively open upon the passage of the working fluid through said at least one first channel (**107**) when the pressure (**PC**) in said at least one working chamber (**20**) exceeds a predetermined threshold value (**PT**).

19. Device according to the preceding claim, wherein said at least one end cap (**27**) further comprises means for adjusting said predetermined threshold value (**PT**).

20. Device according to claim 18 or 19, wherein said threshold value (**PT**) is calibrated so as to avoid the unhinging of the closing element (**D**) by a user who forces the opening and / or closing thereof.

21. Device according to claim 19 or 20, wherein said second valve means (**140**) are closed when the pressure (**PC**) in said at least one working chamber (**20**) is below said predetermined threshold value (**PT**) to prevent the passage of the working fluid through said at least one second duct (**130**), so as to force the passage thereof through said at least one first duct (**120**).

22. Device according to any one of the preceding claims, wherein said hydraulic circuit (**100**) includes at least one second channel (**131**) with a fourth opening (**132**) in said one of said first compartment (**23**) and said second compartment (**24**) and a fifth opening (**133**) in fluid communication with said at least one second duct (**130**).

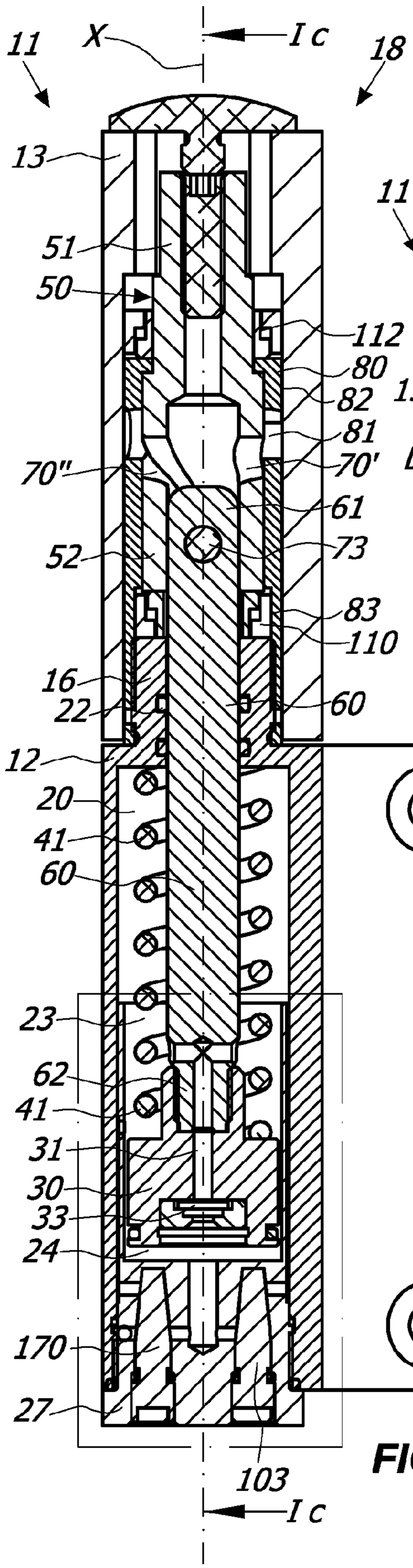
23. Device according to any one of the preceding claims, wherein said at least one working chamber (**20**) further includes first elastic counteracting means (**40**) acting upon said

at least one slider (**30**, **60**) to return it from one of said first and second end-stroke position to the other of said first and second end-stroke position, said threshold pressure value (**PT**) being greater than the maximum pressure (**PCmax**) imparted to said working chamber (**20**) by said first elastic counteracting means (**40**).

24. Device according to the preceding claim, wherein said threshold pressure value (**PT**) is greater than said maximum pressure (**PCmax**) of a percentage of 15% to 30%.

25. Device according to any one of the preceding claims, wherein said second valve means (**140**) include a shutter element (**141**) acting upon said at least one second duct (**130**) and second elastic means (**142**) acting upon said shutter element (**141**), said second elastic means (**142**) being selected to provide said threshold pressure value (**PT**).

26. Device according to the preceding claim, wherein said means for adjusting said predetermined threshold value (**PT**) include an adjusting screw (**143**) controllable from the outside by a user to act upon said second elastic means (**142**), so as to vary the action thereof upon said shutter element (**141**).



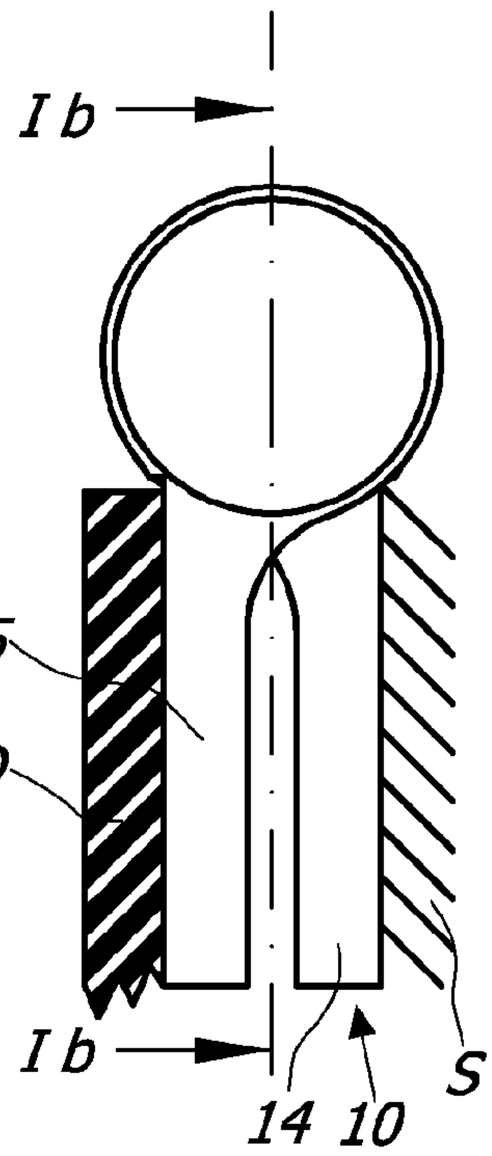


FIG. 1a

14

FIG. 1b

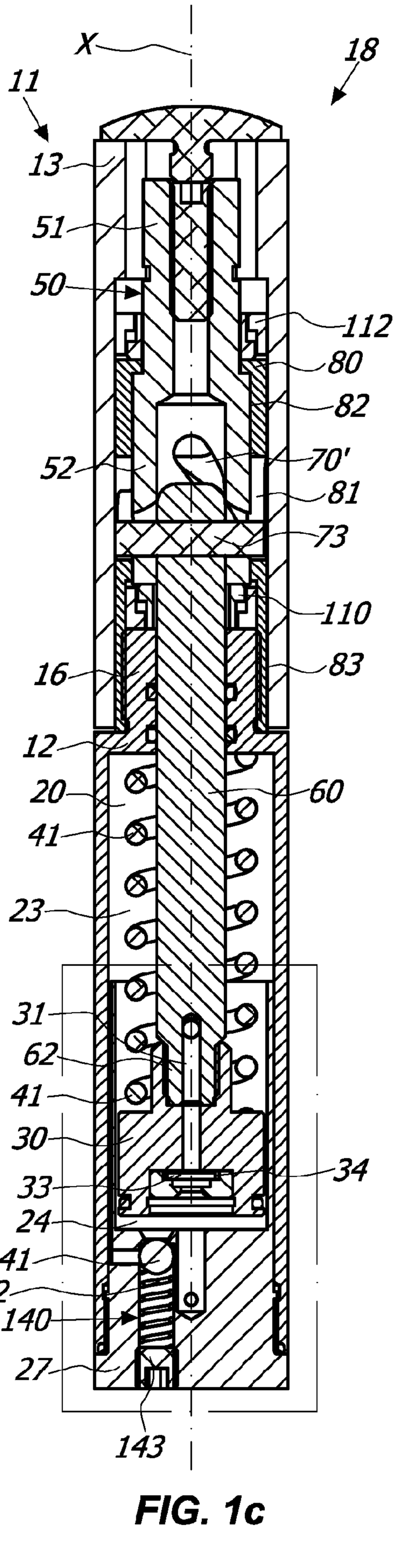


FIG. 1c

1

10

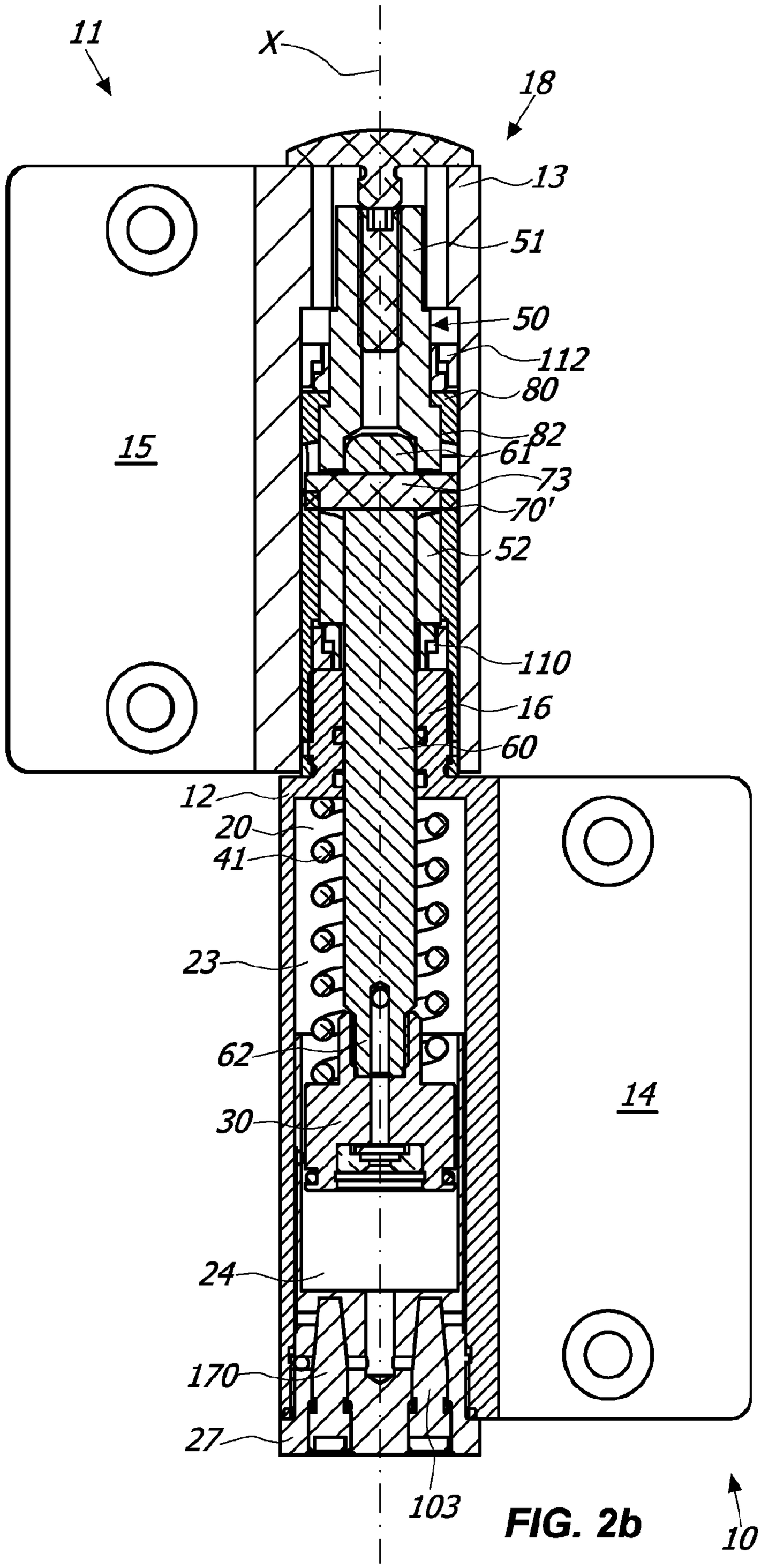

11
X
18
13
51
50
112
80
82
61
73
70'
52
110
16
60
15
12
20
41
23
62
30
24
170
27
14
103
10

FIG. 2b

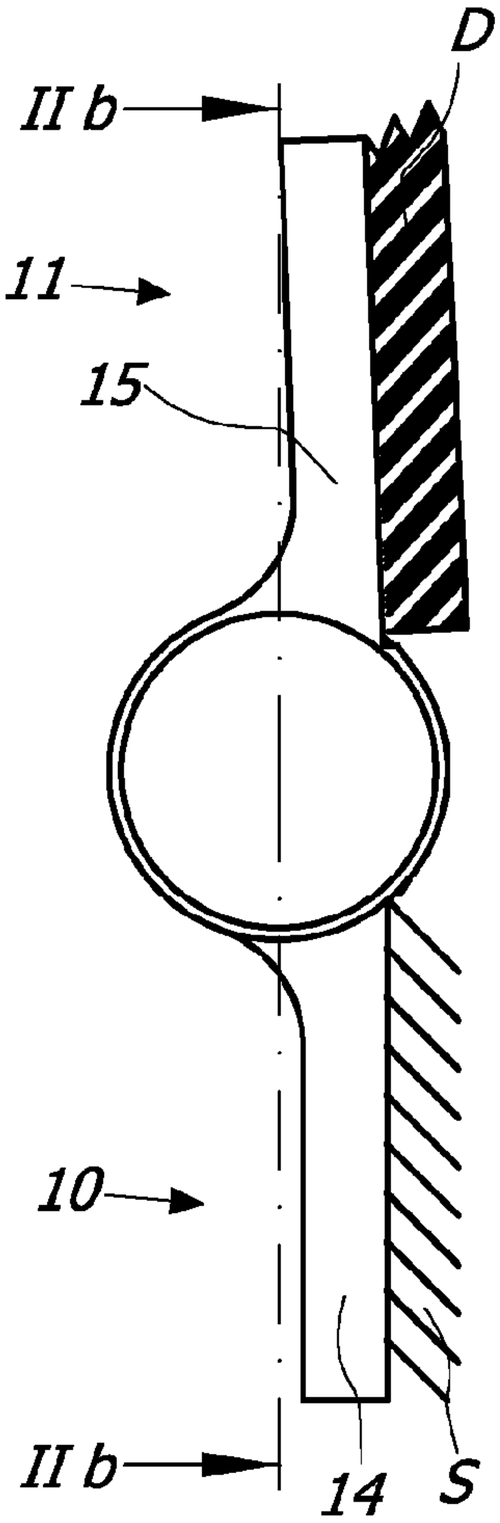

D
II b
11
15
10
II b
14
S

FIG. 2a

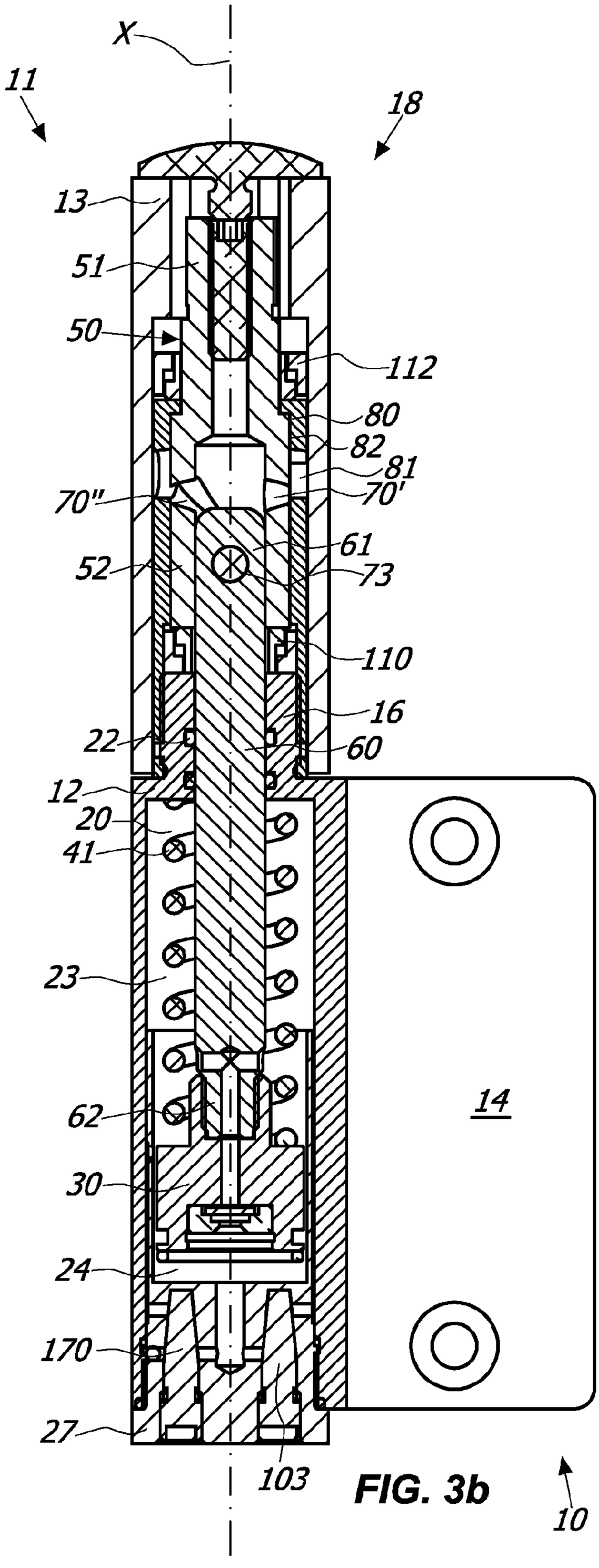

X
11
18
13
51
50
112
80
82
81
70"
70'
61
52
73
110
16
22
60
12
20
41
23
62
30
24
170
27
103
14
10

FIG. 3b

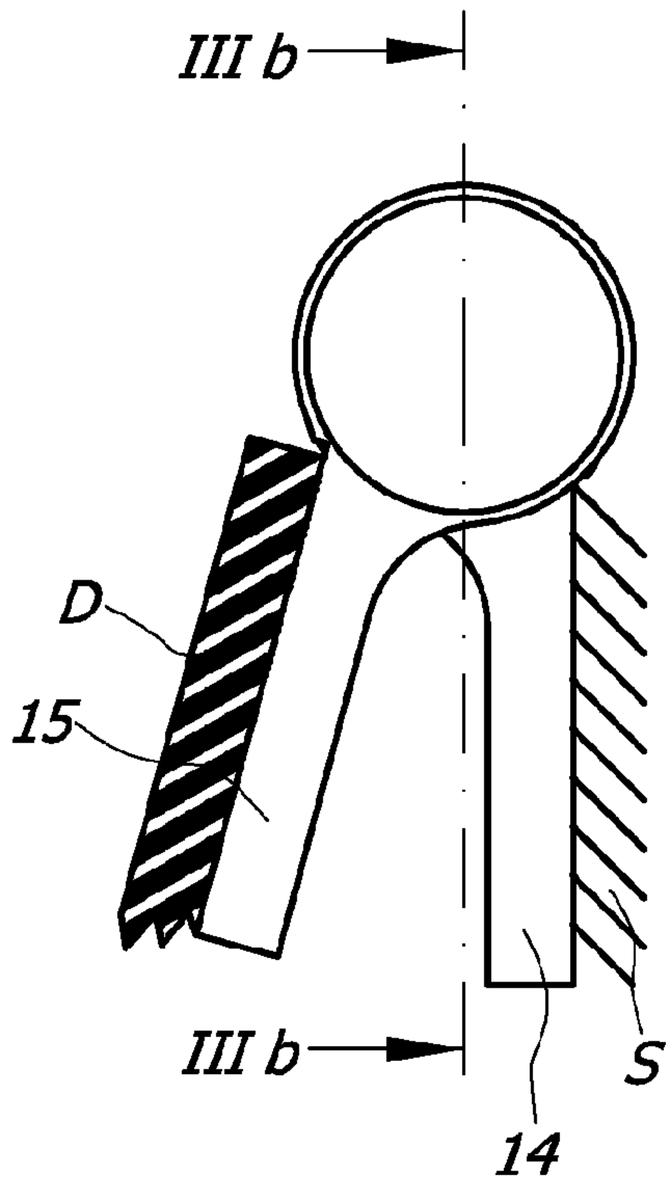

III b
D
15
III b
S
14

FIG. 3a

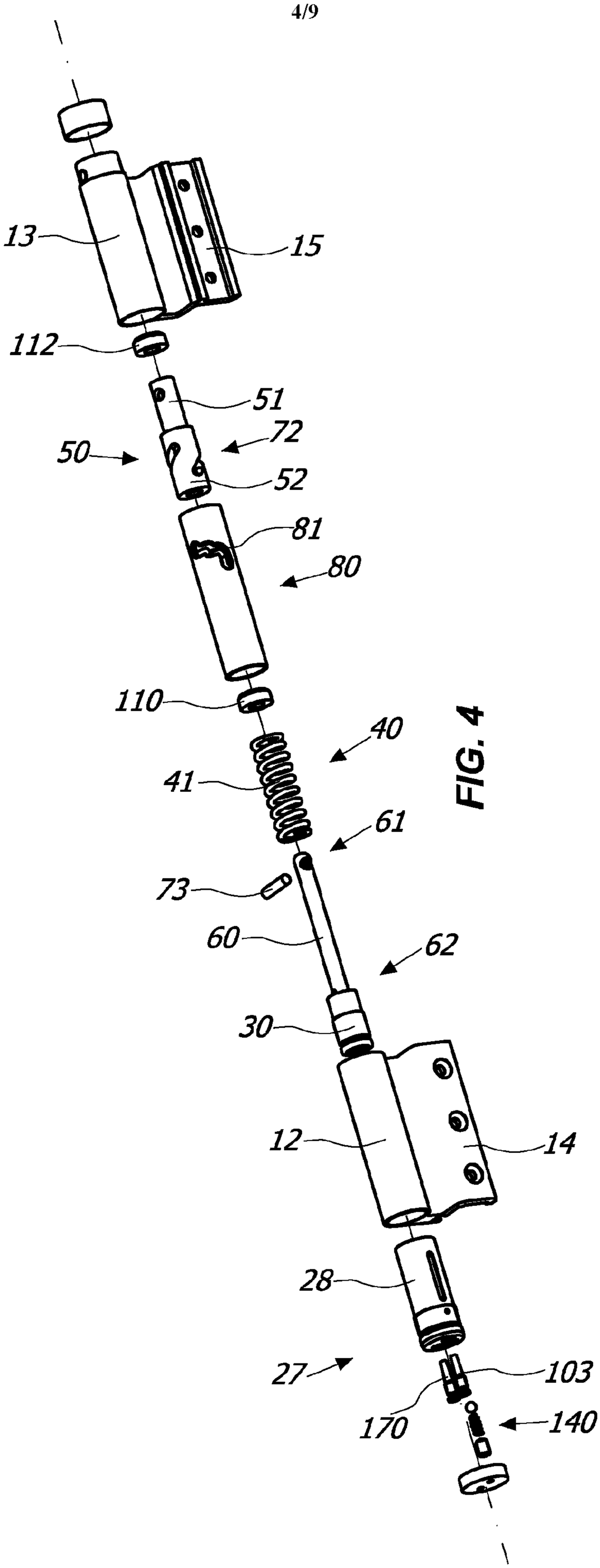

13
15
112
51
72
50
52
81
80
110
40
41
61
73
60
62
30
12
14
28
27
103
170
140

FIG. 4

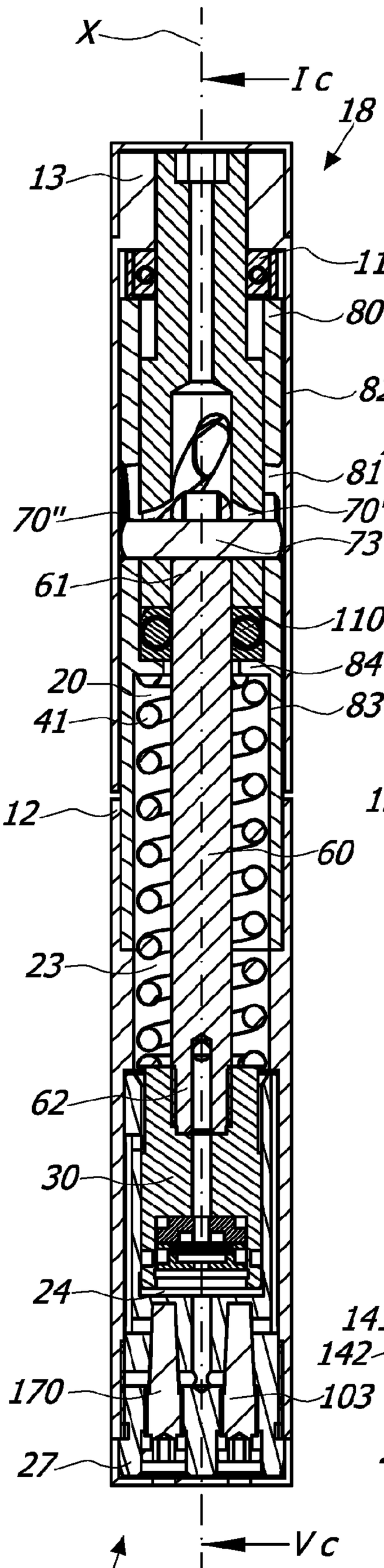


FIG. 5b

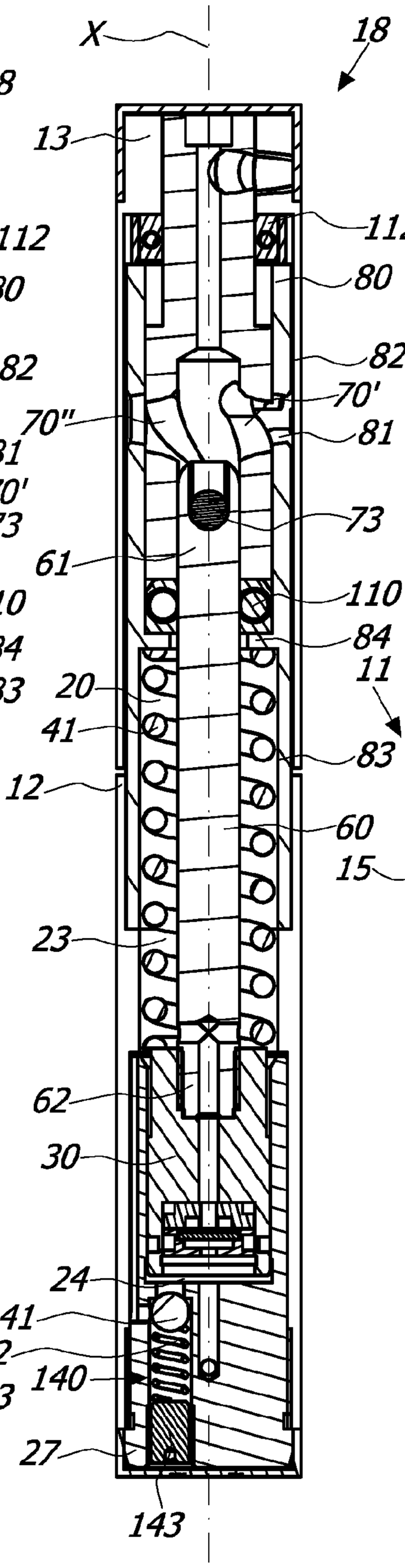


FIG. 5c

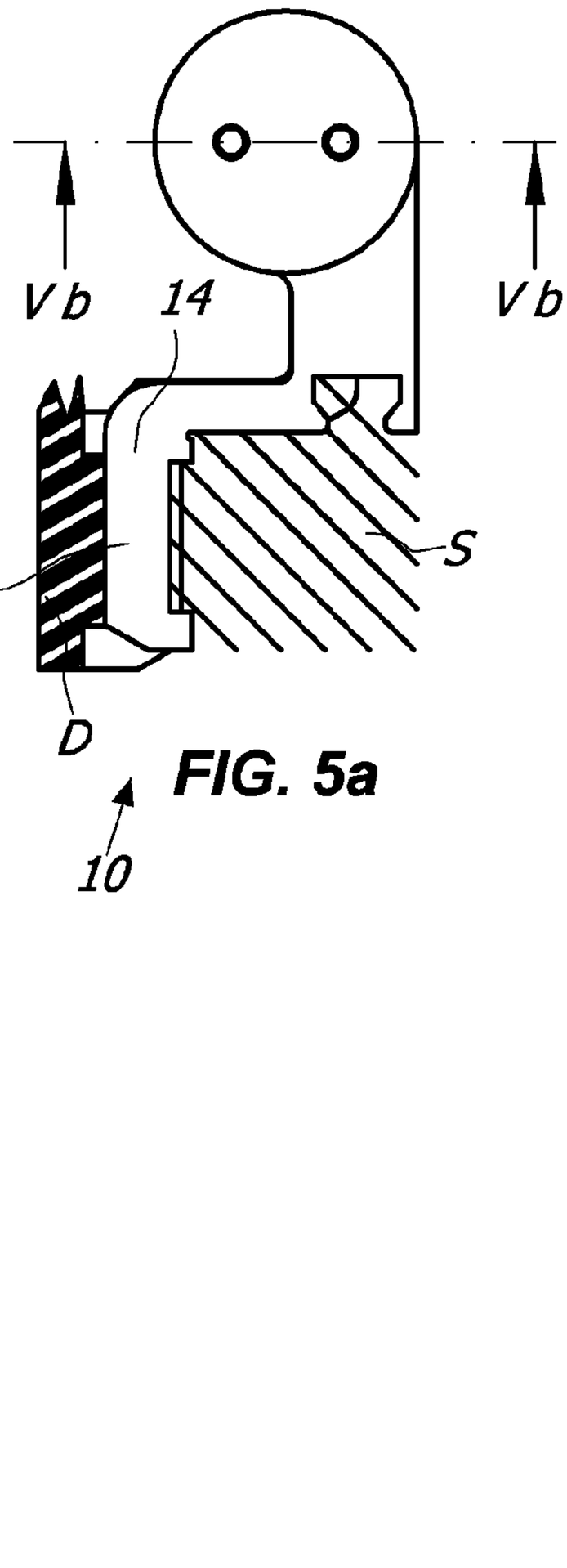


FIG. 5a

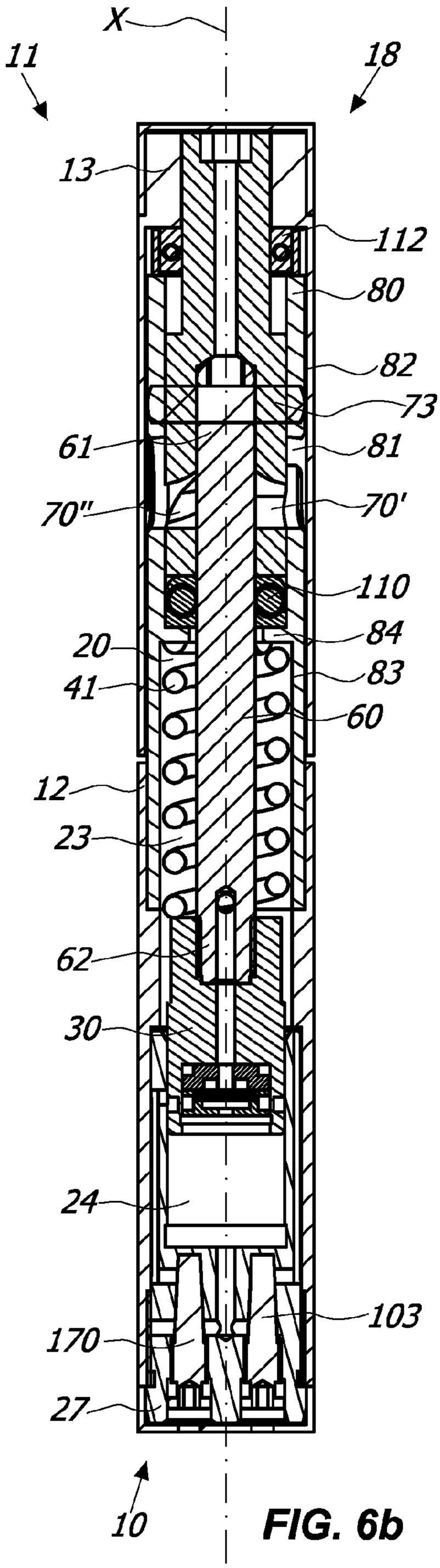

X
11
18
13
112
80
82
73
61
81
70''
70'
110
84
20
83
41
60
12
23
62
30
24
103
170
27
10

FIG. 6b

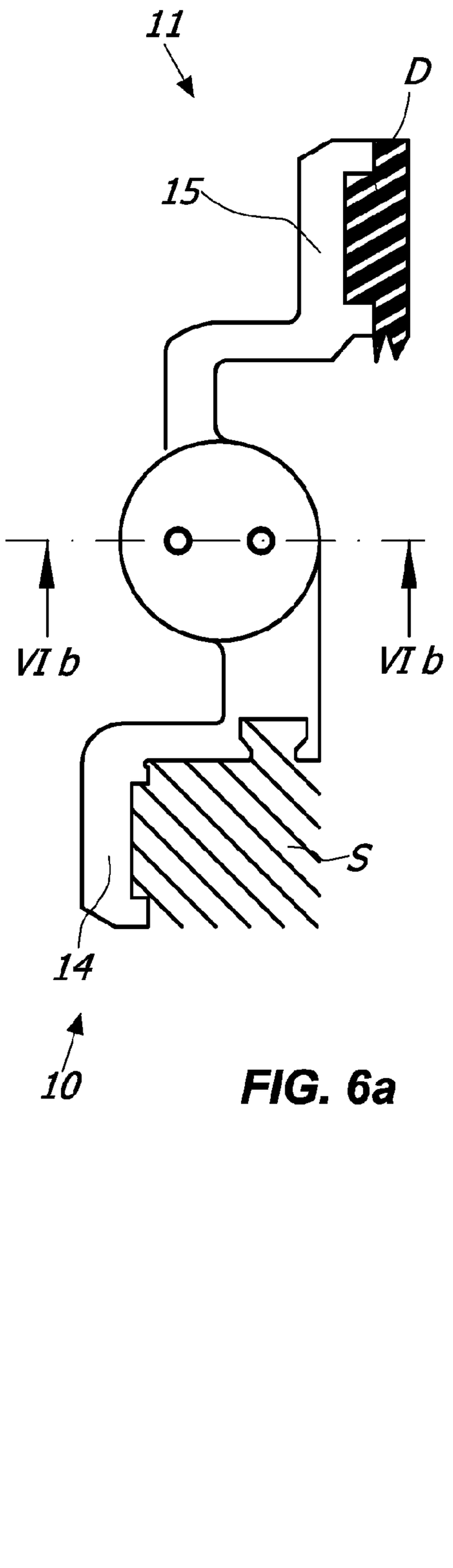

11
D
15
VI b
VI b
S
14
10

FIG. 6a

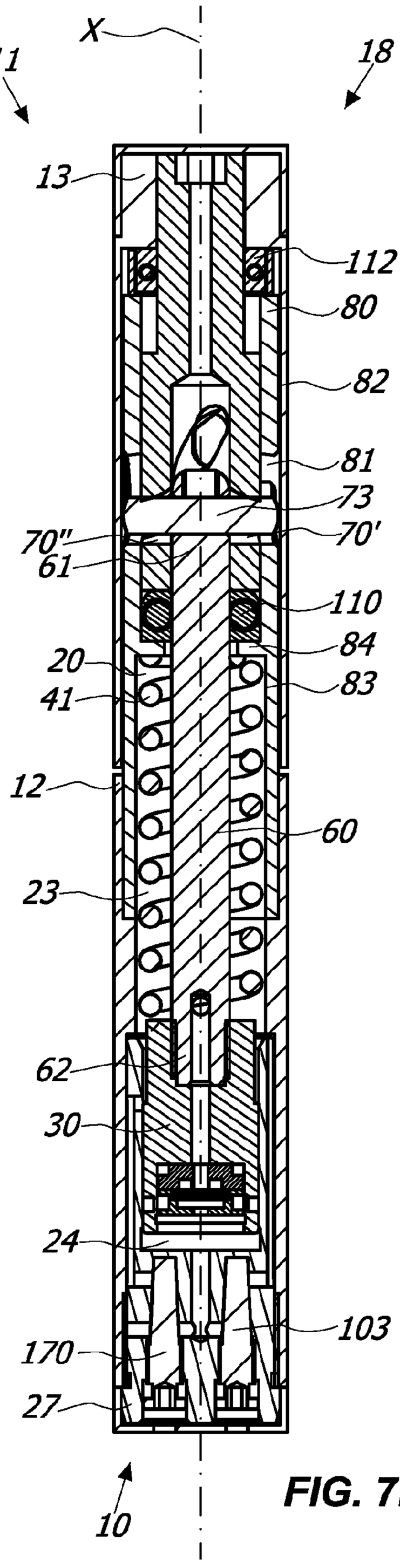

X
11
18
13
112
80
82
81
73
70''
70'
61
110
84
20
83
41
12
60
23
62
30
24
103
170
27
10

FIG. 7b

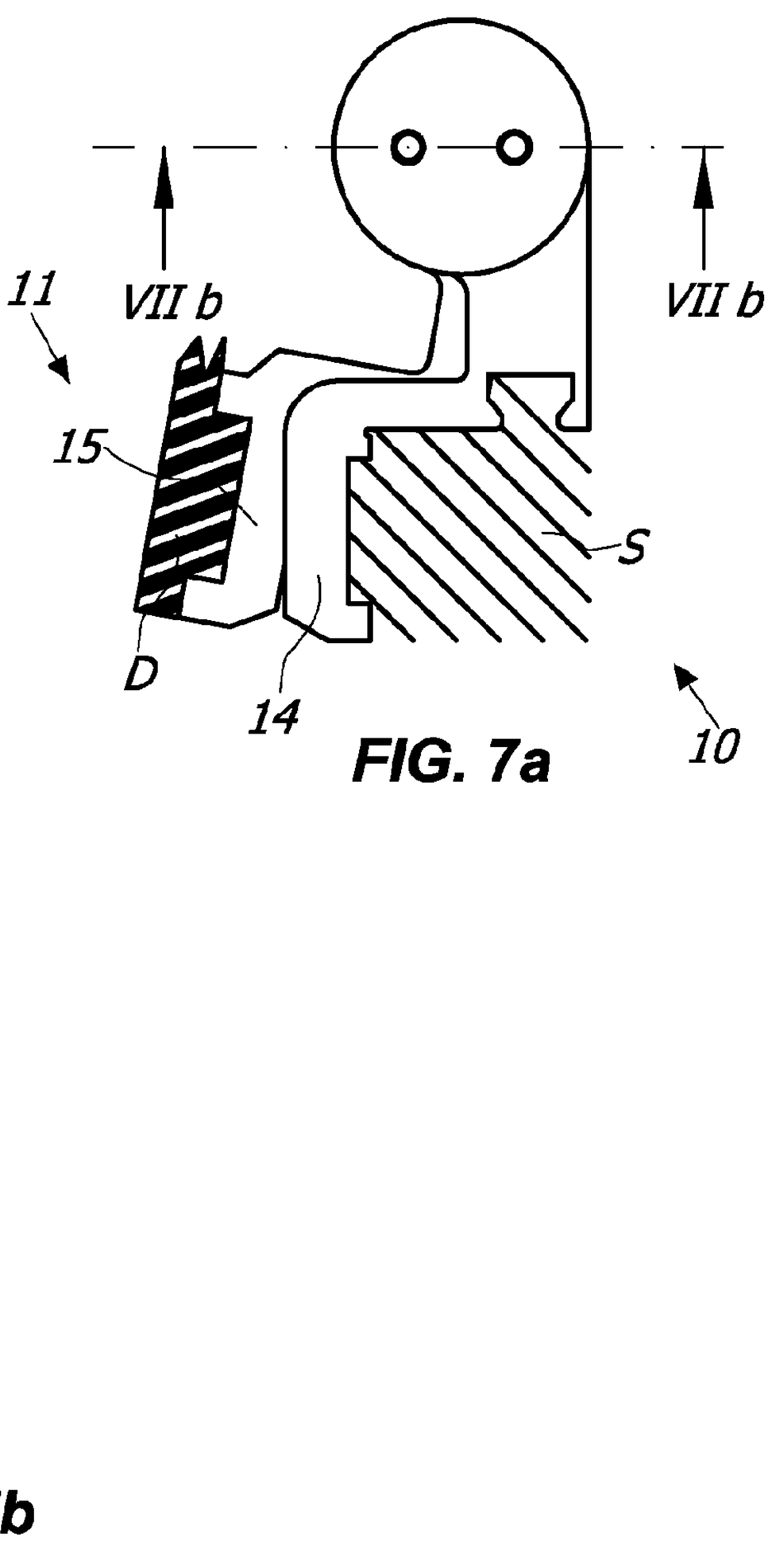

11
VII b
VII b
15
S
D
14
10

FIG. 7a

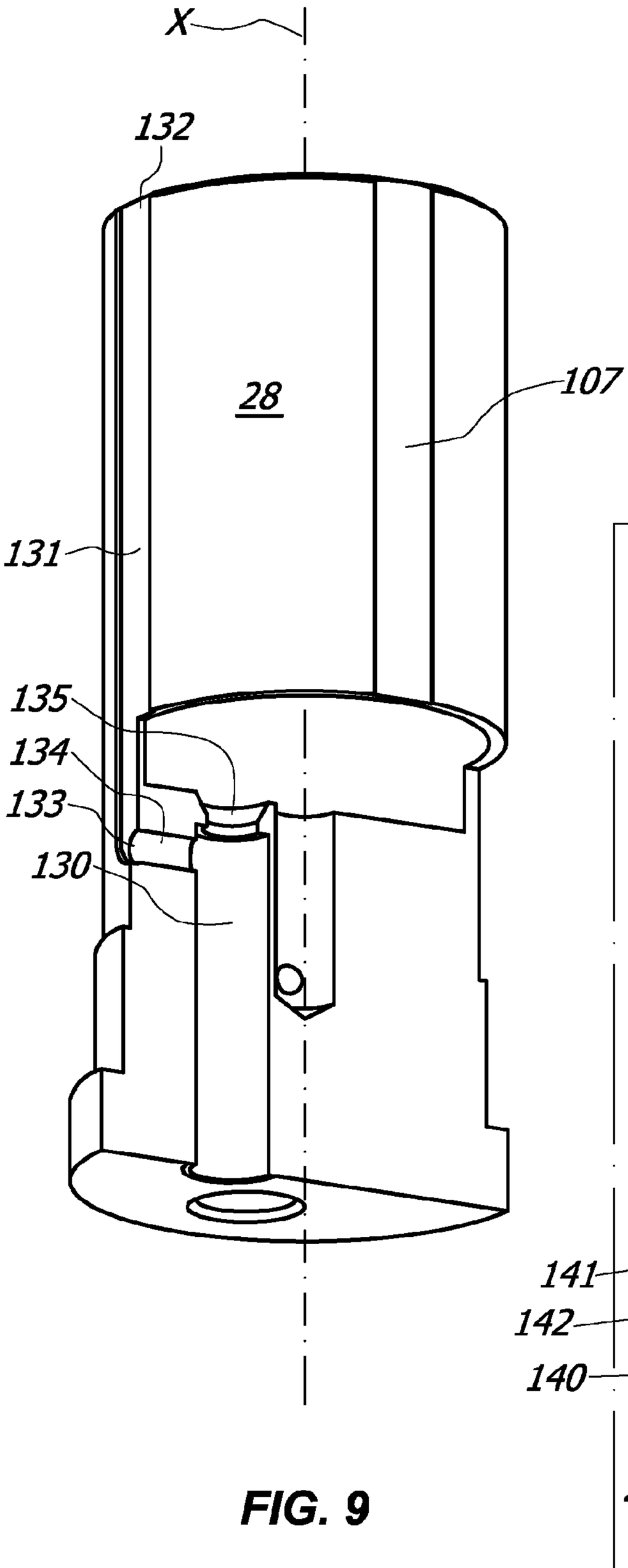


FIG. 9

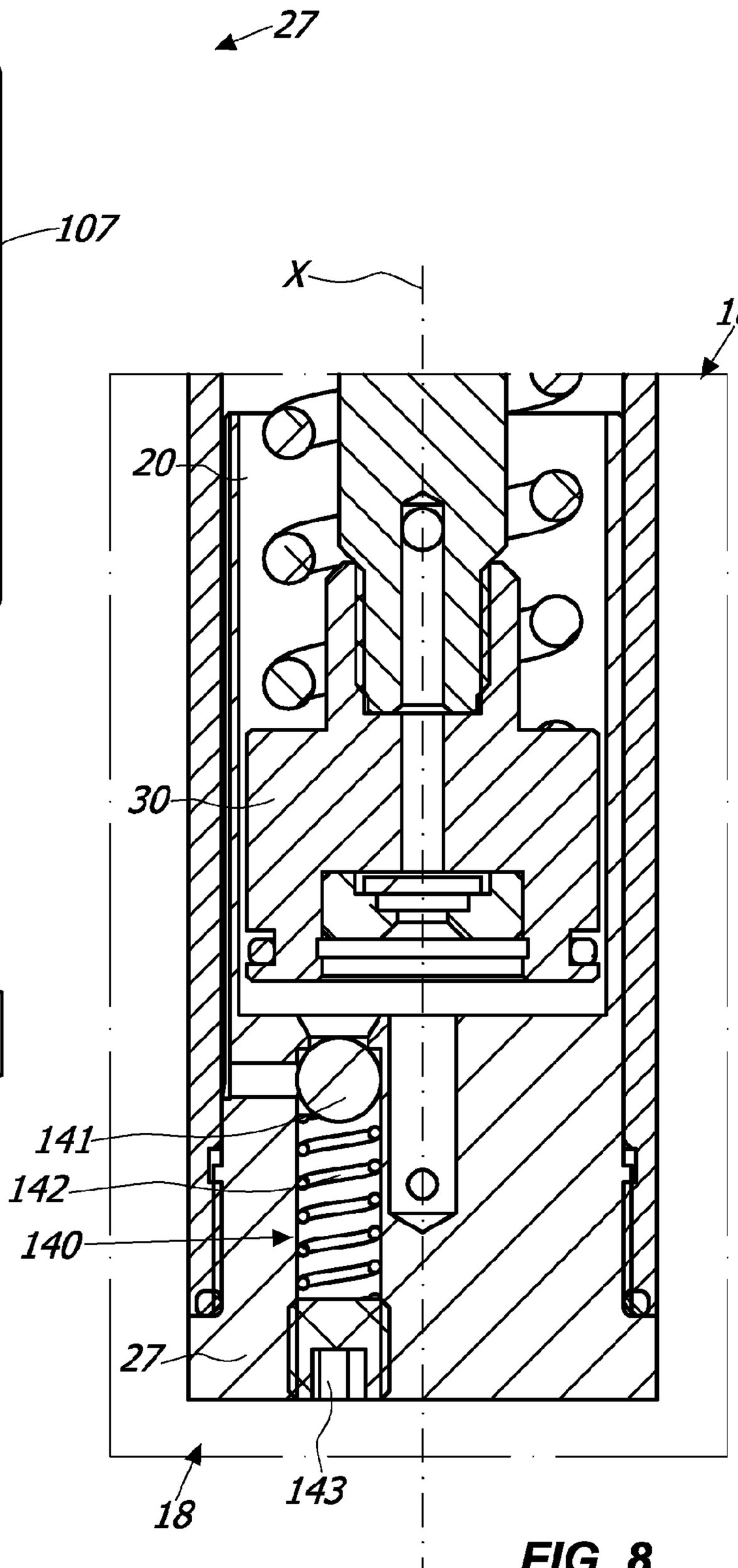


FIG. 8

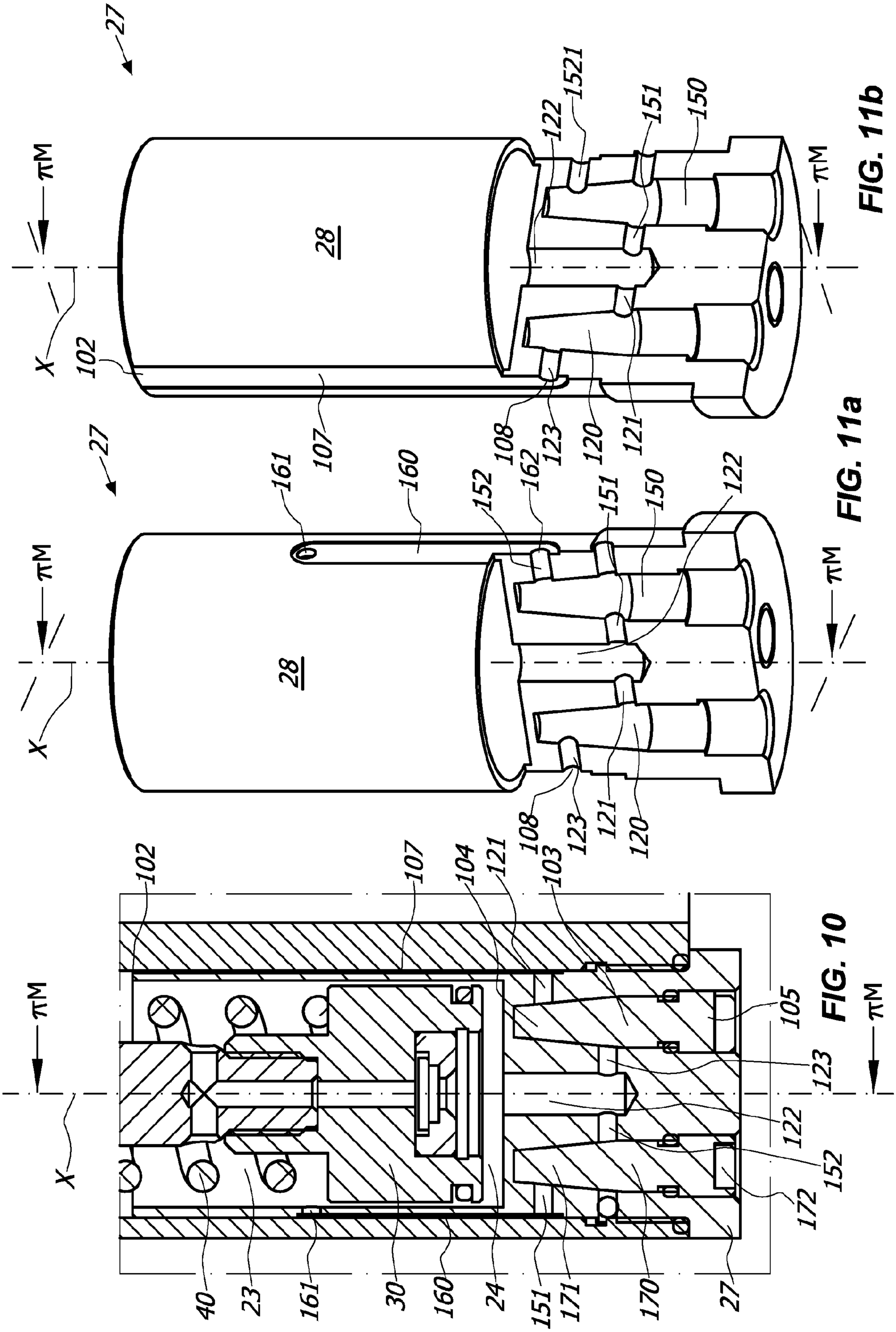
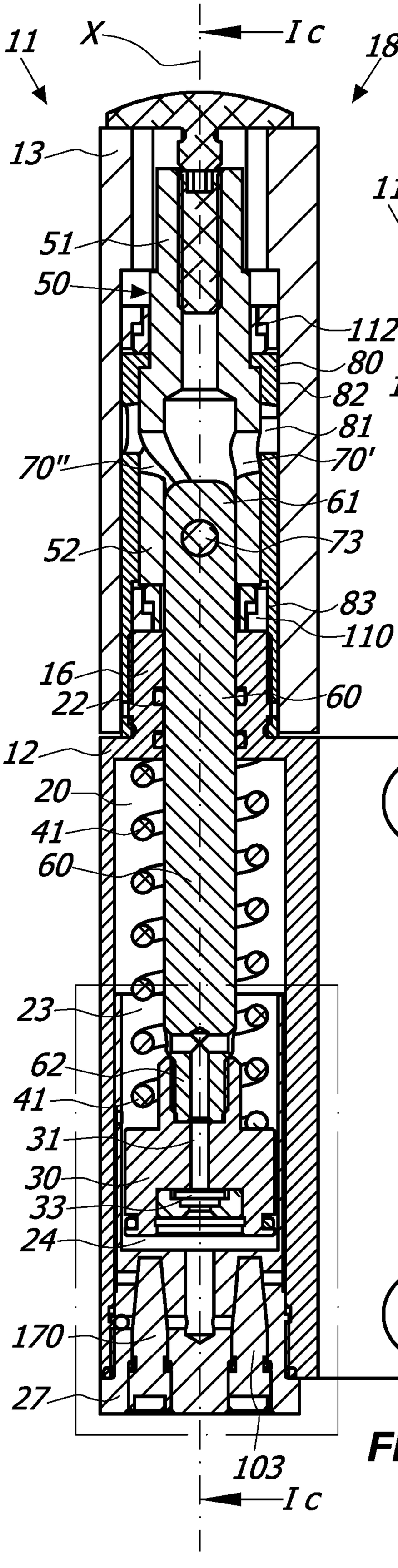


FIG. 11b

FIG. 11a

FIG. 10



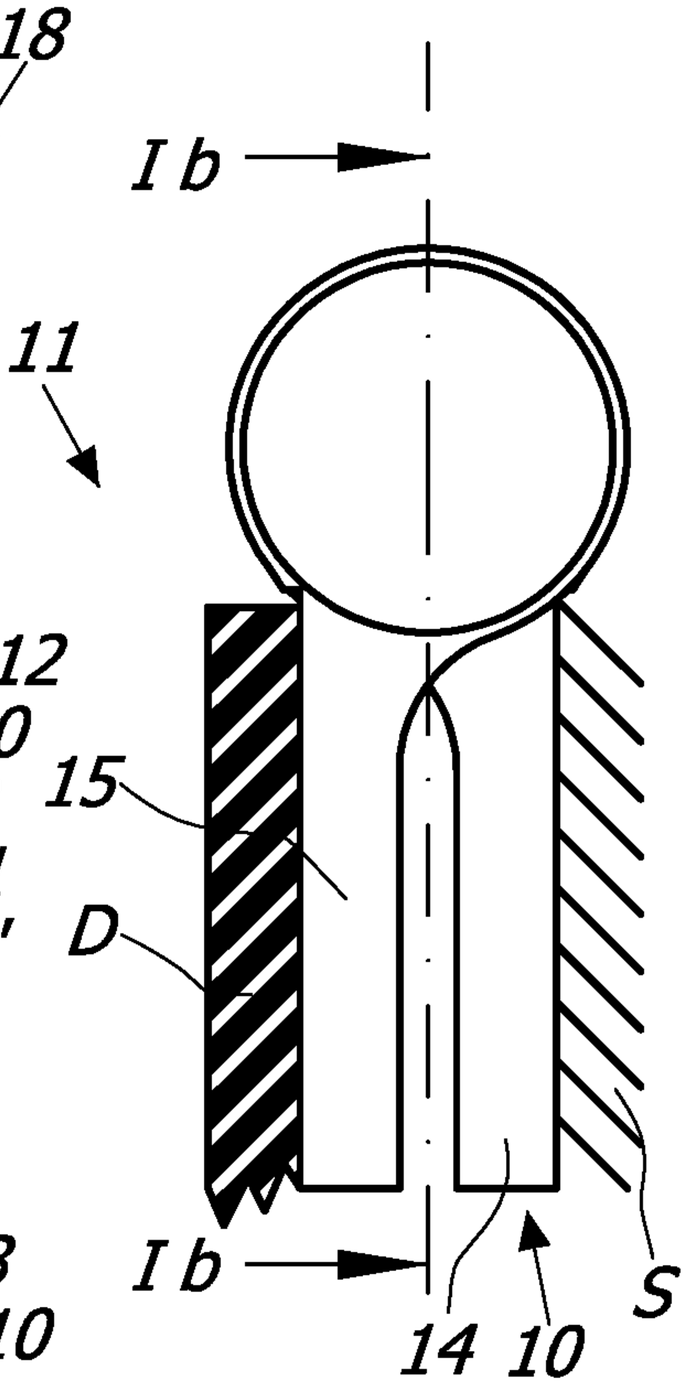


FIG. 1a

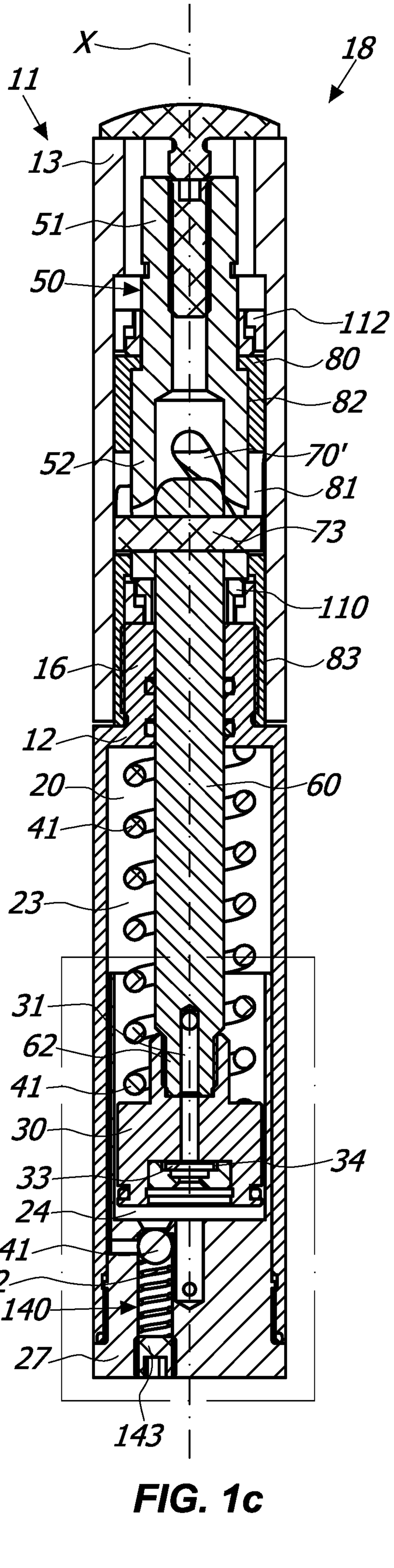


FIG. 1b

FIG. 1c