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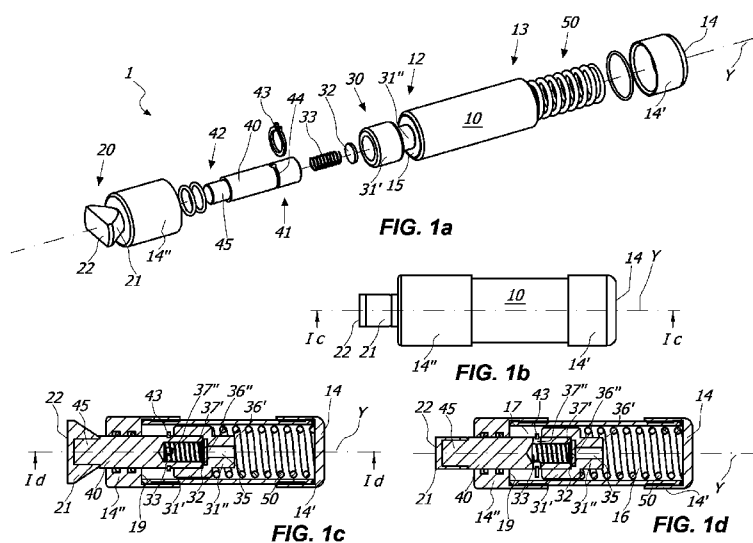
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(54) Title: PISTON DEVICE FOR THE CONTROLLED ROTATABLE MOVEMENT OF DOORS, SHUTTERS OR LIKE MEMBERS



(57) Abstract: A piston device for the controlled rotatable movement of a closing element (D) anchored to a stationary support structure (W) including a tubular body (10) removably insertable into at least one seat (S) of a hinge device (H), an actuating head (20) external to the tubular body (10), a plunger member (30) slidably movable unitary with the actuating head (20) between a retracted end position and an extended end position, elastic contrast means (50) acting on said plunger member (30) for the returning thereof from the retracted end position to the extended end position and a working fluid acting on the plunger member (30) to hydraulically counteract the action thereof. A hinge device in which the piston device is removably insertable.

PISTON DEVICE FOR THE CONTROLLED ROTATABLE MOVEMENT OF DOORS, SHUTTERS OR LIKE MEMBERS**DESCRIPTION**Field of invention

5 The present invention is generally applicable to the technical field of the closing or damping hinges, and particularly relates to a piston device for the controlled rotatable movement of a closing element, such as a door, a shutter or the like, anchored to a stationary support structure, such as a wall, a frame and/or a floor.

10 The invention further relates to a hinge device which includes the above piston device, as well as to an assembly thereof.

Background of the invention

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

15 Usually, such hinges comprise a cam element which interacts with a plunger member slidably movable in an operative chamber within the fixed or mobile element.

Moreover, elastic contrast means acting on the plunger member and a working fluid, usually oil, adapted to hydraulically counteract the action thereof are provided, thus controlling the rotation of the door, the shutter or the like.

20 From the international applications WO2007/125524 and WO2011/016000 exemplary embodiments of these hinges are known, which have a pivot defining a substantially vertical axis perpendicular to the horizontal sliding axis of the plunger member.

25 Although these hinges have high functionality and reliability, they have the recognized drawback that the plunger member is insertable in correspondence of the rear portion of the hinge body, after the making of the operating chamber by a difficult deburring machining process and internal thread thereof to allow the screwing of the closure cap.

Such process, long, difficult and hence expensive *per se*, is even more difficult by the fact that the plunger member moves in an oil bath, so that the machining tolerances must be very low.

30 In these conditions, it is self-evident that the shape of the hinge body is strongly conditioned by the presence of the closure cap.

Moreover, the materials to be used must be of the best quality, since any maintenance and replacement of the internal mechanical members is extremely difficult and requires, in any case, the dismounting of the door, shutter or the like from the hinge device, and of the latter from the support structure to which it is coupled.

Further, the overall dimensions of the hinge device are strongly influenced by the above described processing.

From the documents US2588010 and US2010/024159 door closers are known in which the plunger member is mounted in a tubular member fixed to the main body of the same door closer.

5 These devices have high dimensions, in particular due to the shape of the respective cam elements.

Moreover, in case of maintenance or replacement they require the dismounting of the door, shutter or the like to which they are coupled.

Summary of the invention

10 A main object of the present invention is to overcome at least partly the above mentioned drawbacks, by providing a piston device and/or a hinge device and/or an assembly thereof of high functionality, simple construction and low cost.

Another object of the invention is to provide a piston device that allows to make a hinge device of any external shape.

15 Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof having extremely small dimensions.

Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof which ensures the automatic closing of the door from the open door position.

20 Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof which ensures the controlled movement of the door to which it is connected, both during opening and closing.

Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof which is capable of moving also very heavy doors and windows without changing its behaviour and without the need for adjustments.

25 Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof which has a minimum number of constituent parts.

Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof capable to maintain over time the exact closing position.

30 Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof that is safe.

Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof which is easy to install.

Another object of the invention is to provide a piston device and/or a hinge device and/or an assembly thereof that simplifies the maintenance and/or replacement operations.

Another object of the invention is to provide a hinge device which allows simple adjustment of the closed position of the door, shutter or the like to which it is connected.

These and other objects, as better explained hereafter, are fulfilled by a piston device and/or a hinge device and/or an assembly thereof having one or more of the features herein disclosed, claimed and/or shown.

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, non-exclusive embodiments of a piston device and/or a hinge device and/or an assembly thereof according to the invention, which is described as non-limiting examples with the help of the annexed drawings, in which:

FIG. 1a is an exploded axonometric view of a first embodiment of the piston device **1**, with in **FIG. 1b** a side view of the device of FIG. 1a in an assembled configuration and in **FIGS. 1c** and **1d** some sectional views of the device of FIG. 1b taken along respective planes indicated *I c - I c* and *I d - I d*;

FIG. 2a is an exploded axonometric view of a second embodiment of the piston device **1**, with in **FIG. 2b** a side view of the device of FIG. 2a in an assembled configuration and in **FIGS. 2c** and **2d** some sectional views of the device of FIG. 2b taken along respective planes indicated *II c - II c* and *II d - II d*;

FIGS. 3a and **3b** are respectively axonometric and side views of the piston device **1**, respectively before and after the insertion thereof into the seat **S** of the hinge body **B** of the hinge device **H**;

FIGS. 4a, 4b and **4c** are respectively top and sectioned along respective planes indicated *IV b - IV b* and *IV c - IV c* views of the hinge device **H** with the moving element **M** in the closed position;

FIGS. 5a, 5b and **5c** are respectively top and sectioned along respective planes indicated *V b - V b* and *V c - V c* views of the hinge device **H** with the moving element **M** in the open position;

FIGS. 6a and **6b** are sectional views respectively totally and partially exploded of a first embodiment of the hinge device **H** in which the angular position of the substantially flat operative surface **A** of the cam element **C** is adjustable;

FIGS. 7a to 7f are axonometric and radially sectioned views of some embodiments of the pivot member **V** of the hinge device **H**, wherein **FIGS. 7a** and **7b** show a first embodiment in which the substantially flat operative surface **A** lies on the median plane π_M , **FIGS. 7c** and **7d** show a second embodiment in which the substantially flat operative surface **A** is offset with respect to the median

plane π_M and the edges **E** are rounded, FIGS. 7e and 7f show a third embodiment in which the substantially flat operative surface **A** is offset with respect to the median plane π_M and the edges **E** are tapered;

FIGS. 8a to 8c are axonometric views of further embodiments of the pivot member **V** of the hinge device **H** which includes the projections **100**;

FIGS. 9a, 9b and 9c are respectively sectioned, top and partially sectioned along a plane $IX - IX$ views of a second embodiment of the hinge device **H** in which the angular position of the substantially flat operative surface **A** of the cam element **C** is adjustable;

FIGS. 10a, 10b and 10c are respectively sectioned, top and partially sectioned along a plane $X - X$ views of a third embodiment of the hinge device **H** in which the angular position of the substantially flat operative surface **A** of the cam element **C** is adjustable;

FIG. 11 is an exploded axonometric view of a further embodiment of the piston device **1**;

FIG. 12 is an exploded axonometric view of a further embodiment of a hinge device **H** susceptible to cooperate with the embodiment of the piston device **1** of FIG. 11;

FIG. 13 is an exploded axonometric view of a closing element **D**, in particular a gate, in which tubular frame **310** is inserted a hinge device **H** in accordance with the embodiment of FIG. 12;

FIG. 14 is an enlarged front view of a corner area of a closing element **D**, such as a swing gate or the door of a cold room, in which tubular frame **310** is directly inserted a piston device **1**;

FIGS. 15a, 15b and 15c are respectively exploded axonometric and axially sectioned views with the actuating head **20** respectively in the distal and proximal position of a further embodiment of the piston device **1**;

FIGS. 16a, 16b and 16c are respectively exploded axonometric and axially sectioned views with the actuating head **20** respectively in the distal and proximal position of a further embodiment of the piston device **1**;

FIGS. 17a, 17b and 17c are respectively exploded axonometric and axially sectioned views with the actuating head **20** respectively in the distal and proximal position of a further embodiment of the piston device **1**;

FIGS. 18a, 18b and 18c are respectively exploded axonometric and axially sectioned views with the actuating head **20** respectively in the distal and proximal position of a further embodiment of the piston device **1**;

FIG. 19 is an exploded axonometric view of a further embodiment of the hinge device **H**;

FIGS. 20a, 20b and 20c are axonometric views of some embodiments of the actuating head **20**;

FIGS. 21a and 21b are axially sectioned views of a further embodiment of the hinge device **H**.

Detailed description of some preferred embodiments

With reference to the annexed figures, the piston device according to the invention, generally indicated with **1**, is particularly useful for the controlled rotatably movement of a closing element **D**, such as a door, a shutter or the like, during closing and/or during opening thereof, which closing element may be anchored to a stationary support structure **W**, such as a wall, a door or window frame and/or a floor.

To this end, the piston device is advantageously to be used with a hinge device **H** which includes a fix element **F** anchorable to the stationary support structure **W** and a movable element **M** anchorable to the closure element **D**. As *per se* known, the fix element **F** and the movable one **M** can be mutually coupled to rotate about an axis **X**, which may be substantially vertical, between an open position and a closed position.

The piston device **1** and/or the hinge device **H** may be particularly useful for rotatably moving glass doors.

The annexed figures show various embodiments of the invention. Unless otherwise specified, it is understood that features which are common to several embodiments may be indicated with a single identification mark, whether number or letter.

As particularly shown in FIGS. 3a and 3b, the hinge device **H** may include a hinge body **B** with a seat **S**, which may preferably be countershaped with respect to the piston device **1**, so as to allow the removable insertion thereof within the hinge device **H** and/or the removal therefrom.

To do this, the plate **P** which may be coupled to the hinge body **B** by means of the screw means **T** may be removed.

Conveniently, the seat **S** may have an elongated shape to define an axis **Y'** substantially perpendicular to the axis **X**.

It is understood that the hinge body **B** may include one or more seats **S** each one including a respective piston devices **1** without departing from the scope of protection defined by the appended claims.

The hinge device **H** may also include a cam element **C**, faced to the seat **S** to interact with the piston device **1**. Moreover, the cam element **C** may suitably be integrally movable with a pivot member **V** defining the axis **X**, and can include a substantially flat operative surface **A** susceptible to interact with the piston device **1**.

The pivot member **V** may have any shape. In particular, the cam element **C** may be made of one piece with the pivot member **V**, as shown for example in Figures 7a to 7f, or may be unitary connected to a support **V'**, as shown for example in Figure 19.

As shown by way of example in FIGS. 7a to 7f, the substantially flat operative surface **A** may

have any position with respect to the median plane π_M passing through the axis **X** and perpendicular to the axis **Y'**. In particular, the substantially flat operative surface **A** may precisely lie on the median plane π_M , as shown in FIGS. 7a and 7b, or may be offset with respect to the latter, whether the former surface **A** is behind the latter plane π_M , in accordance with the teachings of the international applications WO2007/125524 and WO2011/016000, or above it, as shown in FIGS. from 7c to 7f.

Further, the latter embodiments may have edges **E** both rounded, as shown in Figures 7c and 7d, so that the closure element always closes automatically also from the completely open position, and tapered, as shown in FIGS. 7e and 7f, so that the closure element has a stop position in the open position.

Advantageously, the cam element **C** may be made according to the teachings of the international application WO2007/125524 and WO2011/016000, which is referred to for proper consultation.

The piston device **1** may include a tubular body **10**, preferably of cylindrical or parallelepiped-like shape, having a front portion **12** susceptible to be faced towards the substantially flat operative surface **A** of the hinge device **H** and a rear portion **13** which includes a bottom wall **14**.

The annexed figures show two embodiments of the piston device **1**.

In a first embodiment, shown by way of example in FIGS. 2a to 2d, the tubular body **10** may include a single closing cap **14'**, located in correspondence of the rear portion **13** and which may at least partially define the bottom wall **14**.

On the other said in a second embodiment, shown by way of example in FIGS. 1a to 1d, the tubular body **10** may include both the closing cap **14'** in correspondence with the rear portion **13** and a further closing cap **14''** located in correspondence of the front portion **12**.

The first embodiment with the single closing cap **14'** has the advantage of having smaller dimensions than the second embodiment.

The tubular body **10**, which may be removably insertable into the seat **S** of the hinge body **B**, may suitably include an operating chamber **15** defining a longitudinal axis **Y**.

Conveniently, as particularly shown in FIG. 3a, the hinge body **B** of the hinge device **H**, and in particular its seat **S**, may be configured to allow the insertion/disinsertion of the piston device into/from the seat **S** by sliding along a plane π substantially perpendicular to the axis **X** and substantially parallel to the axis **Y'**.

Once the piston device **1** is inserted into the seat **S** the axis **Y** of the former coincides with the axis **Y'** of the latter.

The piston device **1** may further include a actuating head **20**, external to the tubular body **10**, which may remain faced to the cam element **C** of the hinge device **H** to interact therewith.

To do this, the actuating head **20** may include a biasing element **21** with a substantially flat pushing face **22** adapted to interact with the substantially flat operative surface **A** of the pivot member **V**. The biasing element **21** may be configured so as to complementarily fit in the compartment **V''** of the pivot member **V** that includes the substantially flat operative surface **A**.

5 As particularly shown in FIGS. 20a, 20b and 20c, the biasing element **21** may have any shape, for example trapezoid-like, parallelepiped-like, cylindrical or disk-shaped.

However, the biasing element **21** may advantageously have a generally plate-like shape, in accordance with the teachings of the international application WO2011016000, which is referred to for proper consultation.

10 The piston device **1** may further include a plunger member **30** slidably movable in the operating chamber **15** along the axis **Y** between a retracted end position, shown in FIGS. 5a to 5c, and an extended end position, shown in FIGS. 4a to 4c.

Although in the particular embodiment shown in the attached figures the retracted end position of the plunger member **30** corresponds to the open position of the movable element **M** and
15 the extended end position corresponds to the closed position thereof, it is understood that it may be possible also the opposite, i.e. that the extended end position of the plunger member **30** corresponds to the open position of the movable element **M** and the retracted end position corresponds to the closed position thereof, without departing from the scope of protection expressed by the appended claims.

20 Conveniently, the actuating head **20** and the plunger member **30** may be mutually connected to unitary move along the axis **Y**.

In particular, the actuating head **20** may move unitary with the plunger member **30** between a position which is proximal to the front portion **12** of the tubular body **10**, corresponding to the retracted end position of the plunger member **30**, and a position distal therefrom, corresponding to
25 the extended end position of the plunger member **30**.

To this end, a rod **40** may be provided passing through the front portion **12** of the tubular body **10** so as to be telescopically coupled therewith. The rod **40** may include a first end **41** within the operating chamber **15** coupled with the plunger member **30** and a second end **42** external to the operating chamber **15** coupled with the actuating head **20**.

30 Conveniently, the operating chamber **15** may include elastic contrast means, for example a compression spring **50**, acting on the plunger member **30** to return it from the retracted end position toward the extended end position. In this way, the spring **50** moves the actuating head **20** from the proximal position to the distal one.

In other words, the elastic contrast means **50** may be configured to move between a position of maximum and minimum elongation, the positions of maximum and minimum elongation thereof respectively coinciding with the distal and proximal positions of the actuating head **20**.

Moreover, since the substantially flat operative surface **A** of the pivot member **V** and the front pushing face **22** of the actuating head **20** may be mechanically disconnected to each other, it is apparent that the elastic contrast means **50** cannot act on the contrary.

In other words, the elastic contrast means **50** cannot act on the plunger member **30** to return the actuating head **20** from the distal to proximal position, such as e.g. in the door closer according to the teachings of the documents US2588010 and US2010/024159.

It is understood that any other elastic means may be employed in place of the spring **50**, for example a fluid cushion, without departing from the scope of protection expressed by the appended claims.

Conveniently, the operating chamber **15** may further include a working fluid, e.g. oil, acting on the plunger member **30** to hydraulically counteract the action of spring **50**.

This way, the hinge device **H** control the rotation of the movable element **M**, both during opening and closing thereof.

More generally, the hinge device **H** ensures a controlled movement of the closure element **D**, both during opening and closing thereof.

This allows e.g. to prevent the closure element **D** during closing strongly impacts against the frame. Further, during opening the controlled movement prevents the closure element **D** to abruptly open, so as to protect both the door *per se* and any user who is in its action range.

The fact that the substantially flat operative surface **A** of the pivot member **V** and the front pushing face **22** of the actuating head **20** are mechanically disconnected to each other makes the piston device **1** and/or the hinge device **H** particularly useful for rotatably moving closure elements **D** made of a fragile material, such as glass doors.

In case of violent opening or closing of the door, for example caused by a child or by a blow wind, the movable element is always free to rotate independently from the bias of the resistance of the plunger member **30**, thereby avoiding an abrupt blocking of the closing element **D**.

Depending on the configuration of the elastic contrast means **50** of the piston device **1**, the hinge device **H** may act as a closing hinge or as a damping hinge for the control of the closure element **D** during opening and/or during closing thereof.

In the first case, the elastic contrast means **50** may be susceptible to act on the plunger member **30** to automatically return the movable element **M** from the open position toward the closed one.

In this case, the elastic contrast means **50** shall be dimensioned for this purpose. therefore, the person skilled in the art has to choose them so as to ensure the automatic closing of the closing element **D** from the open position.

Advantageously, the elastic contrast means **50** may include a bias spring.

5 It is understood that the closing hinge may also have the damping function, during opening and/or during closing.

In the second case, the elastic contrast means **50** may have the only function of returning the plunger member **30** from the retracted position to the extended one, and not also the function of closing the closure element **D**. As a consequence, they may have a lower power with respect to the first case.

Therefore, the person skilled in the art has to choose them to ensure such a function.

Suitably, the substantially flat operative surface **A** of the pivot member **V** and the front pushing face **22** of the actuating head **20** may be substantially parallel when the actuating head **20** is in the distal position and substantially perpendicular when the same actuating head **20** is in the proximal one.

The shape of the cam element **C** determines the position of the actuating head **20** upon the closing or the opening of the closure element **D**.

For example, in the embodiments shown in FIGS 4a to 5b the distal position of the actuating head **20** may correspond to the closed position of the movable element **M** of the hinge device **H**, while the proximal position of the same actuating head **20** may correspond to the the open position of the movable element **M** of the hinge device **H**.

In this case, the pivot member **V** may include a single substantially flat operative surface **A**, which may be substantially parallel to the front pushing face **22** when the closure element **D** is in the closed position, while it may be substantially perpendicular to the front face **22** when the closure element **D** is in the open position.

In a further embodiment of the invention, as shown in FIGS 21a and 21b, the distal position of the actuating head **20** may correspond to the open position of the movable element **M** of the hinge device **H**, while the proximal position of the same actuating head **20** may correspond to the closed position of the movable element **M** of the hinge device **H**.

30 In this case, the pivot member **V** may include a pair of substantially flat operative surfaces **A**, **A'**, which may be susceptible to selectively interact with the front pushing face **22** according to the opening direction of the closure element.

This operative surface **A** may be substantially parallel to the front pushing face **22** when the closure element **D** is in the open position, while it may be substantially perpendicular to the front

face **22** when the closure element **D** is in the closed position.

Conveniently, the plunger member **30**, which may include a tubular body with a front portion **31'** and a rear portion **31''** coupled with the spring **50**, may be able to separate the operating chamber **15** in a first and a second variable volume compartments **16, 17**, fluidly communicating with each other, and preferably reciprocally adjacent.

Advantageously, the spring **50** may be placed in the first compartment **16**, so that the first and the second compartments **16, 17** may have respectively the maximum and minimum volume at the distal position of the actuating head **20**, and the minimum and maximum volume at the proximal position thereof.

Advantageously, the plunger member **30** may be inserted in the operating chamber **15** so as to define therewith an interspace **18** for the passage of the working fluid between the first and the second compartments **16, 17**.

In other words, the interspace **18** may at least partially define a circuit for the passage of the working fluid between the first and the second compartments **16, 17**.

Conveniently, the plunger member **30** may be inserted in the operating chamber **15** with a predetermined clearance, which may be of a few tenths of a millimeter, so that the interspace **18** may have a tubular shape.

On the other hand, the plunger member **30** may be inserted in the operating chamber **15** substantially without clearance, so that the interspace **18** may be defined by one or more tapered portion made on the plunger member **30**.

In a preferred but not exclusive embodiment, shown in FIGS. from the 15th to 15c, the working fluid may pass between the first and the second compartments **16, 17** exclusively through the interspace **18**, both upon opening of the closure element **D** and upon the closing thereof.

Conveniently, the plunger member **30** may include valve means for controlling the passage of the working fluid between the first and the second compartments **16, 17** upon rotation of the movable element **M** in the opening or closing direction.

In a preferred but not exclusive embodiment, the valve means, which may be of the one-way type, may include a disk **32** and, possibly, a correspondent contrast spring **33**.

The absence or presence of the contrast spring **33** may determine the greater or lesser progressivity of the damping effect of the piston device **1**.

For example, in the embodiment shown in FIGS. 16a to 16c the valve means include the contrast spring **33**, while in the embodiment shown in FIGS. from 17a to 17c they are free of the latter.

Advantageously, the disc **32** and, if present, the relative spring **33** may be inserted in a

suitable seat **34**, defined by the blind hole in the rear portion **41** of the stem **40**. The latter, in turn, is susceptible to engage the front portion **31'** of the plunger member **30** for a portion **T** thereof.

The valve means may be inserted into the seat **34** so that the disc **32**, possibly pushed by the spring **33**, selectively blocks the passage of the working fluid between the first and second compartment **16, 17**, forcing the fluid to pass through the interspace **18**.

The passing-through hole **35** and the blind one **34** may be susceptible to put in mutual fluid communication the first and the second compartments **16, 17** passing through the disc **32**, which controls the flow passage of working fluid.

Advantageously, the passing-through hole **35** may have a first opening **36'** for the working fluid which is in the first compartment **16** and a second opening **36''** to allow the passage of the working fluid.

The blind hole **34** may further have a first opening **37'** which faces the second opening **36''** of the passing-through hole **35** and a second opening **37''** to allow the passage of the working fluid from/towards the second compartment **17**.

The disc **32**, possibly pushed by the spring **33**, may be susceptible to selectively obstruct the opening **36''** or **37'**.

This configuration may allow to determine the passage of working fluid through the valve means **32, 33** and the interspace **18**, thus controlling the damping effect of the piston device **1**.

In fact, the valve means **32, 33** may be configured to control the passage of the working fluid between the first and the second compartments **16, 17** upon the passage of the actuating head **20** from from one between the proximal and distal postions towards the other between the proximal and distal postions, while the interspace **18** may allow the passage of the working fluid between the first and second compartments **16, 17** upon the moving back of the actuating head **20** from the other between the proximal and distal postions towards the starting one.

In a preferred but not exclusive embodiment, shown for example in FIGS. 1a to 2d, the disc **32** and the relative spring **33** may be configured to open upon the passage of the actuating head **20** from the distal position to proximal one, so as to allow the passage of the working fluid from the first compartment **16** to the second compartment **17**, and to close upon the passage of the same actuating head **20** from the proximal position to the distal one, so as to force the passage of the working fluid from the second compartment **17** to the first compartment **16** through the interspace **18**.

In this embodiment, the opening of the valve means may correspond to the opening of the movable element **M**, while the closing of the same valve means may correspond to the closing thereof.

On the other hand, in an alternative embodiment, shown for example in FIGS. 16a to 16c, the valve means may be configured to work on the contrary.

In fact, the valve means may open upon the passage of the actuating head **20** from the proximal position to the distal one, so as to allow the passage of the working fluid from the second compartment **17** to the first compartment **16**, and may close upon the passage of the actuating head **20** from the distal position to the proximal one, so as to force the passage of the working fluid from the first compartment **16** to the second compartment **17** through the interspace **18**.

Preferably, the biasing element **21** may be removably connected to the second portion **42** of the stem **40**. To this end, the second portion **42** may have an elongated appendix **45** adapted to complementarily engage in a suitable seat of the biasing element **21**.

This embodiment allows to minimize the manufacturing costs of the piston device **1**. In fact, it is possible to manufacture the biasing element **21** in a first metal material having high mechanical properties, such as stainless steel, while the rod **40** may be made of a second metal material having relatively less mechanical properties, for example brass or aluminum.

In fact, the biasing element **21** may have to bear all the mechanical stress caused by the interaction with the cam element **C**. Further, the biasing element **21** may work substantially dry or anyway not in an oil bath, so that it wears more of the components that are in an oil bath.

Advantageously, the stem **40**, the valve means **32** and **33**, the plunger member **30** and the elastic contrast means **50** may be inserted sequentially "packed" into the tubular body **10**, so as to be mutually coupled in the operating chamber **15** without screws or similar connecting means. This allows to minimize the overall dimensions and to maximize the duration of the piston device **1**.

In order to prevent the decoupling of the stem **40** from the front part **12** of the tubular body **10**, suitable decoupling-preventing means may be provided.

Conveniently, the decoupling-preventing means may include a stop element fixed to the rod **40** and/or to the plunger member **30** susceptible to impact against the inner wall **19** of the tubular body **10** faced to the bottom wall **14**.

For example, as shown in FIGS. 1a to 2d, a blocking ring **43** preferably of the Seeger type may be provided.

The blocking ring **43** may be fitted on the rod **40** by inserton in a suitable annular seat **44**. Advantageously, the position of the seat **44** on the rod **40** may be in a spatial relationship with the inserting portion **T** of the same rod **40** into the portion **31'** of the plunger member **30** such that when the actuating head **20** is in the extended position, as shown in FIGS. 2c and 2d, the blocking ring **43** impacts against the wall **19** preventing the decoupling of the rod **40** from the plunger member **30**.

On the other hand, as shown for example in FIGS. 15a to 18c, the stop element may include

an abutment surface **38** of the plunger member **30** susceptible to impact with the inner wall **19**.

In this case, the plunger member **30** and the rod **40** may be unitary connected to each other.

To this end, as shown for example in FIGS. 16a to 16c, the plunger member **30** and the rod **40** may be unitary coupled to each other by interference.

5 On the other hand, as shown for example in FIGS. 17a to 18c, a passing-through pin **39** insertable in corresponding seats **39'**, **39''** of the rod **40** and of the plunger member **30** may be provided.

10 In a further aspect, as particularly shown in FIGS. 6a to 10c, the hinge device **H** may include means for adjusting the angular position of the substantially flat operative surface **A** of the pivot member **V** with respect to the axis **Y**.

15 It is understood that the adjustment means may equivalently be included in a hinge device **H** which includes the piston device **1** or in a hinge device in which the actuating head **20**, the plunger member **30**, the possible rod **40**, the elastic contrast means **50** and the working fluid are inserted in a seat directly made within the hinge body, for example configured according to the teachings of the international applications WO2007/125524 and WO2011/016000.

In this case, the assembly of the actuating head **20**, the plunger member **30**, the possible rod **40**, the elastic contrast means **50** and the working fluid may be unremovably anchored into the hinge body.

20 Advantageously, the hinge device **H** may include an anchoring element **120**, which may have a substantially "C" shape, for anchoring thereof to the stationary support structure **W** or to the closure element **D**.

The anchoring element **120** may include an upper portion with a respective upper surface **110'** and a lower portion with a respective lower surface **110** faced to respective ends **115**, **115'** of the pivot member **V**.

25 The upper and lower portions may be planar, substantially parallel to the axis **Y'** and substantially perpendicular to the axis **X**. The upper and lower portions may be joined to each other by means of a joining portion, which may preferably be planar, substantially parallel to the axis **X** and substantially perpendicular to the axis **Y'**.

30 In a first embodiment, shown in FIGS. 6a to 8c, the adjustment means may include one or more protrusions **100** in correspondence of the respective end **115** of the pivot member **V** adapted to engage the corresponding surface **110** of the anchoring element **120** faced thereto.

To this end, a first threaded screw **130'** inserted in a corresponding unthreaded hole **135'** passing through the anchoring element **120** may be provided, which may be susceptible to engage the pivot member **V** in a corresponding counterthreaded blind hole **136'** in correspondence of the

end **115** that includes the protrusions **100**.

At the opposite end, a second threaded screw **130''** engaged with a corresponding counterthreaded hole **135''** passing through the anchoring element **120** may be provided, which may be inserted into a corresponding unthreaded blind hole **136''** in correspondence of the respective
5 end **115'** of the pivot member **V**.

Therefore, to change the angular position of the substantially flat operative surface **A** of the pivot member **V** with respect to the axis **Y** may be sufficient to unscrew the screw **130'**, to rotate the anchoring element **120** about the **X** axis to the desired position and to screw the screw **130'**, so as to promote the penetration of the projections **100** into the surface **110**.

10 In a second embodiment, shown in FIGS. 9a to 10b, the adjustment means may include a pin **200** inserted into a radial hole **200'** passing through at least one of the ends **115**, **115'** of the pivot member **V** and in a corresponding radial hole **205** passing through the respective end **125** of the anchoring element **120**. To this end, the pin **200** may have a length greater than the one of the radial hole **200'** of the pivot member **V**.

15 Preferably, the radial hole **200'** may be substantially perpendicular to the axis **X** and to the substantially flat operative surface **A**, while the radial hole **205** may be substantially parallel to the axis **Y'**.

The pin **200** may be susceptible to impact against one couple of abutment adjusting screws **210'**, **210''** inserted into respective seats **215'**, **215''** defining respective sliding directions **d'**, **d''**
20 thereof which may be substantially parallel to each other and substantially perpendicular to the axis **X** and to the axis **Y'**.

Suitably, the seats **215'**, **215''** may be placed on only one side of the end **125** of the anchoring element **120** or on opposite sides thereof, as shown respectively in FIGS 9a to 9c and 10a to 10c.

FIG. 11 shows a further embodiment of the piston device **1**, having features similar to the
25 embodiments shown in FIGS 1a and 2a, but having a tubular body **10** of generally parallelepiped-like shape.

This embodiment of the piston device **1** is particularly suitable to be inserted into the hinge device **H** shown in FIG. 12, which includes a hinge body **B** which defines the moving element **M** and a pivot member **V** defining the fix element **F**.

30 To this end, the pivot member **V** may include a shaped end portion **V'**, insertable into a suitable countershaped seat made e.g. in a floor, not shown in the figures because *per se* known.

The hinge body **B** may include a first elongated portion **300'** which is internally hollow to define the seat **S** for the removable insertion of the piston device **1**. Preferably, the seat **S** may be countershaped with respect to the tubular body **10** of the parallelepiped-like piston device **1**, so as to

avoid rotation thereof about the axis **Y**.

The hinge body **B** may further include a second elongated portion **300''** which is internally hollow to house the pivot member **V**, which may define the axis of rotation **X** of the hinge body **B**.

Advantageously, as particularly shown in FIG. 13, the first and/or the second elongated portions **300'**, **300''**, which may be substantially perpendicular to each other, may be slidably inserted in the tubular frame **310** of a closure element **D** hidden to the sight, such as a swing gate or a shutter of a cold room.

It is understood that the embodiment of the hinge device **H** shown in FIG. 12 can also be made in accordance with the teachings of the international applications WO2007/125524 and/or WO2011/016000. In other words, the hinge device **H** shown in FIG. 12 may be configured to house both the pivot member **V** and a piston assembly directly made into the seat **S** and non removable therefrom, according to the teachings of one of the above mentioned applications, or both.

In a further embodiment, shown in FIG. 14, the piston device **1** and the relative pivot member **V** which includes the cam element **C** may be directly inserted in the tubular frame **310**. In other words, a closing element **D** may be provided, such as a swing gate or door of a cold room, which is not designed to hold the hinge device **H** as in FIG. 13 and that includes a tubular frame **310** suitably configured to house directly the piston device **1** and the relative pivot member **V**. To this end, the tubular frame **310** may provide suitable seats.

Also in this case, it is understood that the embodiment of closure element **D** shown in FIG. 14 can be made in accordance with the teachings of the international applications WO2007/125524 and/or WO2011/016000. In other words, the tubular frame **310** of the closure element **D** shown in FIG. 14 may be configured to accommodate both the pivot member **V** and a plunger assembly made directly within it and non removable therefrom, according to the teachings of one of the above mentioned applications, or both.

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

In particular, the piston device **1** allows to provide a hinge device **H** of any outer shape, since the whole hydraulic part of the hinge device is enclosed within the tubular body **10**.

Apparently, the piston device **1** is extremely low cost, simple to manufacture and reliable over time due to the limited number of constituent parts.

Thanks to the particular configuration, the hinge device **H** and the piston device **1** may be made separately, so that the assembly constituted by the two devices is particularly low cost and simple to manufacture with respect to the prior art hinge devices.

Moreover, in case of need for maintenance or replacement, it is sufficient to disassemble the plate **P** and remove the piston device **1** from the seat **S**. Where possible, these operations can also be

carried out without dismounting the closure element **D** from the support **W**, which greatly simplifies the maintenance of the hinge device **H**.

The invention is susceptible to many changes and variants. All particulars may be replaced by other technically equivalent elements, and the materials may be different according to the needs,
5 without exceeding the scope of the invention defined by the appended claims.

CLAIMS

1. A piston device for the controlled rotatable movement of a closing element (**D**) anchored to a stationary support structure (**W**) to be used with a hinge device (**H**) including a fix element (**F**) anchorable to the stationary support structure (**W**) and a movable element (**M**) anchorable to the closing element (**D**), said movable element (**M**) and said fix element (**F**) being reciprocally coupled to allow the rotation of the movable element (**M**) between an open position and a closed position, one between said movable element (**M**) and said fix element (**F**) including a hinge body (**B**) having at least one seat (**S**) for removably inserting the piston device, the other between said movable element (**M**) and said fix element (**F**) including a pivot member (**V**) having a cam element (**C**) with at least one substantially flat operative surface (**A**) faced to said at least one seat (**S**) to interact with the piston device, the piston device including:

- a tubular body (**10**) removably insertable into the at least one seat (**S**) of the hinge device (**H**) having a front portion (**12**) susceptible to be faced towards the at least one substantially flat operative surface (**A**) of the hinge device (**H**) and a rear portion (**13**) including a bottom wall (**14**), said tubular body (**10**) including an operating chamber (**15**) defining a first longitudinal axis (**Y**);

- an actuating head (**20**) external to said tubular body (**10**) including a substantially flat front pushing face (**22**) susceptible to contact engage the at least one substantially flat operative surface (**A**) of the hinge device (**H**);

- a plunger member (**30**) slidably movable in said operating chamber (**15**) between a retracted end position and an extended end position for separating thereof in at least one first and one second variable volume compartments (**16**, **17**) fluidically communicating with each other;

wherein said actuating head (**20**) is unitary connected with said plunger member (**30**) to move along said first axis (**Y**) between a position proximal to the front portion (**12**) of the tubular body (**10**), corresponding to the retracted end position of the plunger member (**30**), and a position distal thereto, corresponding to the extended end position of the plunger member (**30**);

wherein said operating chamber (**15**) further includes elastic contrast means (**50**) acting on said plunger member (**30**) for the returning thereof from the retracted end position to the extended end position, said operating chamber (**15**) further including a working fluid acting on said plunger member (**30**) to hydraulically counteract the action thereof.

2. Piston device according to claim 1, wherein said at least one first and one second variable volume compartments (**16**, **17**) are adjacent to each other.

3. Piston device according to claim 1 or 2, wherein said elastic contrast means (**50**) are

placed in said first compartment (16) so that said at least one first and second compartments (16, 17) have respectively the maximum and minimum volume in correspondence of the distal position of said actuating head (20) and respectively the minimum and maximum volume in correspondence of the proximal position thereof.

5 4. Piston device according to claim 1, 2 or 3, wherein said plunger member (30) is inserted into said the operating chamber (15) so as to define therewith an interspace (18) for the passage of the working fluid between said at least one first and second compartments (16, 17).

 5. Piston device according to the preceding claim, wherein said at least one first and second compartments (16, 17) are fluidically coupled each other only through said interspace (18).

10 6. Piston device according to the claim 4, wherein said plunger member (30) includes valve means (32, 33) of the one-way type for controlling the passage of the working fluid between said at least one first and second compartments (16, 17) upon the moving of said actuating head (20) from one between said proximal and distal postions towards the other between said proximal and distal postions, said interspace (18) allowing the passage of the working fluid between said at least one first
15 and second compartments (16, 17) upon the moving back of said actuating head (20) from the other between said proximal and distal postions towards the one between said proximal and distal postions.

 7. Piston device according to the preceding claim, wherein said valve means (32, 33) are configured to open upon the moving of said actuating head (20) from the distal postion towards the
20 proximal postion, thus allowing the passage of the working fluid from the first compartment to the second compartment (16, 17), and to close upon the moving of said actuating head (20) from the proximal postion towards the distal postion, so as to force the passage of working fluid from the second compartment to the first compartment (16, 17) through said interspace (18).

 8. Piston device according to the claim 6, wherein said valve means (32, 33) are configured
25 to open upon the moving of said actuating head (20) from the proximal postion towards the distal postion, thus allowing the passage of the working fluid from the second compartment to the first compartment (16, 17), and to close upon the moving of said actuating head (20) from the distal postion towards the proximal postion, so as to force the passage of working fluid from the first compartment to the second compartment (16, 17) through said interspace (18).

30 9. Piston device according to any one of the preceding claims, wherein the at least one substantially flat operative surface (A) of the pivot member (V) and the substantially flat front pushing face (22) of said actuating head (20) are substantially parallel each other when the actuating head (20) is in the distal position and substantially perpendicular each other when the same actuating head (20) is in the proximal position.

10. Piston device according to the preceding claim, wherein the distal position of said actuating head (20) corresponds to the closed position of the movable element (M) of the hinge device (H), the proximal position of the same actuating head (20) correspond to the open position of the movable element (M) of the hinge device (H).

5 11. Piston device according to claim 9, wherein the distal position of said actuating head (20) corresponds to the open position of the movable element (M) of the hinge device (H), the proximal position of the same actuating head (20) corresponding to the closed position of the movable element (M) of the hinge device (H).

10 12. Piston device according to any one of the preceding claims, wherein the at least one seat (S) of the hinge body (B) has an elongated shape to define a second longitudinal axis (Y') substantially coinciding with said first axis (Y) when the piston device is inserted therein.

13. Piston device according to the preceding claim, wherein the pivot member (V) of the hinge device (H) has an elongated shape to define a third axis (X) substantially perpendicular to said second axis (Y').

15 14. Piston device according to the preceding claim, wherein the at least one substantially flat operative surface (A) of the pivot member (V) is substantially parallel to said third axis (X).

15. Piston device according to any one of the preceding claims, wherein said elastic contrast means (50) are configured to move between a position of maximum and minimum elongation respectively corresponding to the distal and proximal positions of said actuating head (20).

20 16. Piston device according to any one of the preceding claims, wherein the at least one operative surface (A) of the pivot member (V) and the front pushing face (22) of said actuating head (20) are mutually mechanically disconnected.

25 17. Piston device according to any one of the preceding claims, further including a rod (40) telescopically coupled with the front portion (12) of said tubular body (10) having a first end (41) within said operating chamber (15) unitary coupled with said plunger member (30) and a second end (42) external to said operating chamber (15) including said actuating head (20).

18. Piston device according to the preceding claim, wherein said actuating head (20) includes a biasing element (21) removably coupable with the second end (42) of said rod (40), said biasing element (21) including said front pushing face (22).

30 19. Piston device according to any one of the preceding claims, wherein said plunger member (30) includes a tubular element with a rear portion (31'') coupled with said elastic contrast means (50) and a front portion (31') coupled with said first end (41) of said rod (40).

20. Piston device according to the preceding claim, wherein said front portion (31') of said plunger member (30) is coupled with the first end (41) of said rod (40) to define a housing (34) for

said valve means (32, 33) which is fluidically coupled with both said at least one first and second compartments (16, 17).

21. Piston device according to the preceding claim, wherein said first end (41) of said rod (40) includes a blind hole (34) defining the housing of said valve means (32, 33).

22. Piston device according to the claim 20 or 21, wherein said rear portion (31'') of said plunger member (30) includes a first passing-through hole (35) to put into fluidical communication said first compartment (16) and the housing (34) of said valve means (32, 33), said first end (41) of said rod (40) including a second passing-through hole (37'') to put into fluidical communication said second compartment (17) and the housing (34) of said means valve (32, 33).

23. Piston device according to any one of claims 20, 21 or 22, wherein said valve means include a disc-like element (32) sliding in said housing (34) along said first axis (Y).

24. Piston device according to the preceding claim, wherein said valve means further include a contrast spring (33) placed in said housing (34) for forcing said disc-like element (32) against the inlet or the outlet thereof.

25. Piston device according to any one of claims 17 to 24, further comprising means for preventing the mutual decoupling of said rod (40) and said tubular body (10).

26. Piston device according to the preceding claim, wherein said decoupling-preventing means include a stop element unitary with said rod (40) and/or said plunger member (30) susceptible to impact against the inner wall (19) of the tubular body (10) facing the bottom wall (14).

27. Piston device according to the preceding claim, wherein said stop element includes a blocking ring (43) inserted in a corresponding annular seat (44) of the rod (40).

28. Piston device according to claim 26, wherein said stop element includes an abutment surface of said plunger member (30), said rod (40) and said plunger member (30) being unitary connected to each other.

29. Piston device according to the preceding claim, wherein said plunger member (30) and said rod (40) are unitary connected by mechanical interference.

30. Piston device according to claim 28 or 29, further comprising at least one passing-through pin (39) insertable in corresponding seats (39', 39'') of said rod (40) and said plunger member (30).

31. Piston device according to any one of the preceding claims, wherein the piston device does not include the pivot member (V) of the hinge device (H).

32. Piston device according to any one of the preceding claims, wherein the hinge body (B) of the hinge device (H) is configured to allow the insertion/removal of the piston device in/from the at least one seat (S) by sliding along a plane (π) substantially perpendicular to said third axis (X) and

substantially parallel to said second axis (Y').

33. Piston device according to any one of the preceding claims, wherein the hinge device (H) is a closing hinge, said contrast elastic means (50) being susceptible to act on said plunger member (30) to automatically return said movable element (M) from the open position toward the closed position.

34. Piston device according to the preceding claim, wherein said elastic contrast means (50) include an actuating spring.

35. Piston device according to any one of the claims 1 to 32, wherein the hinge device (H) is a damping hinge for the control of the rotating movement of the closing element (D) during opening and/or during closing thereof.

36. Piston device according to any one of the preceding claims, wherein the piston device is inserted into said at least one seat (S) so that said first axis (Y) and said second axis (Y') coincide.

37. A hinge device (H) to be used with a piston device (1) according to one or more of the preceding claims for the controlled rotatable movement of a closing element (D) anchored to a stationary support structure (W), the hinge device (H) including a fix element (F) anchored to the stationary support structure (W) and a movable element (M) anchorable to the closing element (D), said movable element (M) and said fix element (F) being mutually coupled to rotate between an open position and a closed position,

wherein the hinge device includes a hinge body (B) having at least one seat (S) for removably inserting the piston device (1) and a pivot member (V) including a cam element (C) having at least one substantially flat operative surface (A) susceptible to contact engage the substantially flat front pushing face (22) of the actuating head (20) of the piston device (1) when inserted in said at least one seat (S), one between said hinge body (B) and said pivot member (V) including said movable element (M), the other between said hinge body (B) and said pivot member (V) including said fix element (F).

38. Hinge device according to the preceding claim, wherein said hinge body (B) includes said movable element (M) and said pivot member (V) includes said fix element (F), said hinge body (B) including a first elongated portion (300') which is internally hollow to define said at least one seat (S) for said piston device (1) and a second elongated portion (300'') which is internally hollow for housing said pivot member (V), said first and second elongated portions (300', 300'') being substantially perpendicular to each other.

39. Hinge device according to the preceding claim, wherein said hinge body (B) consists of an angular member including said first and second elongated portions (300', 300''), the angular member having respective ends coupable with the tubular frame (310) of a closing element (D).

40. Hinge device according to the claim 38, wherein said tubular frame (310) of a closing

element (D) includes said first and second elongated portions (300', 300'').

41. Hinge device according to any one of the claims 37 to 40, further comprising means (110, 115, 130, 130', 200, 200', 210', 210'') for adjusting the angular position relative to said second axis (Y') of the substantially flat operative surface (A) of the pivot member (V).

5 42. Hinge device according to the preceding claim, further comprising an anchoring element (120) to the stationary support structure (W) or to the closing element (D) having an upper surface (110') and a lower surface (110) faced to the respective ends (115, 115') of said pivot member (V).

43. Hinge device according to the preceding claim, wherein said adjustment means include at least one projection (100) in correspondence of one of said ends (115) of said pivot member (V)
10 susceptible to engage the respective upper or lower surface (110) of the anchoring element (120) faced thereto.

44. Hinge device according to the preceding claim, wherein said adjustment means further include a first threaded screw (130') insertable in a corresponding unthreaded hole (135') passing through said anchoring element (120) in correspondence of the upper or lower surface (110) faced to
15 said one of said ends (115) of said pivot member (V) and engageable therewith in a corresponding counterthreaded blind hole (136').

45. Hinge device according to the preceding claim, wherein said adjustment means further include a second threaded screw (130'') engageable with a corresponding counterthreaded hole (135'') passing-through said anchoring element (120) in correspondence of the upper or lower
20 surface (110') faced to the other of said ends (115') of said pivot member (V) and insertable into a corresponding unthreaded blind hole (136'') made therein.

46. Hinge device according to any one of the claims 41 to 45, wherein said adjustment means include a pin (200) inserted into a radial hole (200') passing through at least one of the ends (115, 115') of said pivot member (V) and in a corresponding radial hole (205) passing through at least
25 one respective end (125, 125') of said anchoring element (120).

47. Hinge device according to the preceding claim, wherein said radial hole (200') of said pivot member (V) is substantially perpendicular to said third axis (X) and said substantially flat operative surface (A), said radial hole (205) of said anchoring element (120) being substantially parallel to said second axis (Y').

30 48. Hinge device according to claim 46 or 47, wherein said adjustment means further include at least one couple of abutment adjusting screw (210', 210'') susceptible to impact against said pin (200), said abutment adjusting screws (210', 210'') being inserted into respective seats (215', 215'') passing through said at least one respective end (125, 125') of said anchoring element (120).

49. Hinge device according to the preceding claim, wherein said seats (215', 215'') of said

abutment adjusting screws (**210'**, **210''**) define respective sliding directions (**d'**, **d''**) thereof which are substantially parallel to each other and substantially perpendicular to said third axis (**X**) and said second axis (**Y'**).

50. Hinge device according to the preceding claim, wherein said seats (**215'**, **215''**) of said abutment adjusting screws (**210'**, **210''**) are placed on only one side of said at least one respective end (**125**, **125'**) of said anchoring element (**120**), respectively on opposite sides thereof.

51. Hinge device according to any one of the claims 37 to 50, wherein the piston device is inserted into said at least one seat (**S**) so that said first axis (**Y**) and said second axis (**Y'**) coincide.

52. An assembly for the rotatable movement of a closing element (**D**) comprising:

- a piston device according to any one of the claims 1 to 36,
- a hinge device according to any one of the claims 37 to 51.

53. An assembly for the automatic closing of a closing element (**D**) consisting of the assembly according to claims 33 and 52 or 34 and 52.

54. An assembly for controlling a closure element (**D**) upon opening and/or closing thereof consisting of the assembly according to claims 35 and 52.

55. A hinge device (**H**) for the controlled rotatable movement of a closing element (**D**) anchored to a stationary support structure (**W**), comprising:

- a fix element (**F**) anchored to the stationary support structure (**W**);
- a movable element (**M**) anchorable to the closing element (**D**), said movable element (**M**) and said fix element (**F**) being mutually coupled to rotate between an open position and a closed position,

wherein one between said fix element (**F**) and movable element (**M**) includes a hinge body (**B**) with at least one operating chamber (**15**) defining a first longitudinal axis (**Y**), the other between said fix element (**F**) and movable element (**M**) including a pivot member (**V**) defining a second longitudinal axis (**X**) which is substantially perpendicular to said first longitudinal axis (**Y**);

wherein said at least one operating chamber (**15**) includes a plunger member (**30**) slidably movable along said first longitudinal axis (**Y**) between a retracted end position and an extended end position for separating thereof in at least one first and one second variable volume compartments (**16**, **17**) fluidically communicating with each other, said pivot member (**V**) having a cam element (**C**) with at least one substantially flat operative surface (**A**);

wherein said at least one operating chamber (**15**) includes a bottom wall (**14**) opposed to said actuating head (**20**), said hinge body (**B**) further including an actuating head (**20**) unitary connected with said plunger member (**30**) to move along said first axis (**Y**) between a position proximal to the bottom wall (**14**) of said at least one operating chamber (**15**), corresponding to the retracted end

position of the plunger member (30), and a position distal thereto, corresponding to the extended end position of the plunger member (30), said actuating head (20) including a substantially flat front pushing face (22) susceptible to contact engage the at least one substantially flat operative surface (A) of the pivot member (V);

5 wherein said at least one operating chamber (15) further includes elastic contrast means (50) acting on said plunger member (30) for the returning thereof from the retracted end position to the extended end position, said operating chamber (15) further including a working fluid acting on said plunger member (30) to hydraulically counteract the action thereof;

10 wherein the hinge device further comprises means (110, 115, 130, 130', 200, 200', 210', 210'') for adjusting the angular position relative to said second axis (Y') of the substantially flat operative surface (A) of the pivot member (V).

56. Hinge device according to the preceding claim, further comprising an anchoring element (120) to the stationary support structure (W) or to the closing element (D) having an upper surface (110') and a lower surface (110) faced to the respective ends (115, 115') of said pivot member (V).

15 57. Hinge device according to the preceding claim, wherein said adjustment means include at least one projection (100) in correspondence of one of said ends (115) of said pivot member (V) susceptible to engage the respective upper or lower surface (110) of the anchoring element (120) faced thereto.

20 58. Hinge device according to the preceding claim, wherein said adjustment means further include a first threaded screw (130') insertable in a corresponding unthreaded hole (135') passing through said anchoring element (120) in correspondence of the upper or lower surface (110) faced to said one of said ends (115) of said pivot member (V) and engageable therewith in a corresponding counterthreaded blind hole (136').

25 59. Hinge device according to the preceding claim, wherein said adjustment means further include a second threaded screw (130'') engageable with a corresponding counterthreaded hole (135'') passing-through said fastening element (120) in correspondence of the upper or lower surface (110') faced to the other of said ends (115') of said pivot member (V) and insertable into a corresponding unthreaded blind hole (136'') made therein.

30 60. Hinge device according to any one of the claims 55 to 59, wherein said adjustment means include a pin (200) inserted into a radial hole (200') passing through at least one of the ends (115, 115') of said pivot member (V) and in a corresponding radial hole (205) passing through at least one respective end (125, 125') of said anchoring element (120).

61. Hinge device according to the preceding claim, wherein said radial hole (200') of said pivot member (V) is substantially perpendicular to said third axis (X) and said substantially flat

operative surface (A), said radial hole (205) of said anchoring element (120) being substantially parallel to said second axis (Y').

62. Hinge device according to claim 60 or 61, wherein said adjustment means further include at least one couple of abutment adjusting screw (210', 210'') susceptible to impact against said pin (200), said abutment adjusting screws (210', 210'') being inserted into respective seats (215', 215'') passing through said at least one respective end (125, 125') of said anchoring element (120).

63. Hinge device according to the preceding claim, wherein said seats (215', 215'') of said abutment adjusting screws (210', 210'') define respective sliding directions (d', d'') thereof which are substantially parallel to each other and substantially perpendicular to said third axis (X) and said second axis (Y').

64. Hinge device according to the preceding claim, wherein said seats (215', 215'') of said abutment adjusting screws (210', 210'') are placed on only one side of said at least one respective end (125, 125') of said anchoring element (120), respectively on opposite sides thereof.

65. Hinge device according to any one of the claims 55 to 64, wherein said at least one first and one second variable volume compartments (16, 17) are adjacent to each other.

66. Hinge device according to any one of the claims 55 to 65, wherein said elastic contrast means (50) are placed in said first compartment (16) so that said at least one first and second compartments (16, 17) have respectively the maximum and minimum volume in correspondence of the distal position of said actuating head (20) and respectively the minimum and maximum volume in correspondence of the proximal position thereof.

67. Hinge device according to any one of the claims 55 to 66, wherein said plunger member (30) is inserted into said the operating chamber (15) so as to define therewith an interspace (18) for the passage of the working fluid between said at least one first and second compartments (16, 17).

68. Hinge device according to the preceding claim, wherein said at least one first and second compartments (16, 17) are fluidically coupled each other only through said interspace (18).

69. Hinge device according to the claim 67, wherein said plunger member (30) includes valve means (32, 33) of the one-way type for controlling the passage of the working fluid between said at least one first and second compartments (16, 17) upon the moving of said actuating head (20) from one between said proximal and distal postions towards the other between said proximal and distal postions, said interspace (18) allowing the passage of the working fluid between said at least one first and second compartments (16, 17) upon the moving back of said actuating head (20) from the other between said proximal and distal postions towards the one between said proximal and distal postions.

70. Hinge device according to the preceding claim, wherein said valve means (32, 33) are

configured to open upon the moving of said actuating head (20) from the distal postion towards the proximal postion, thus allowing the passage of the working fluid from the first compartment to the second compartment (16, 17), and to close upon the moving of said actuating head (20) from the proximal postion towards the distal postion, so as to force the passage of working fluid from the second compartment to the first compartment (16, 17) through said interspace (18).

71. Hinge device according to claim 69, wherein said valve means (32, 33) are configured to open upon the moving of said actuating head (20) from the proximal postion towards the distal postion, thus allowing the passage of the working fluid from the second compartment to the first compartment (16, 17), and to close upon the moving of said actuating head (20) from the distal postion towards the proximal postion, so as to force the passage of working fluid from the first compartment to the second compartment (16, 17) through said interspace (18).

72. Hinge device according to any one of the claims 55 to 71, wherein the at least one substantially flat operative surface (A) of the pivot memeber (V) and the substantially flat front pushing face (22) of said actuating head (20) are substantially parallel each other when the actuating head (20) is in the distal position and substantially perpendicular each other when the same actuating head (20) is in the proximal position.

73. Hinge device according to the preceding claim, wherein the distal position of said actuating head (20) corresponds to the closed position of the movable element (M), the proximal position of the same actuating head (20) correspond to the open position of the movable element (M).

74. Hinge device according to claim 72, wherein the distal position of said actuating head (20) corresponds to the open position of the movable element (M), the proximal position of the same actuating head (20) corresponding to the closed position of the movable element (M).

75. Hinge device according to any one of the claims 55 to 74, wherein the at least one substantially flat operative surface (A) of the pivot member (V) is substantially parallel to said second axis (X).

76. Hinge device according to any one of the claims 55 to 75, wherein said elastic contrast means (50) are configured to move between a position of maximum and minimum elongation respectively corresponding to the distal and proximal positions of said actuating head (20).

77. Hinge device according to any one of the claims 55 to 76, wherein the at least one operative surface (A) of the pivot member (V) and the front pushing face (22) of said actuating head (20) are mutually mechanically disconnected.

78. Hinge device according to any one of the claims 55 to 77, further including a rod (40) having a first end (41) unitary coupled with said plunger member (30) and a second end (42)

including said actuating head (20).

79. Hinge device according to the preceding claim, wherein said actuating head (20) includes a pushing element (21) removably coupable with the second end (42) of said rod (40), said pushing element (21) including said front pushing face (22).

5 80. Hinge device according to any one of the claims 55 to 79, wherein said plunger member (30) includes a tubular element with a rear portion (31'') coupled with said elastic contrast means (50) and a front portion (31') coupled with said first end (41) of said rod (40).

10 81. Hinge device according to the preceding claim, wherein said front portion (31') of said plunger member (30) is coupled with the first end (41) of said rod (40) to define a housing (34) for said valve means (32, 33) which is fluidically coupled with both said at least one first and second compartments (16, 17).

82. Hinge device according to the preceding claim, wherein said first end (41) of said rod (40) includes a blind hole (34) defining the housing of said valve means (32, 33).

15 83. Hinge device according to the claim 81 or 82, wherein said rear portion (31'') of said plunger member (30) includes a first passing-through hole (35) to put into fluidical communication said first compartment (16) and the housing (34) of said valve means (32, 33), said first end (41) of said rod (40) including a second passing-through hole (37'') to put into fluidical communication said second compartment (17) and the housing (34) of said means valve (32, 33).

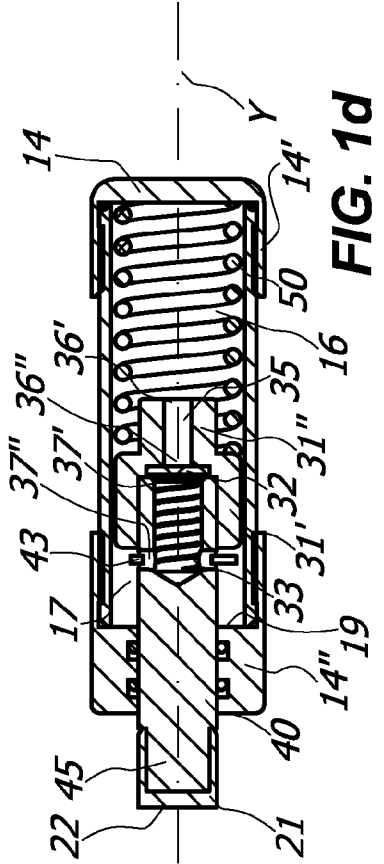
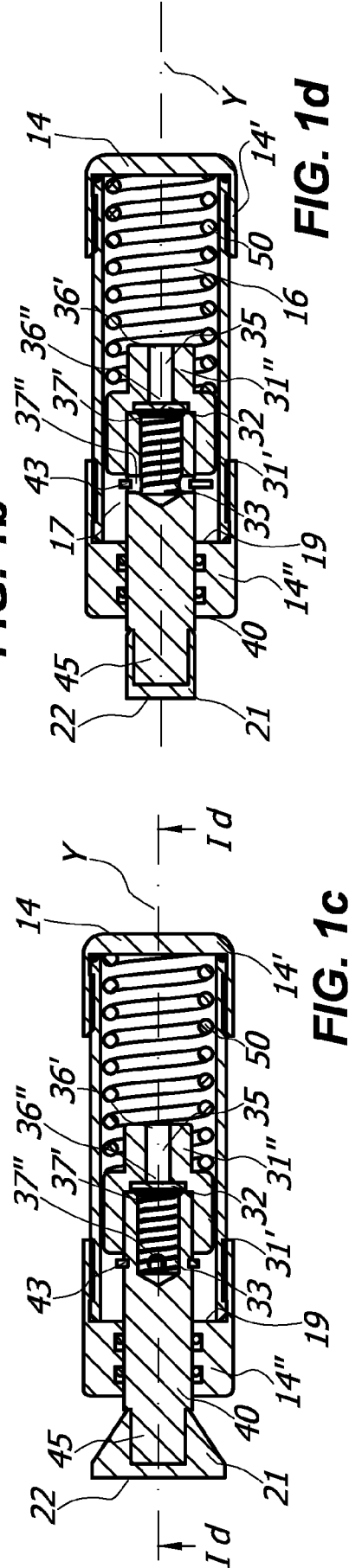
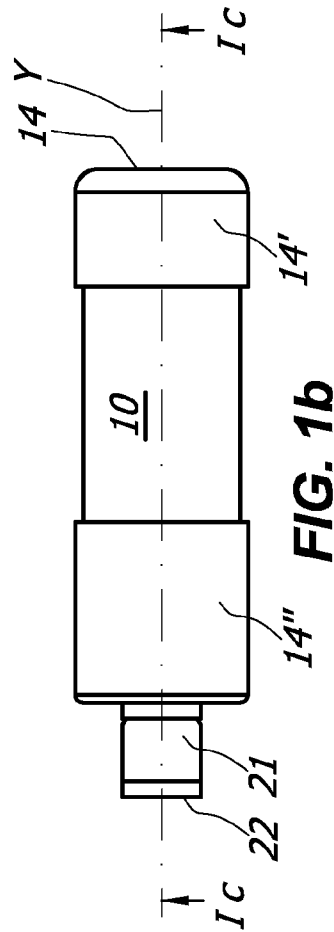
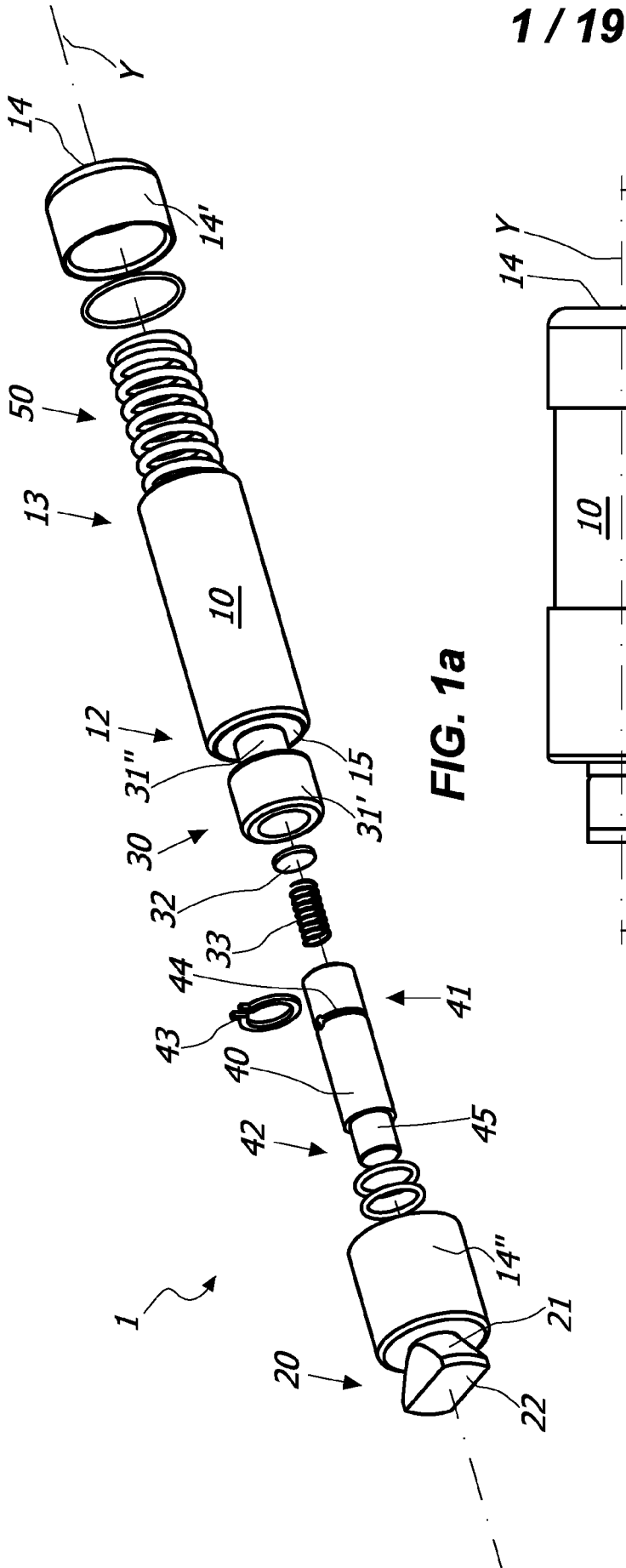
20 84. Hinge device according to any one of claims 55 to 83, wherein said valve means include a disc-like element (32) sliding in said housing (34) along said first axis (Y).

85. Hinge device according to the preceding claim, wherein said valve means further include a contrast spring (33) placed in said housing (34) for forcing said disc-like element (32) against the inlet or the outlet thereof.

25 86. Hinge device according to any one of the claims 55 to 85, wherein the hinge device (H) is a closing hinge, said contrast elastic means (50) being susceptible to act on said plunger member (30) to automatically return said movable element (M) from the open position toward the closed position.

87. Hinge device according to the preceding claim, wherein said elastic contrast means (50) include an actuating spring.

30 88. Hinge device according to any one of the claims 55 to 85, wherein the hinge device (H) is a damping hinge for the control of the rotating movement of the closing element (D) during opening and/or during closing thereof.



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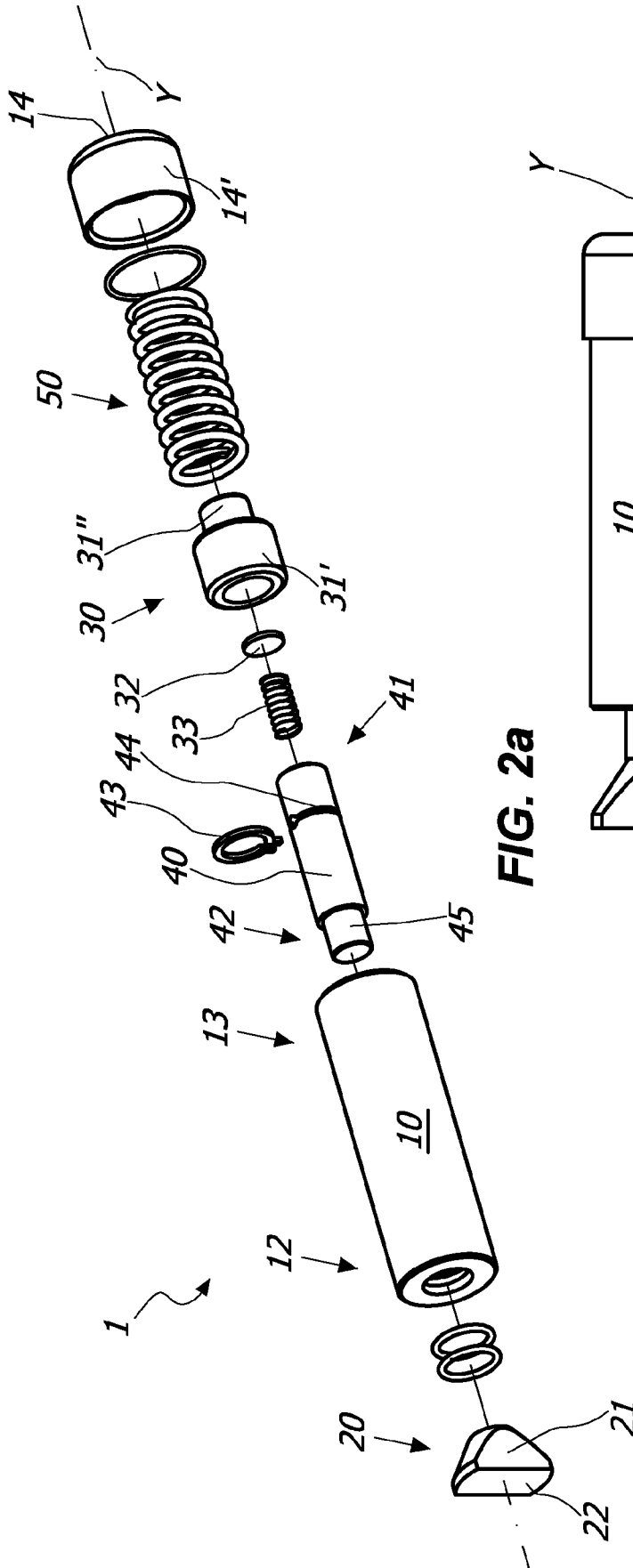


FIG. 2a

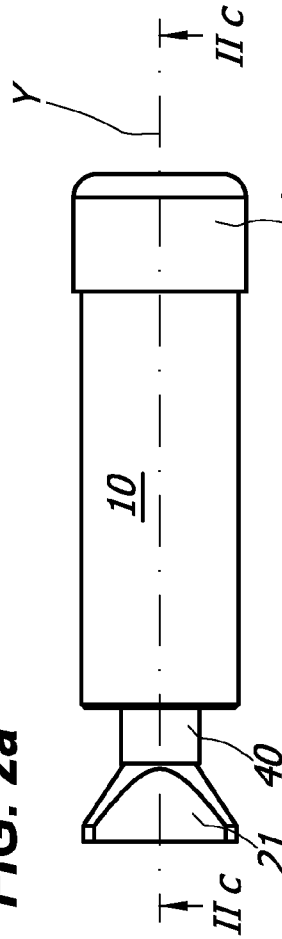


FIG. 2b

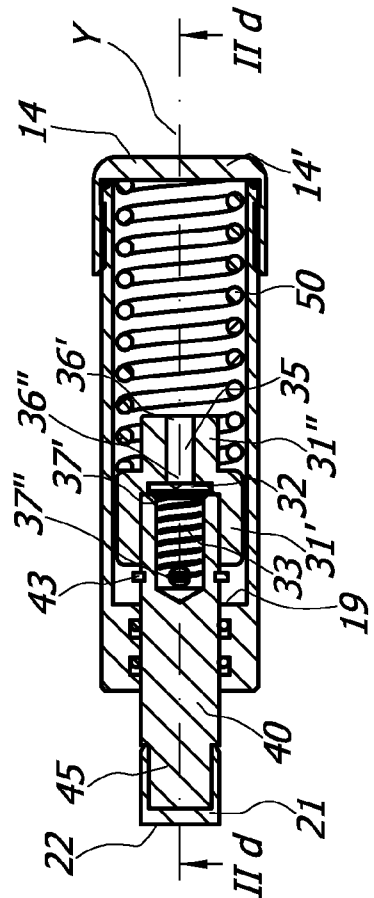


FIG. 2c

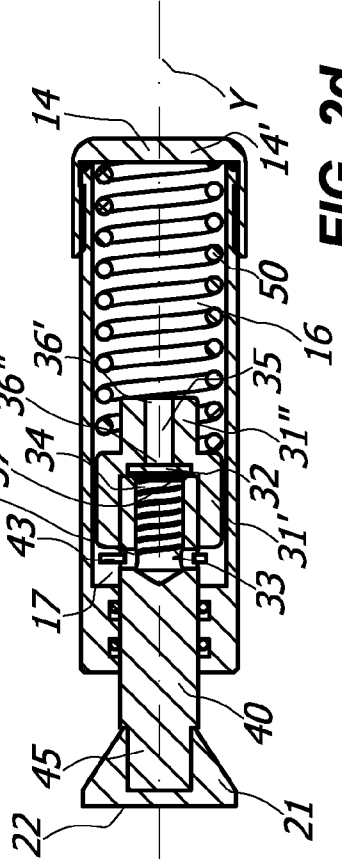
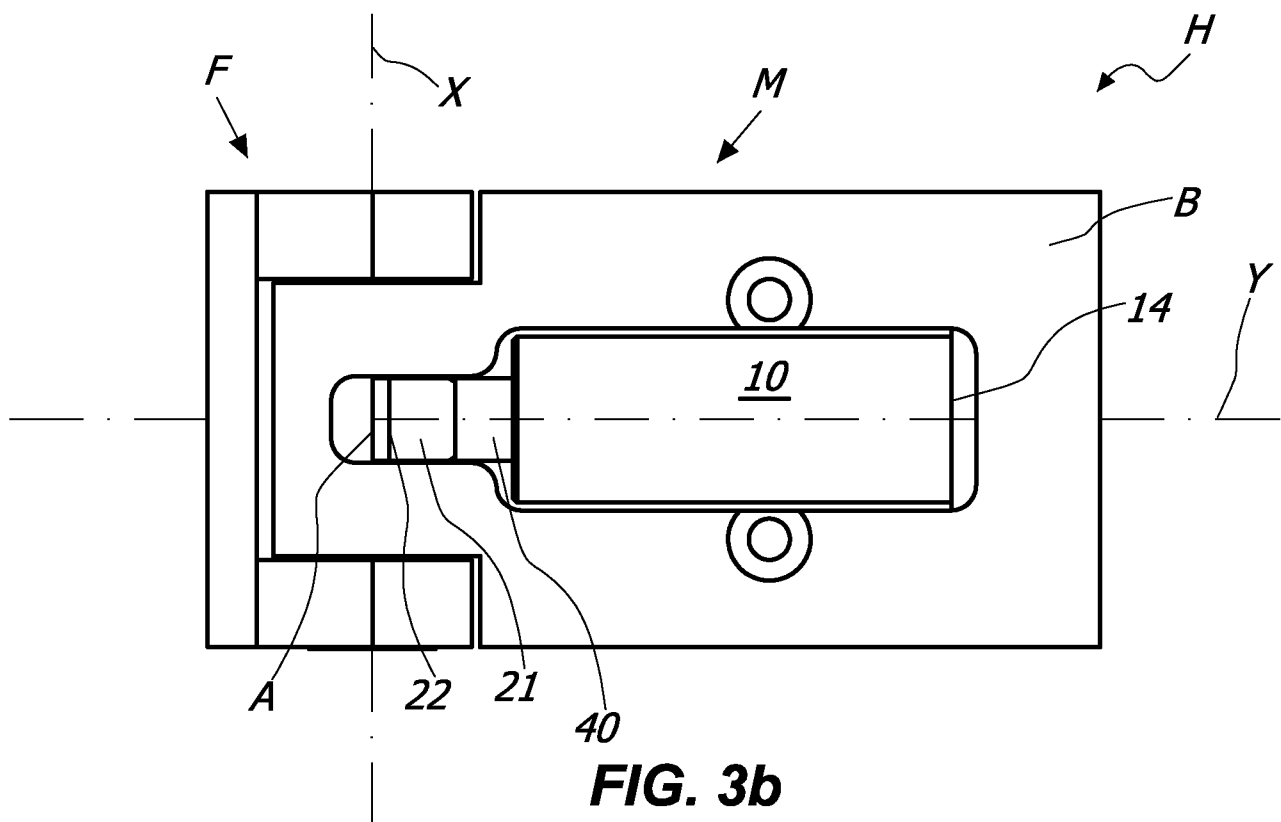
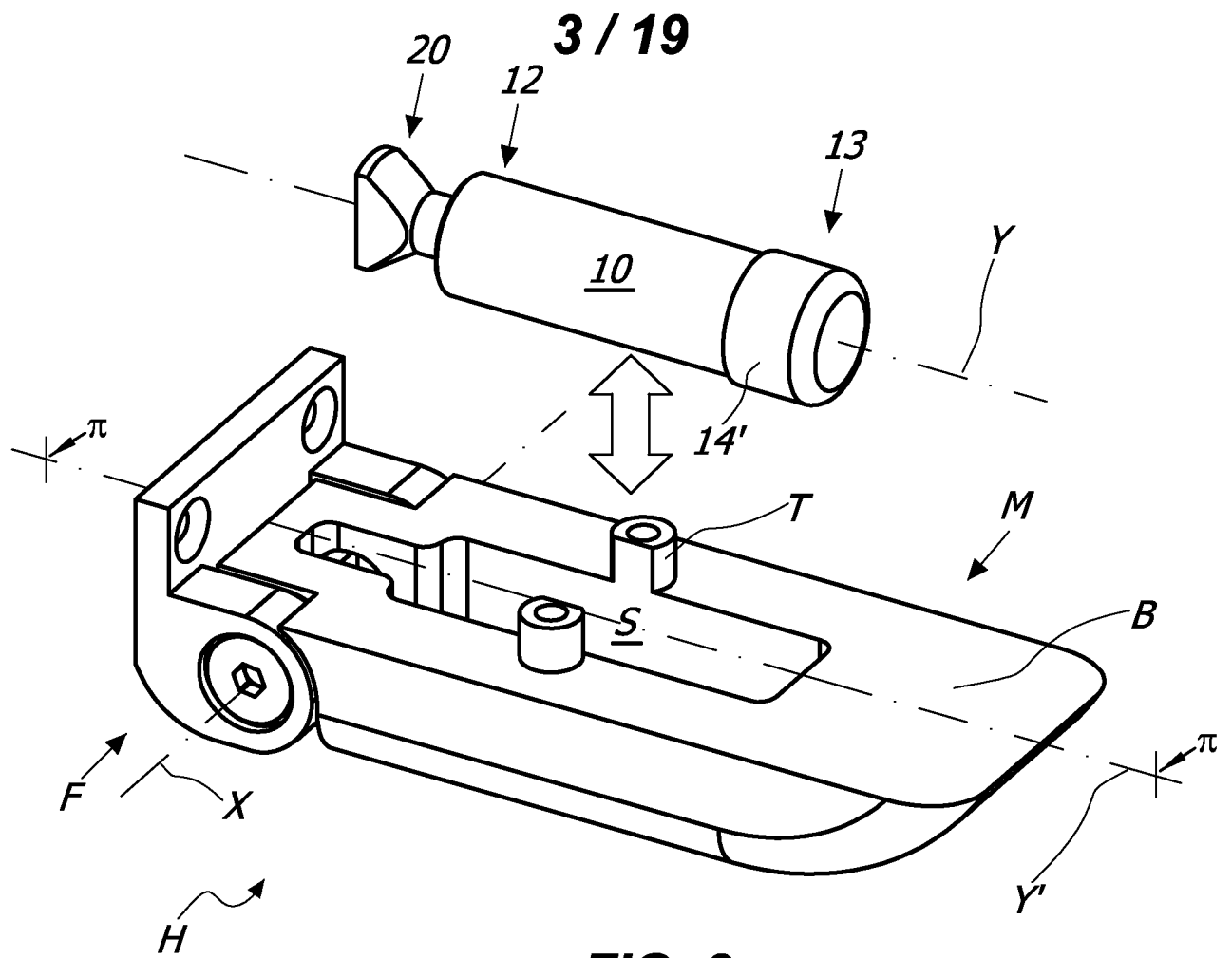
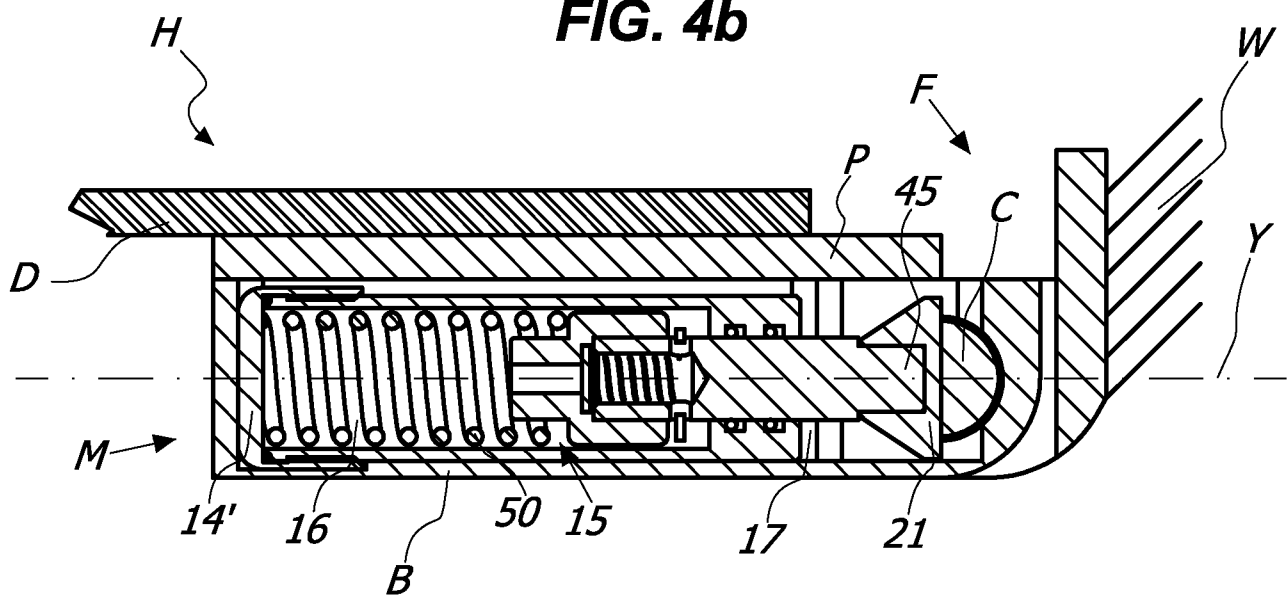
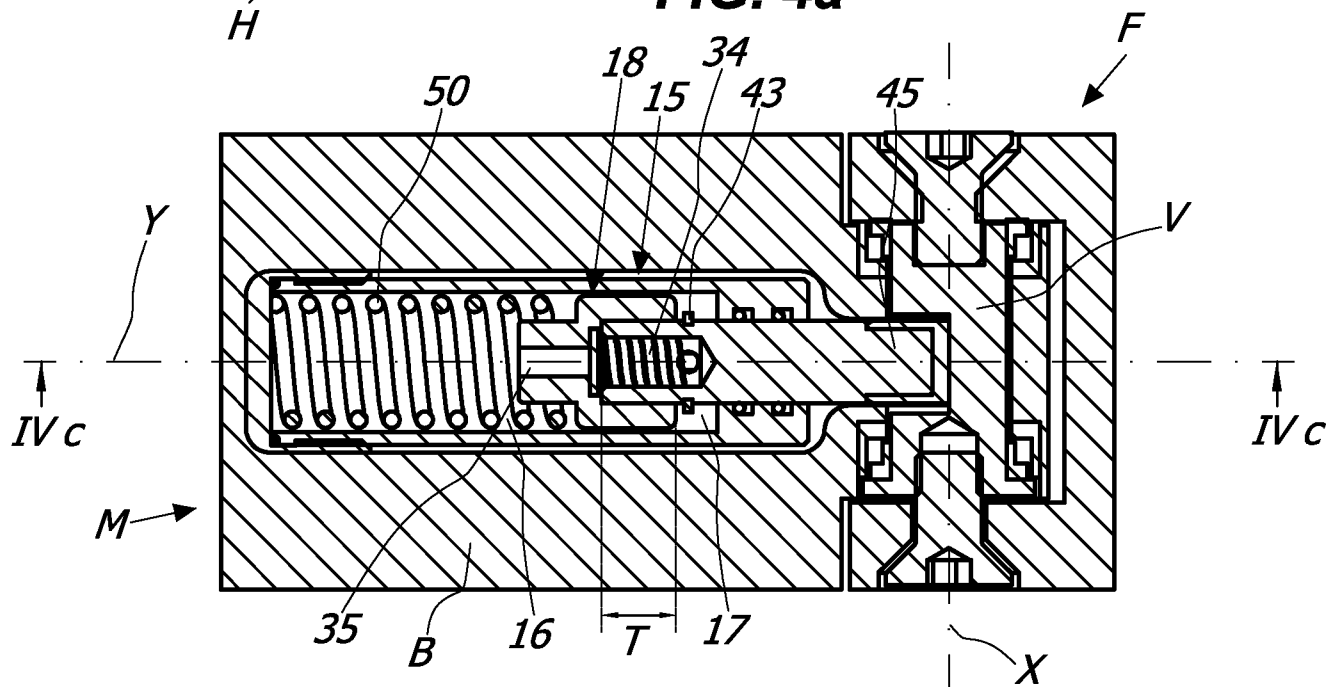
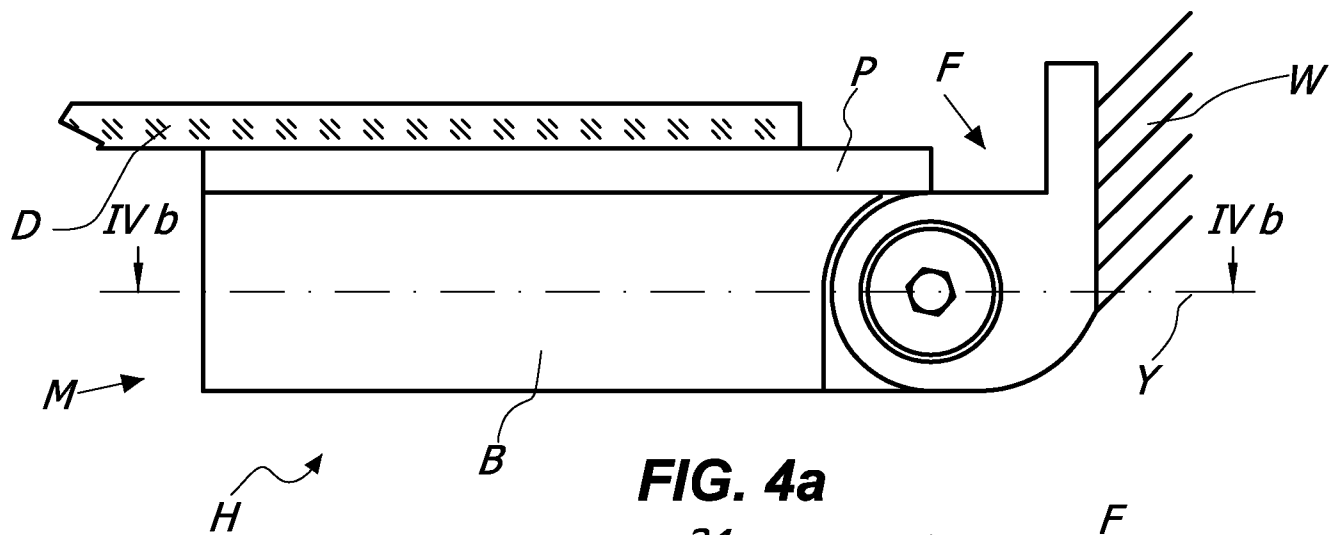


FIG. 2d



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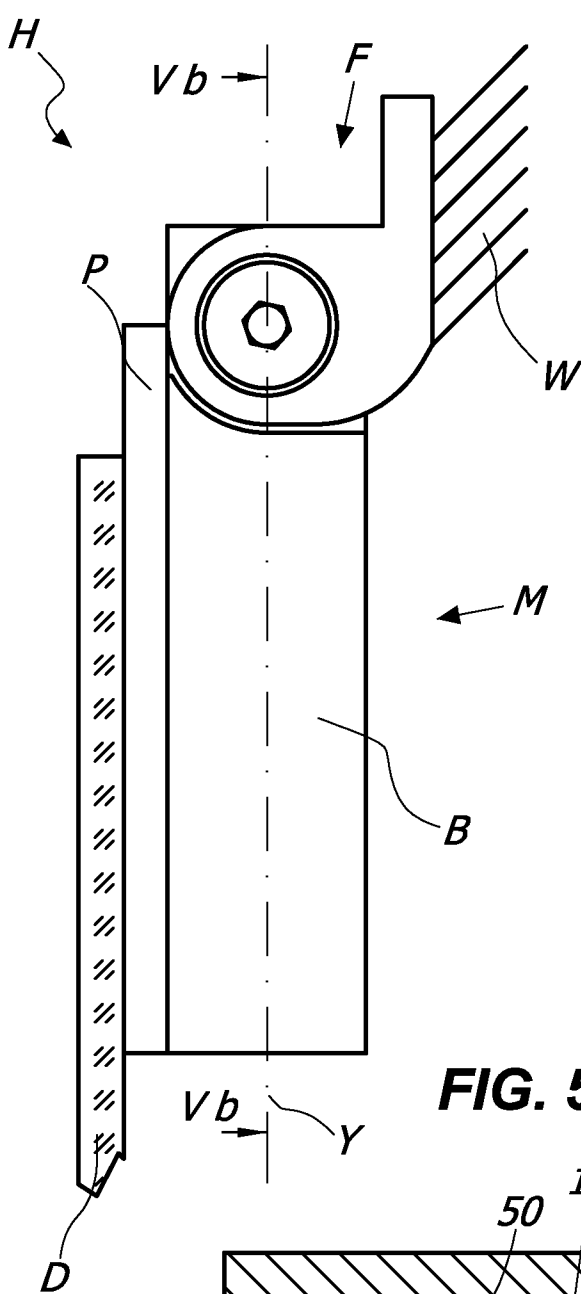


FIG. 5a

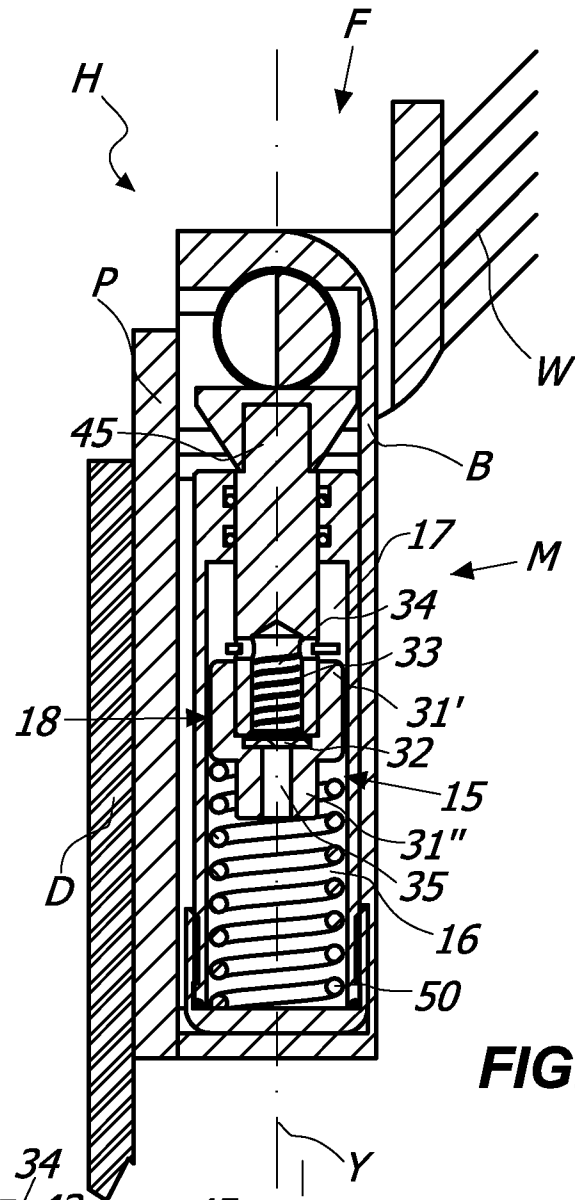


FIG. 5c

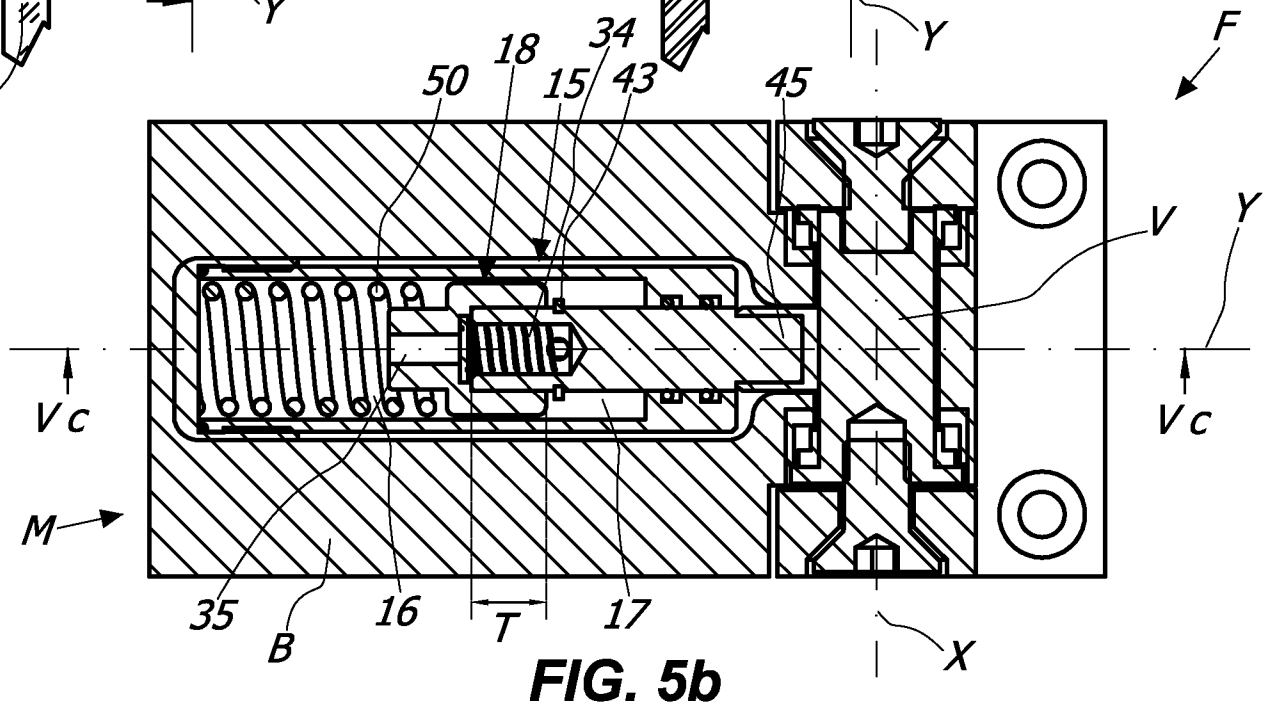
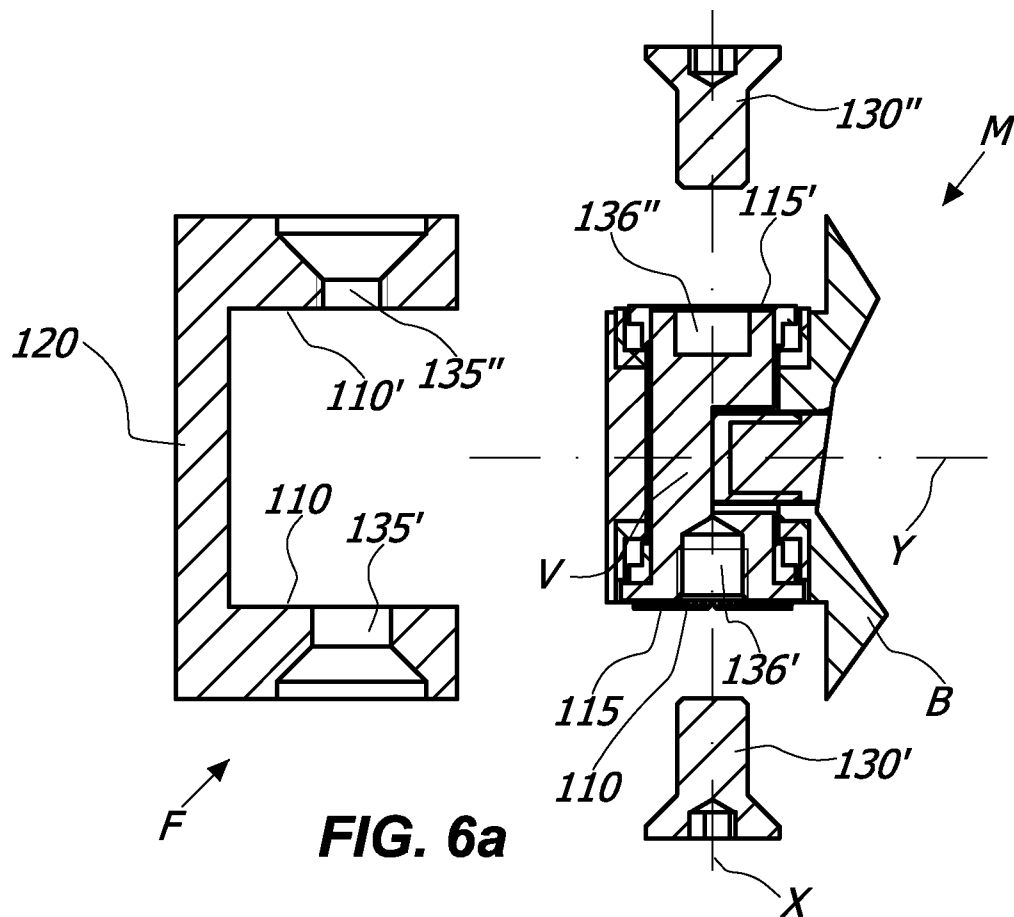
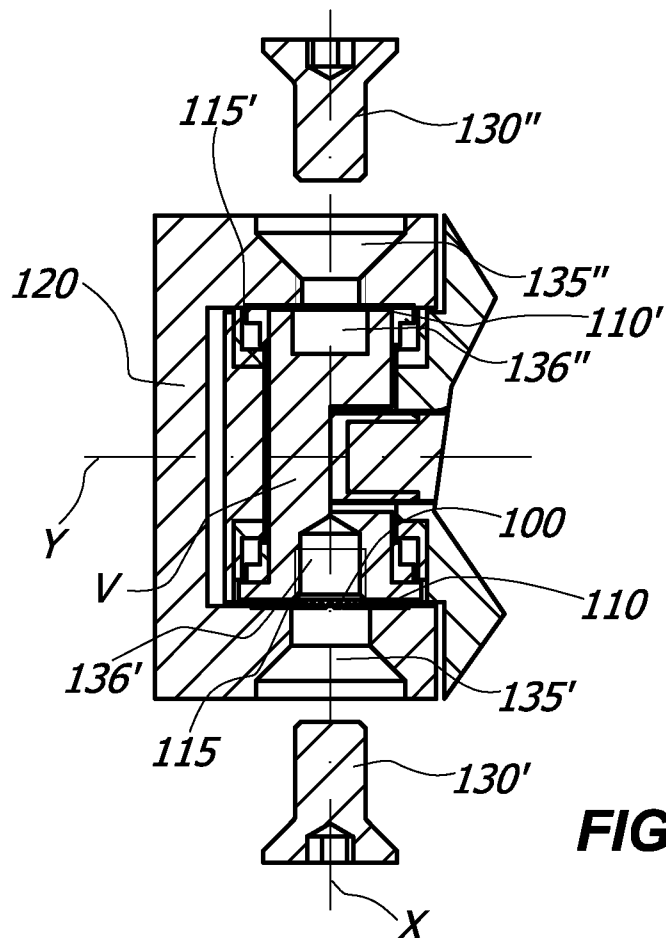


FIG. 5b

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**FIG. 6a****FIG. 6b**

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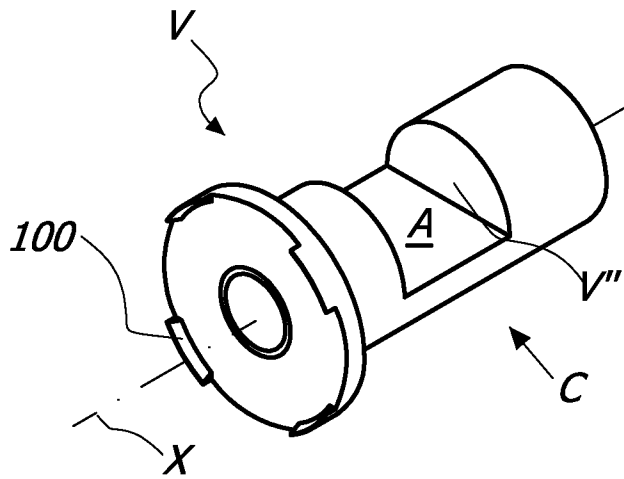


FIG. 7a

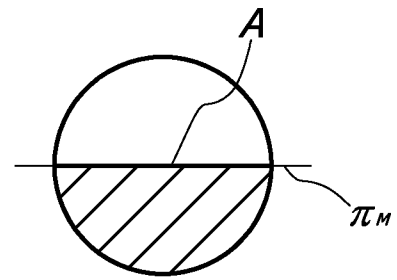


FIG. 7b

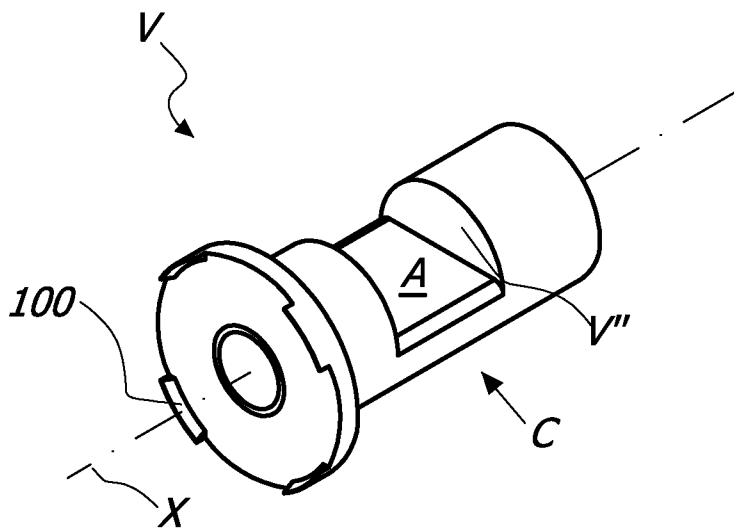


FIG. 7c

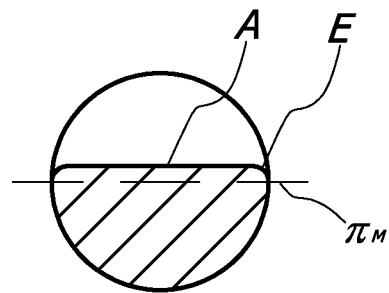


FIG. 7d

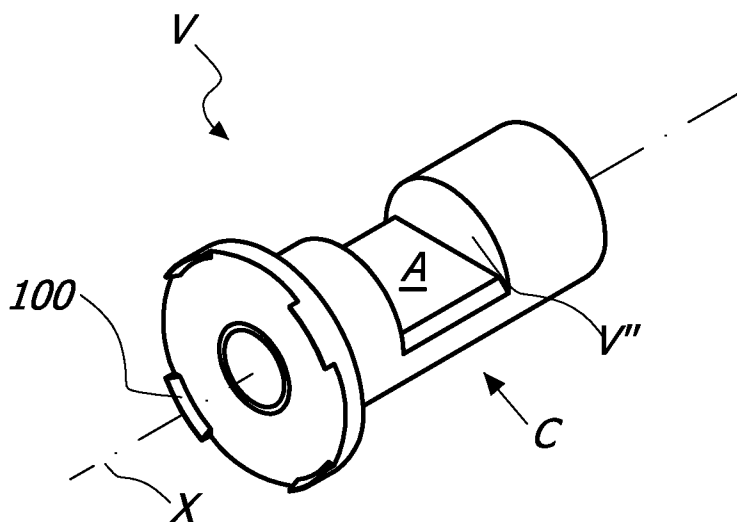


FIG. 7e

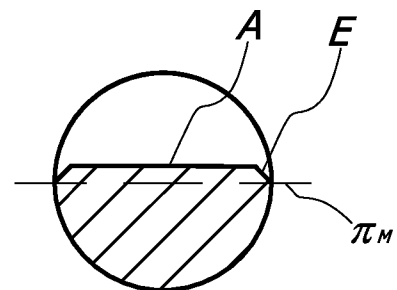
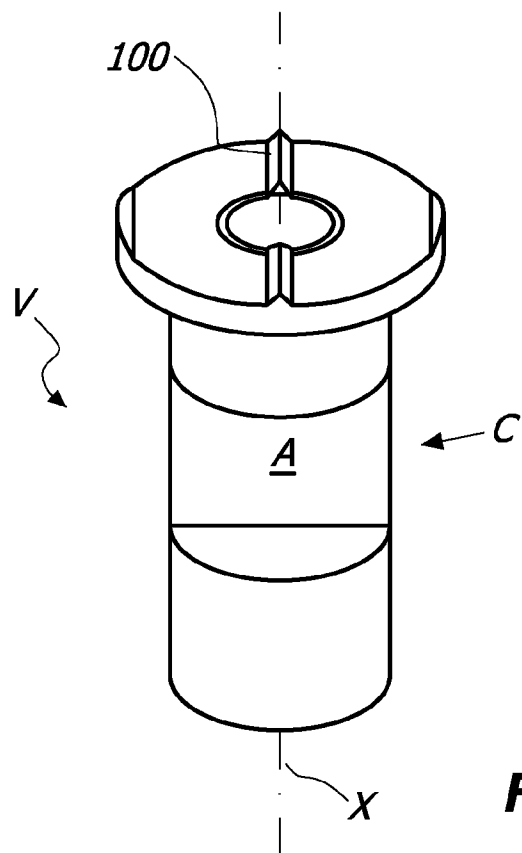
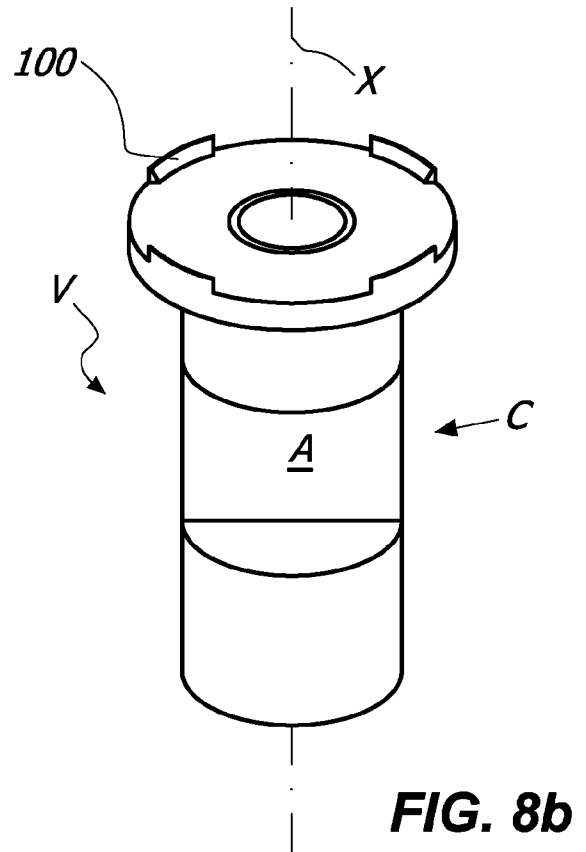
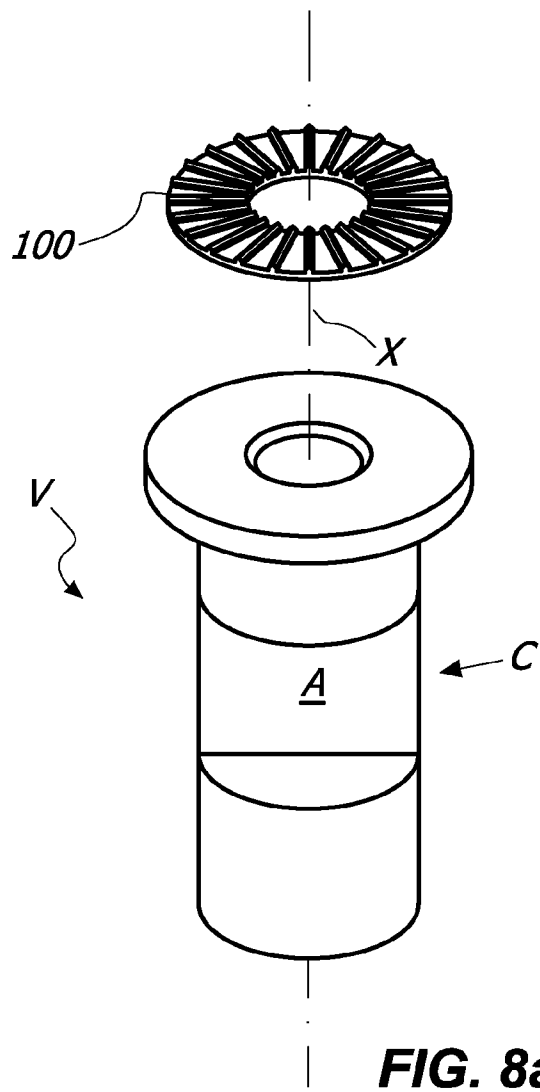


FIG. 7f

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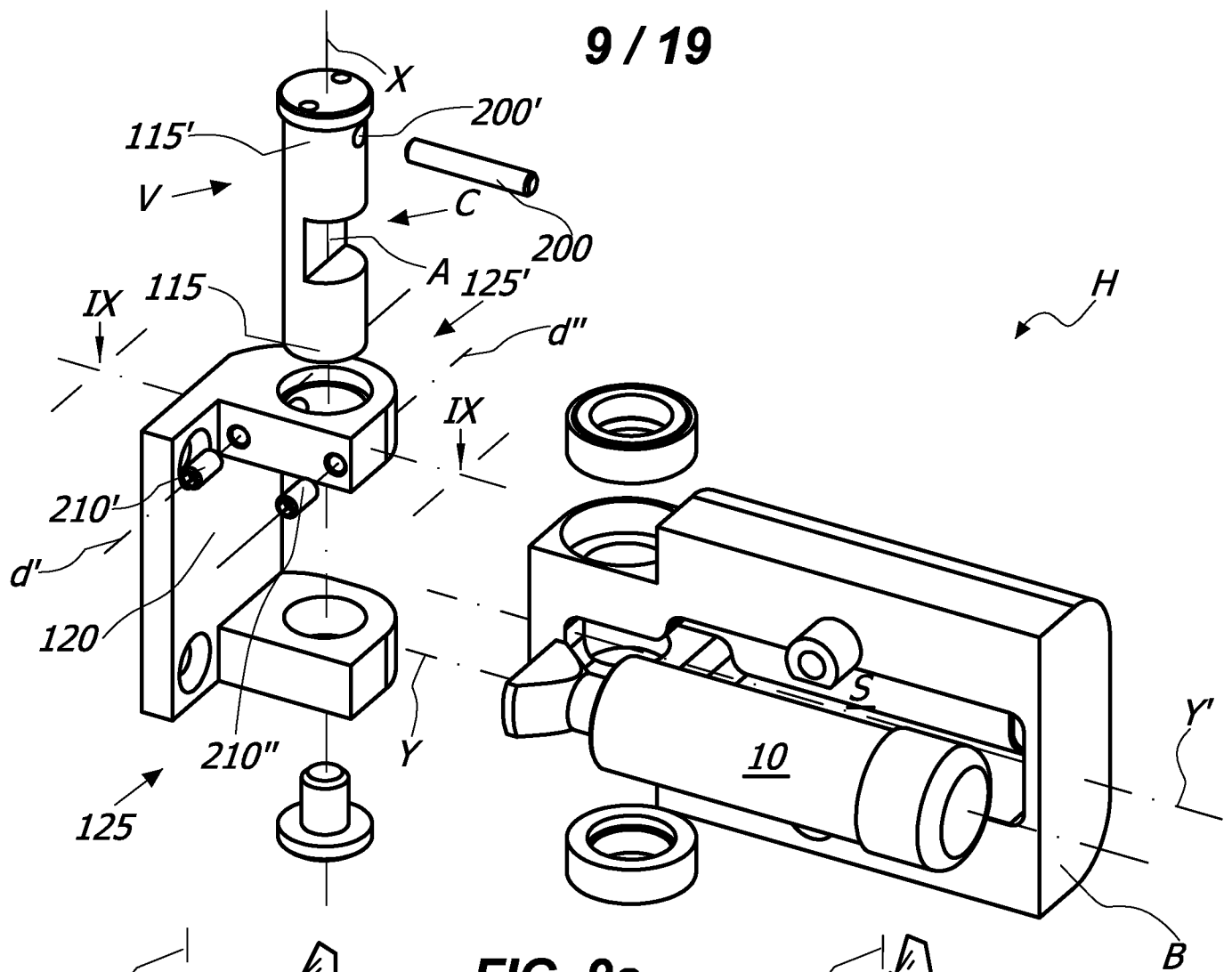


FIG. 9a

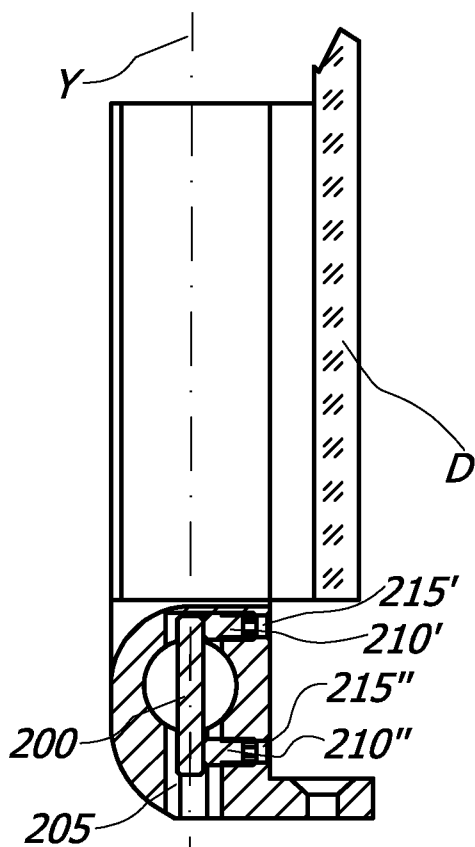


FIG. 9b

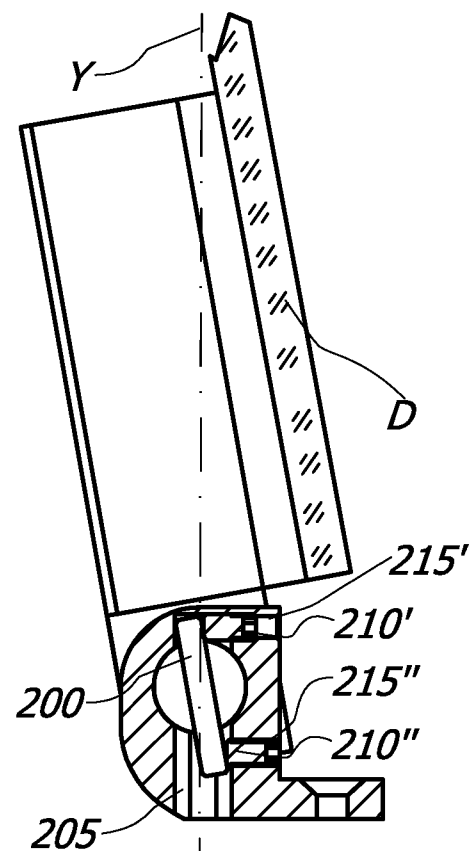


FIG. 9c

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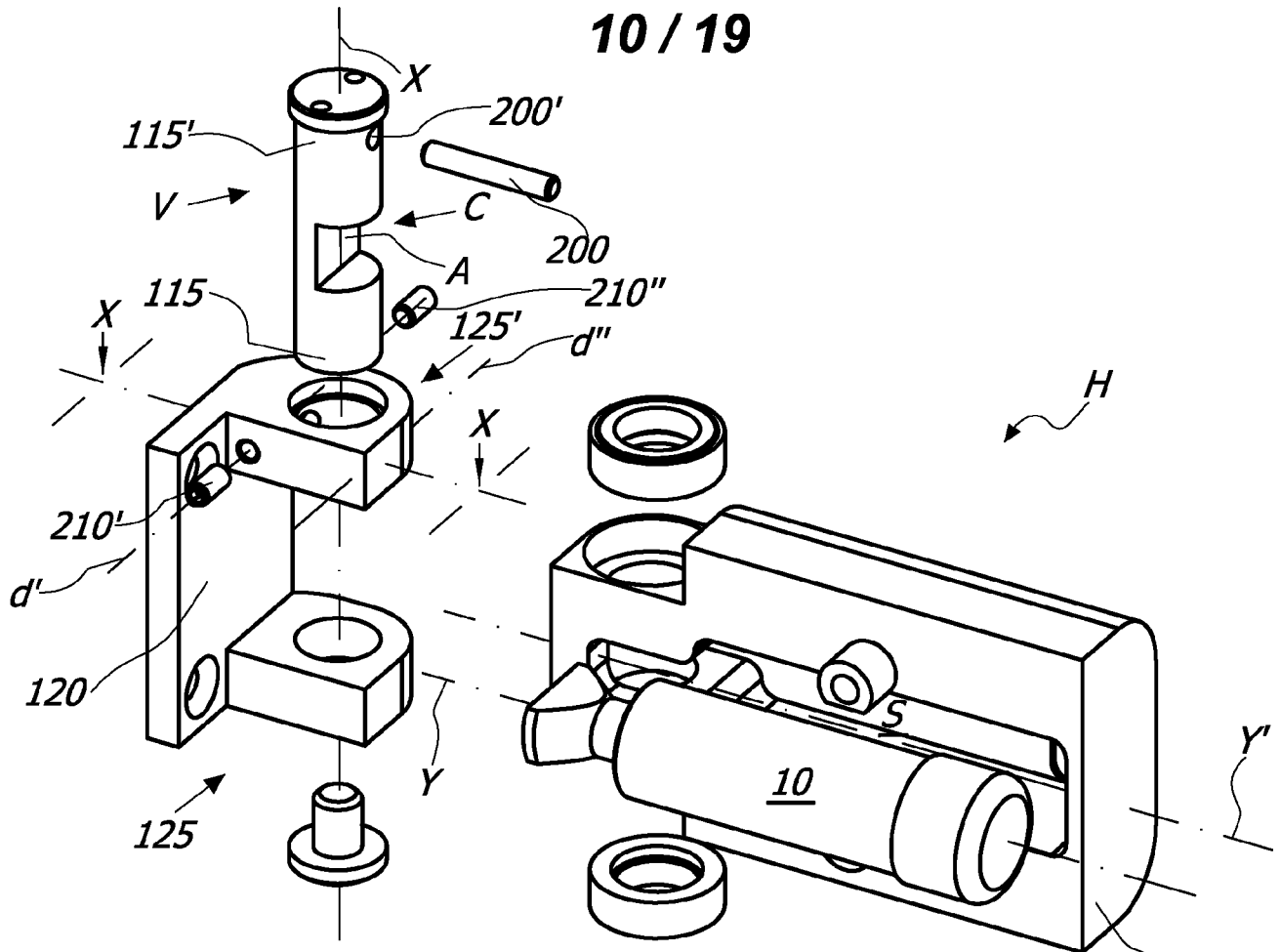


FIG. 10a

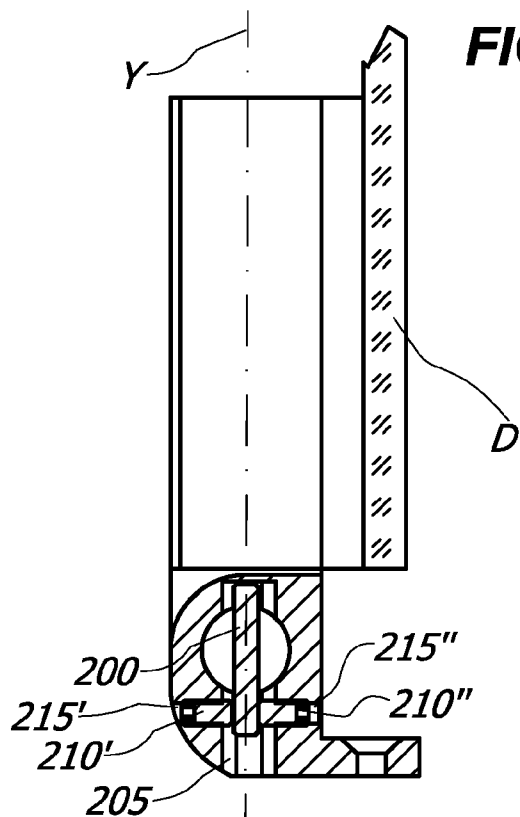


FIG. 10b

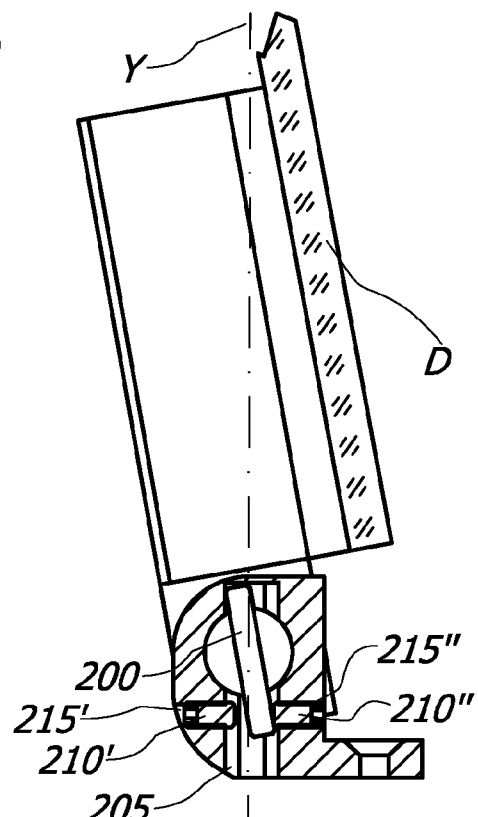


FIG. 10c

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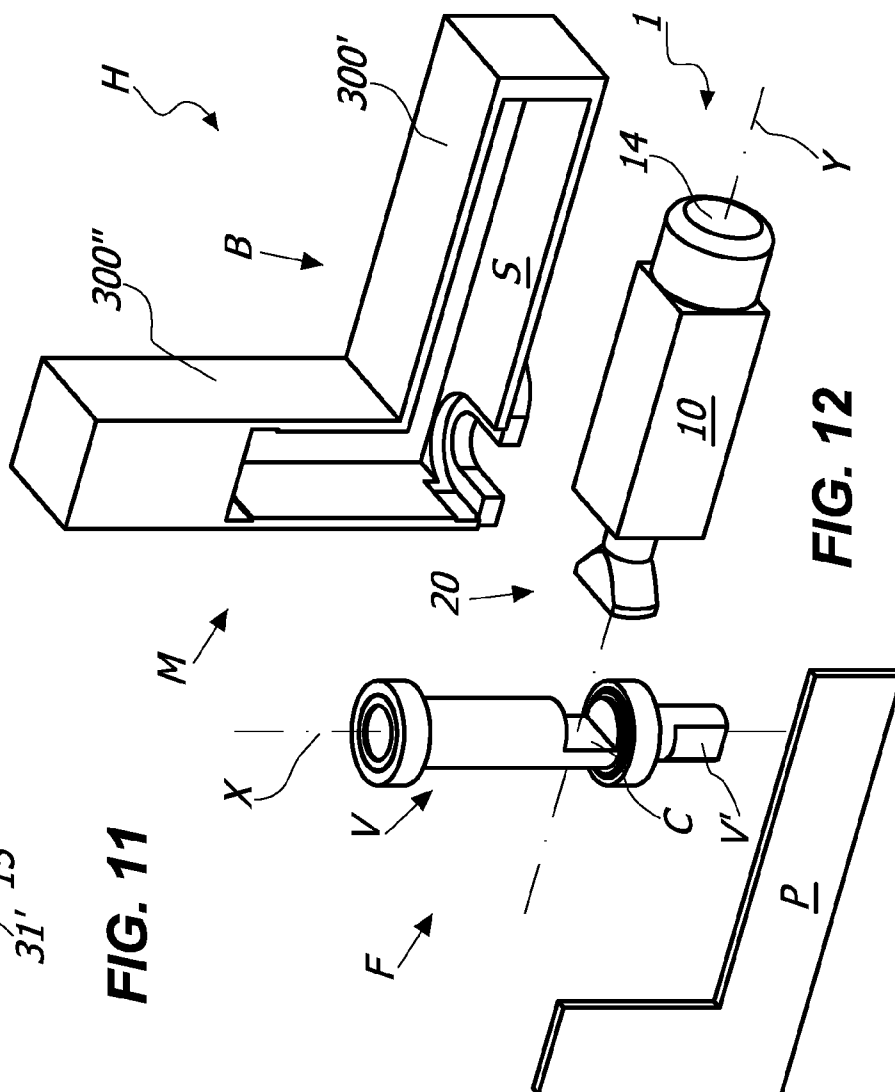
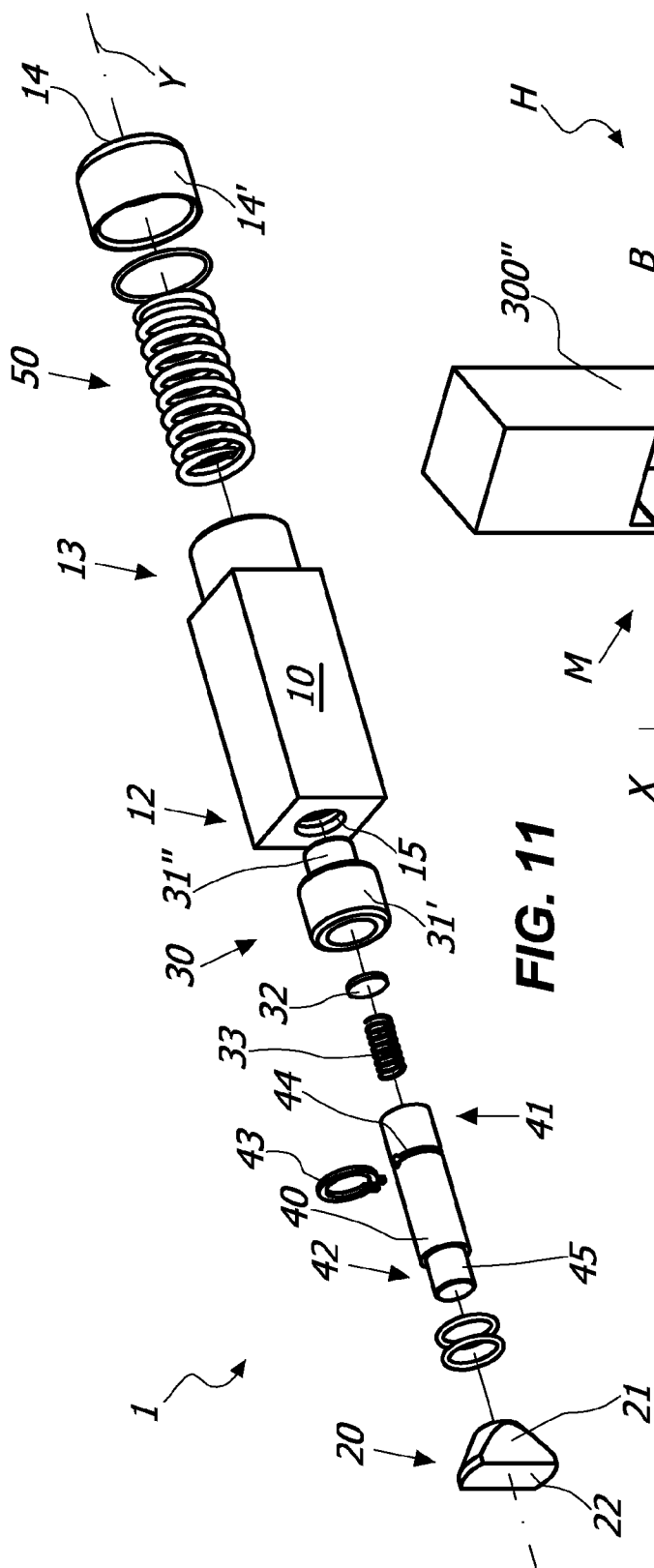


FIG. 14

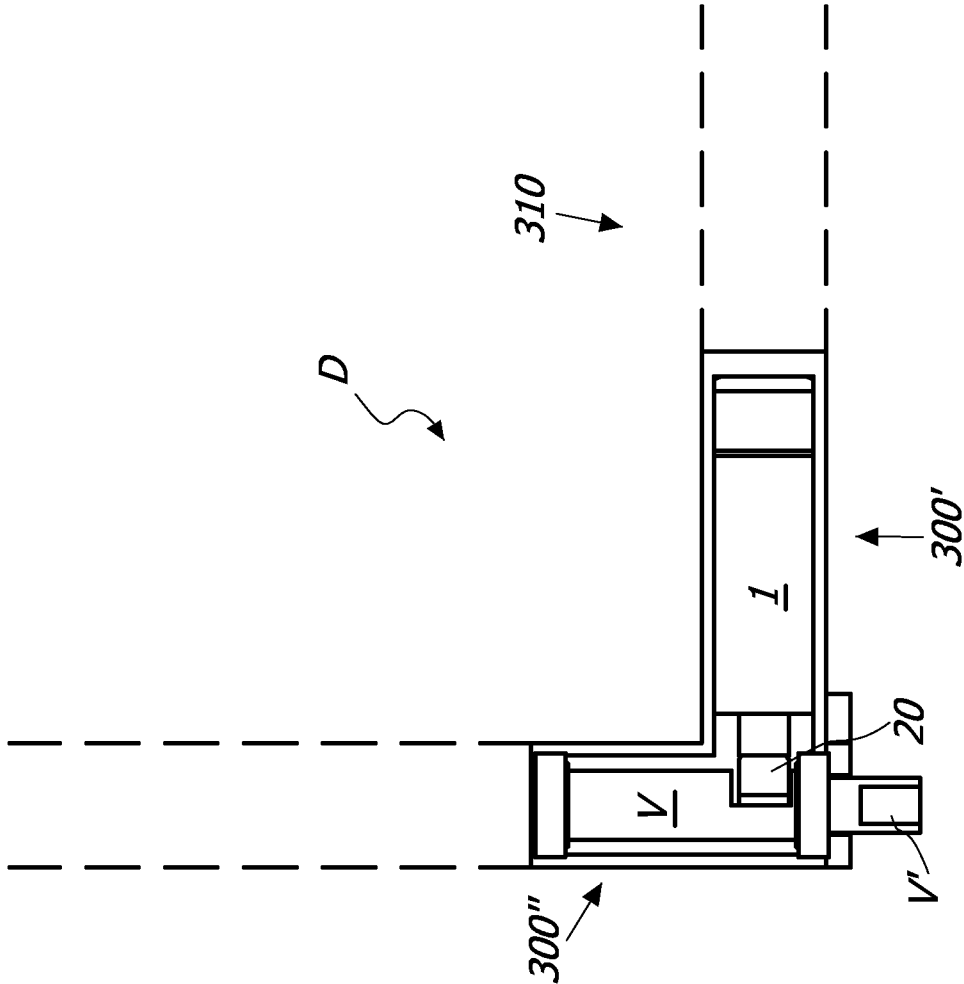
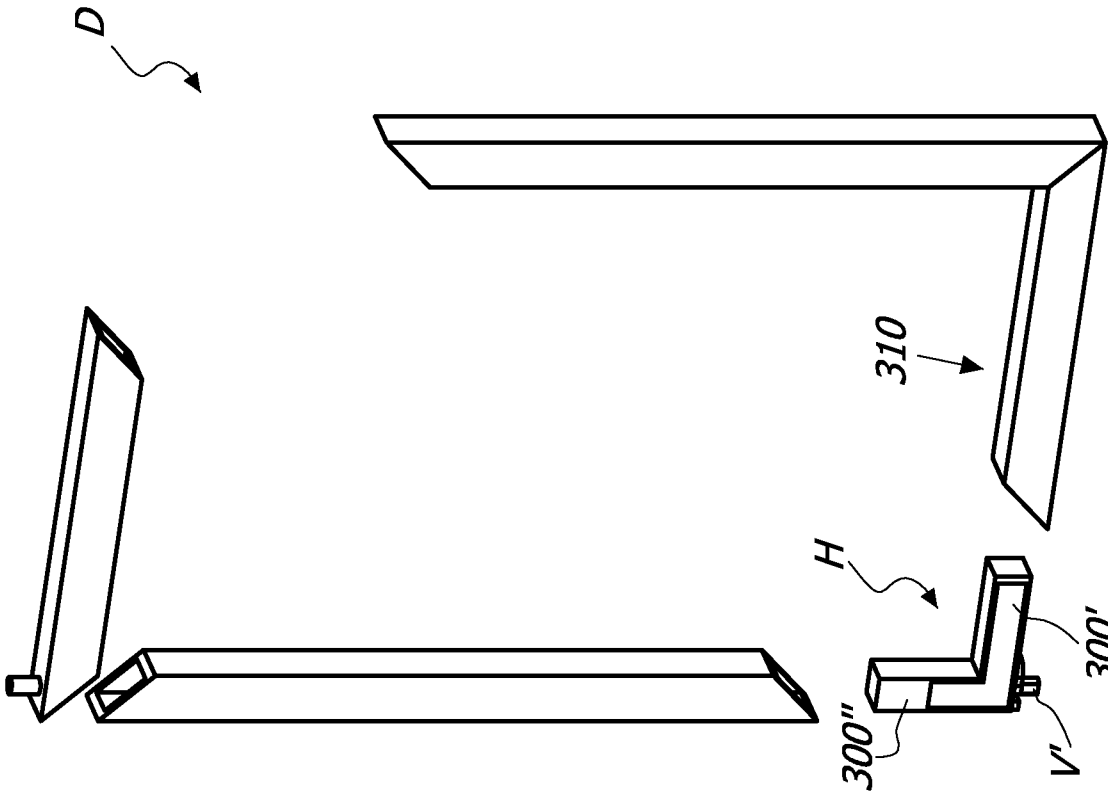


FIG. 13



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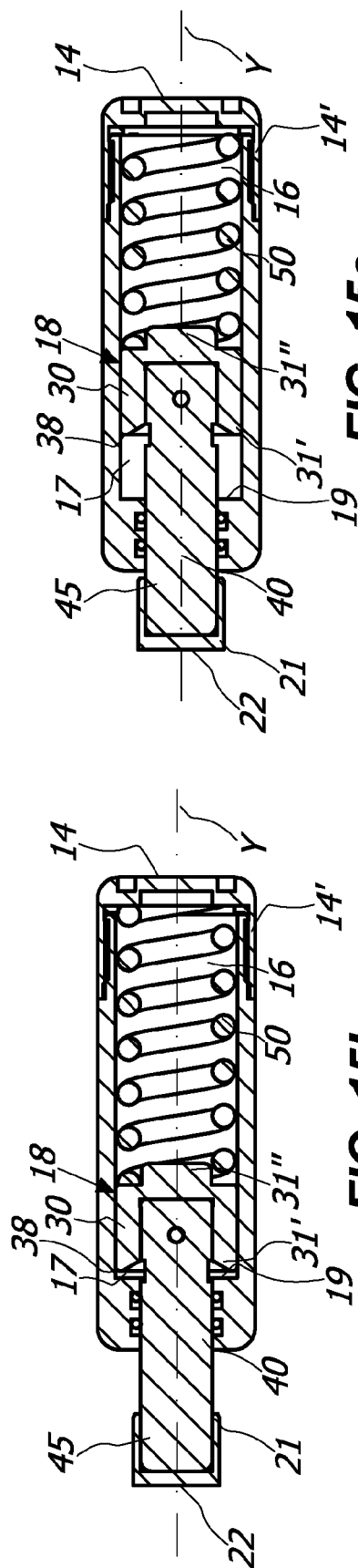


FIG. 15c

FIG. 15b

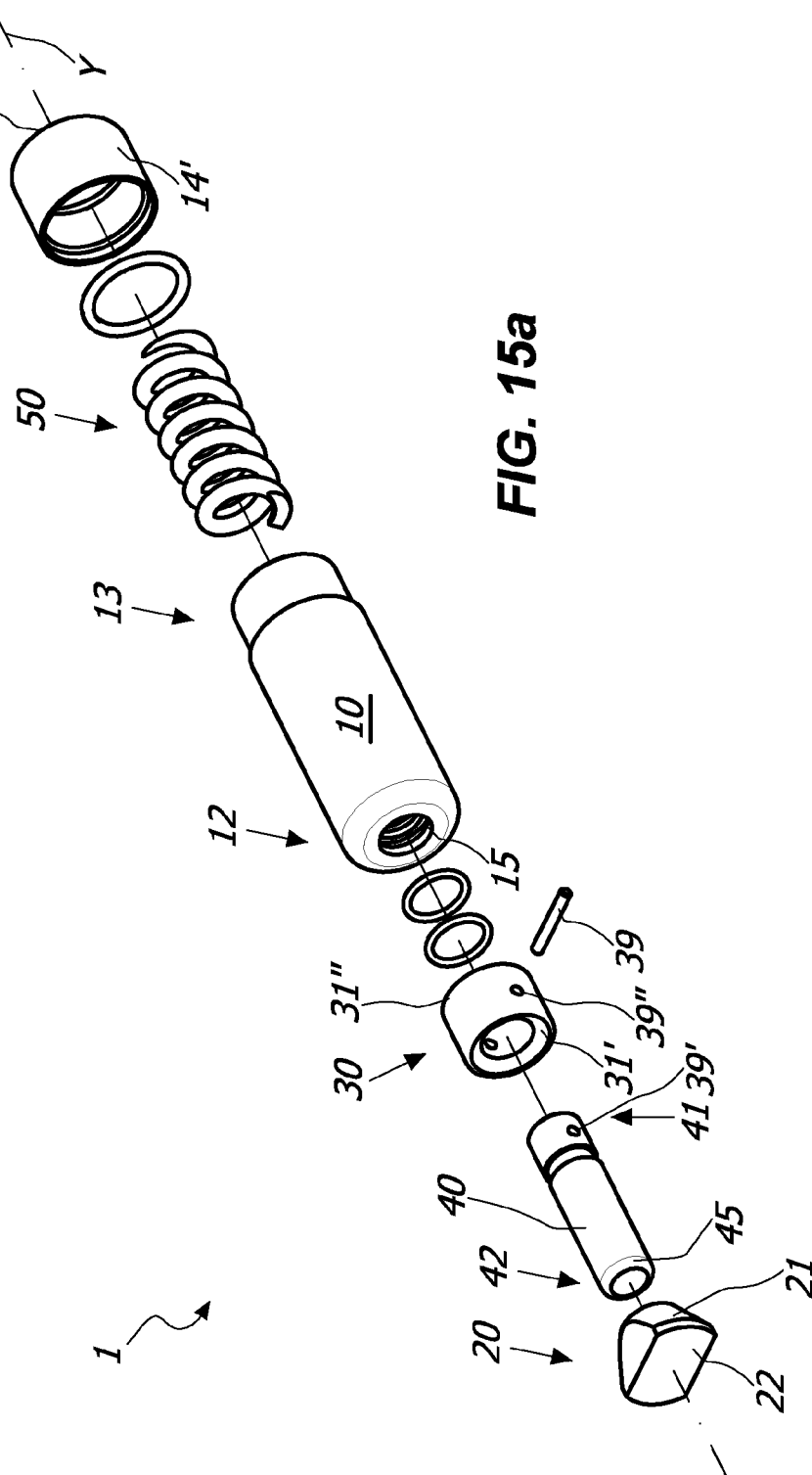


FIG. 15a

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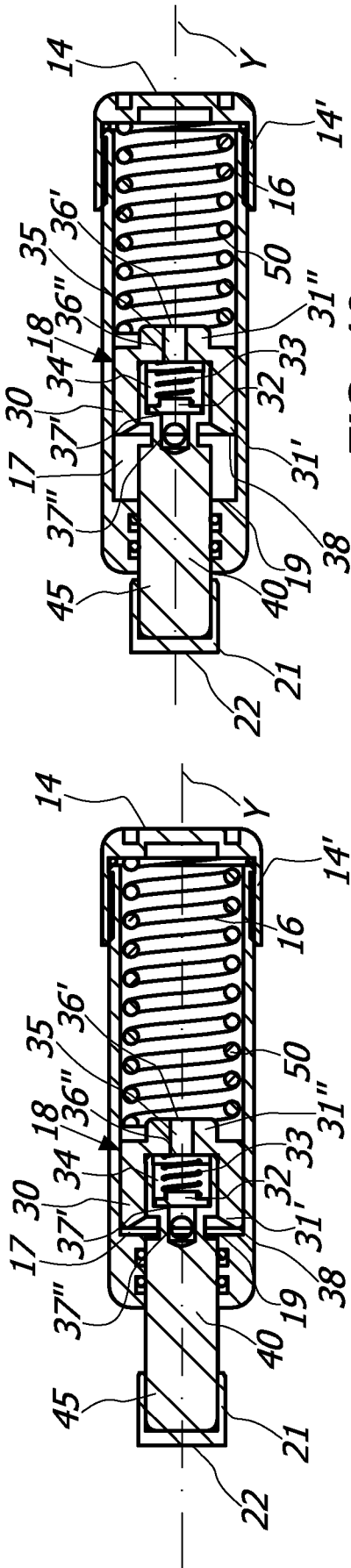


FIG. 16c

FIG. 16b

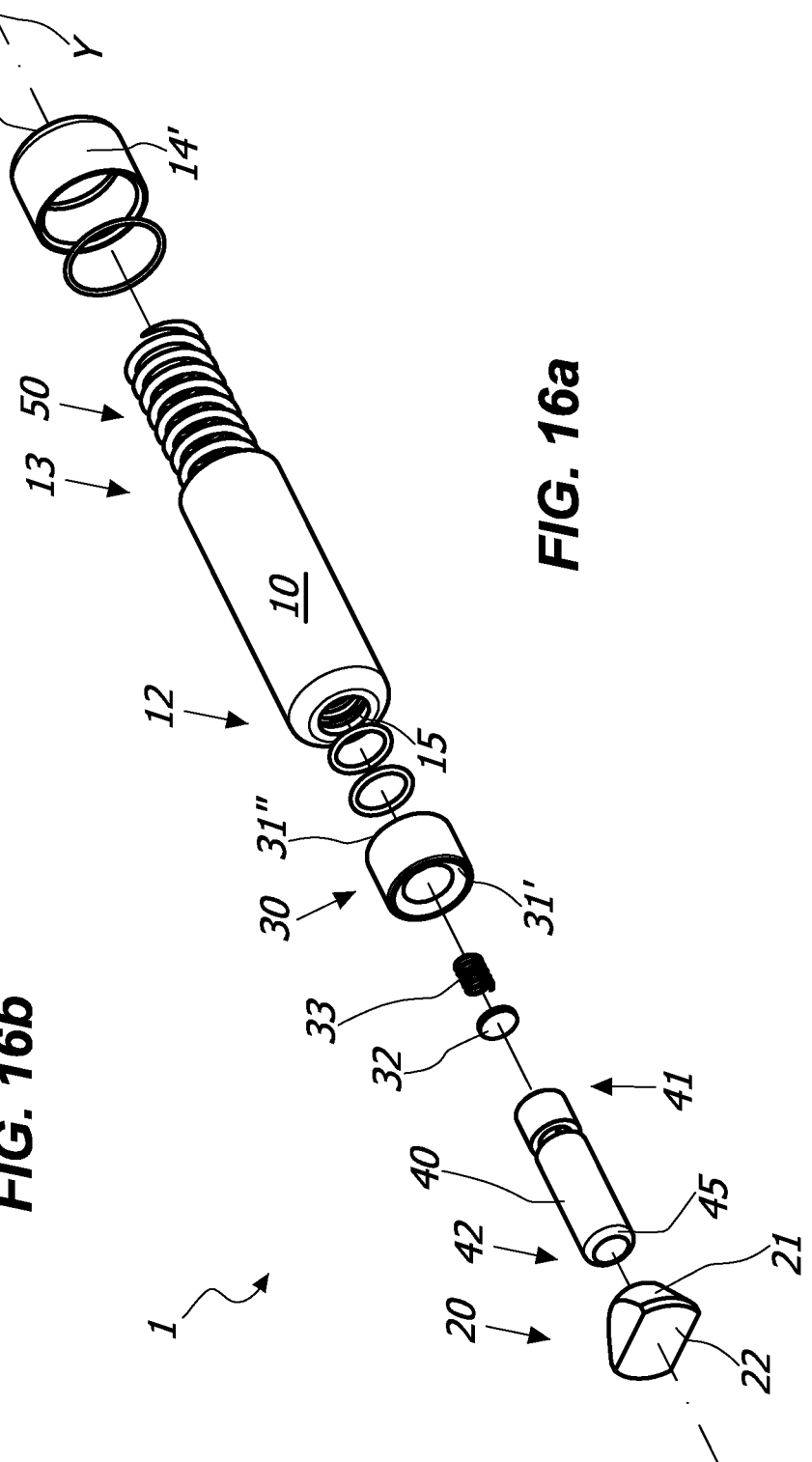


FIG. 16a

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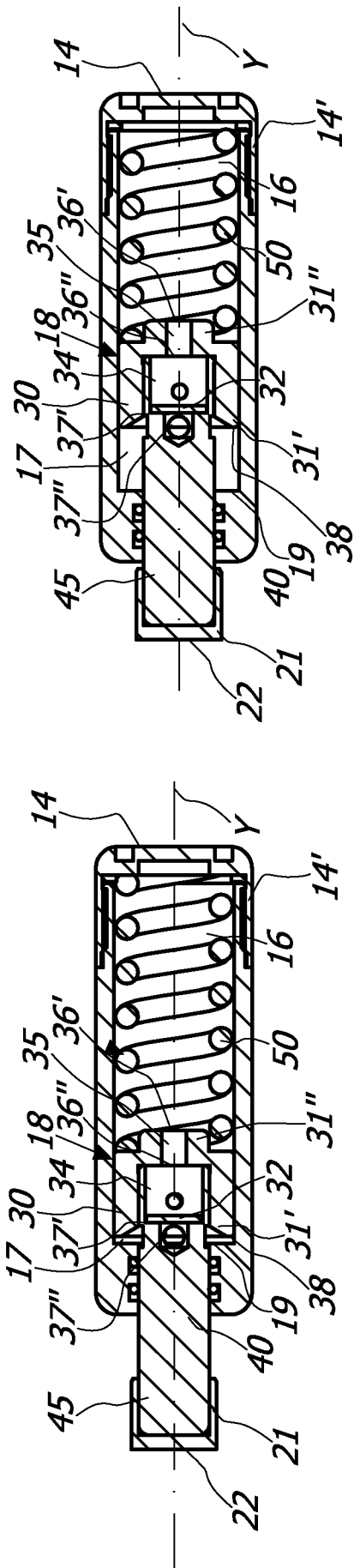


FIG. 17c

FIG. 17b

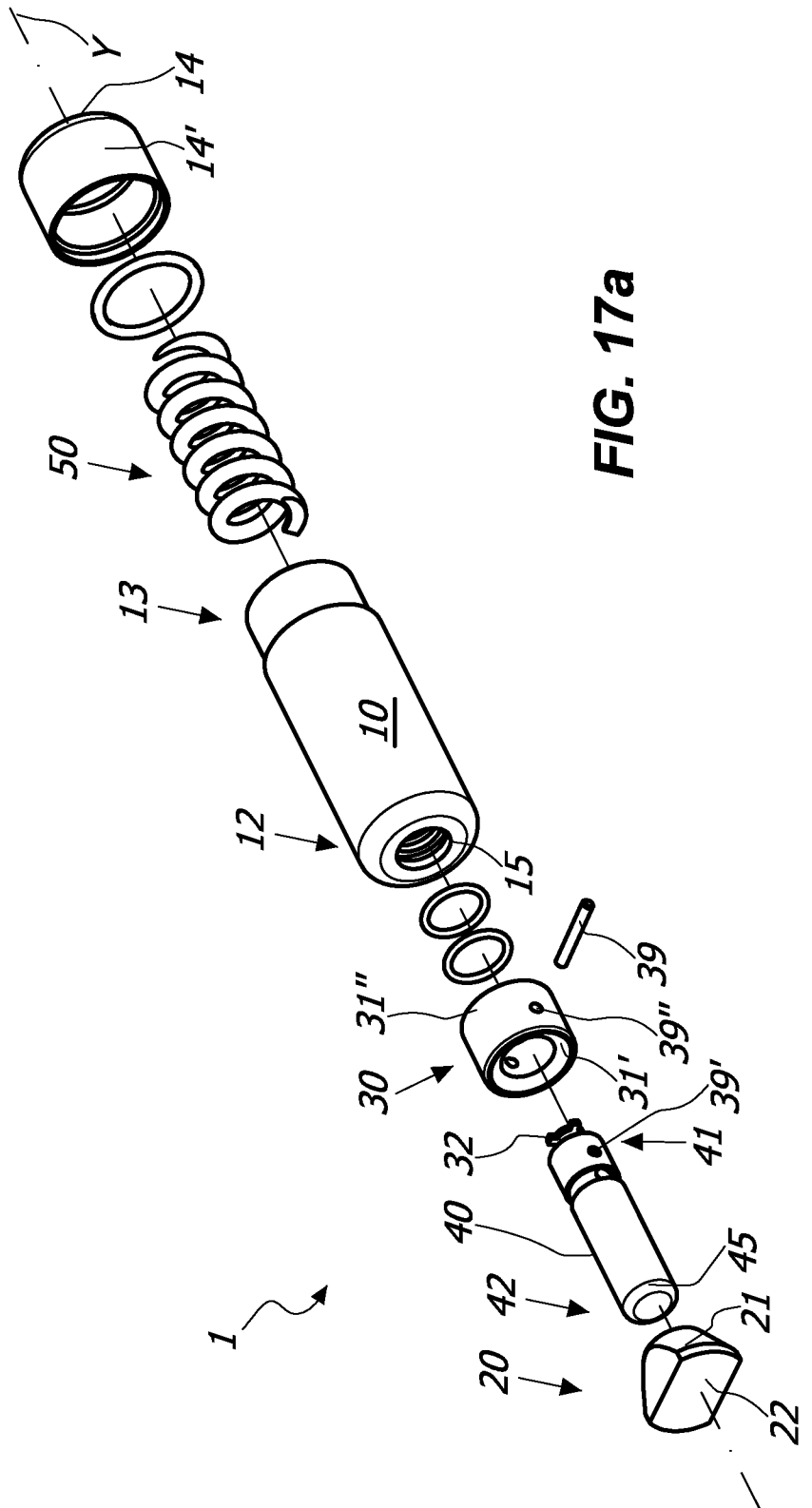


FIG. 17a

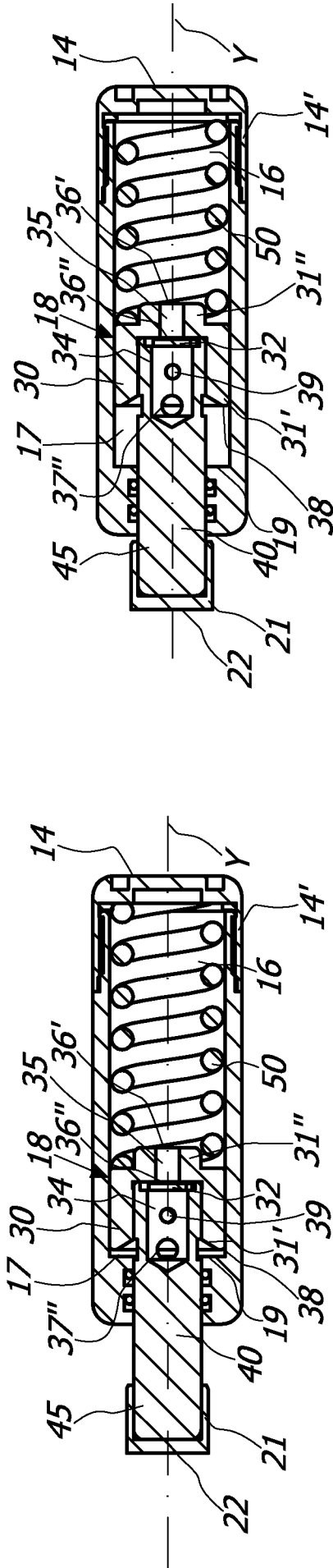


FIG. 18b

FIG. 18c

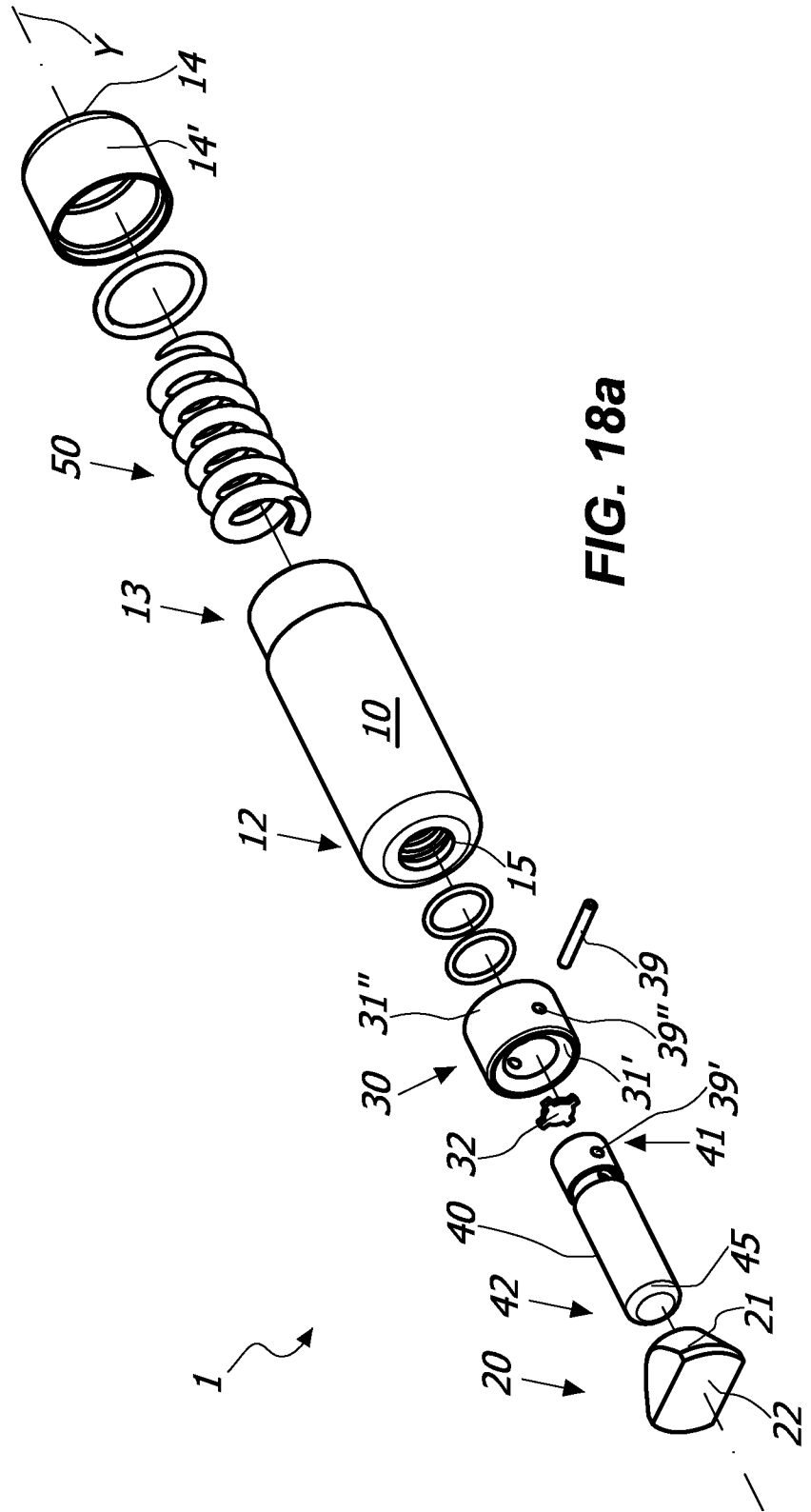


FIG. 18a

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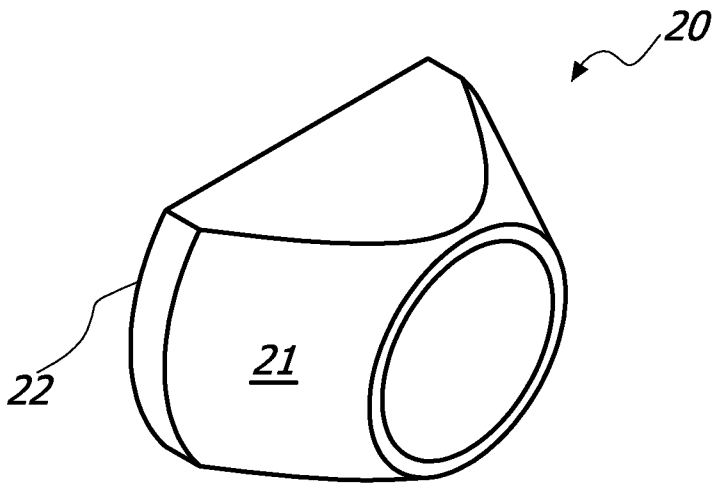


FIG. 20a

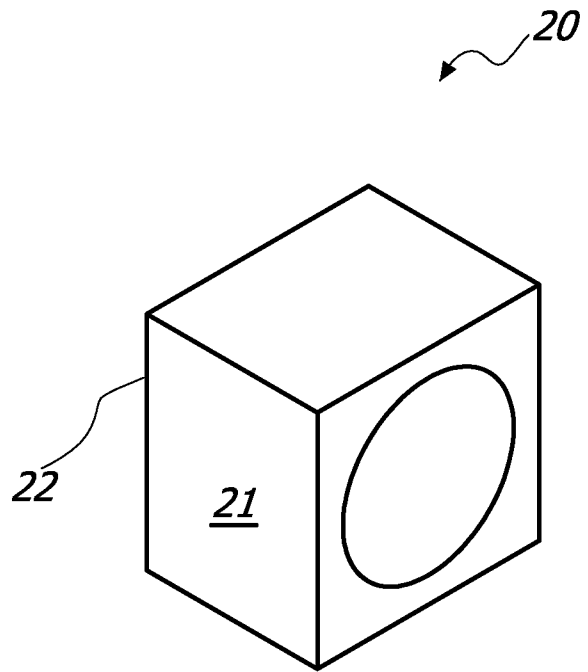


FIG. 20b

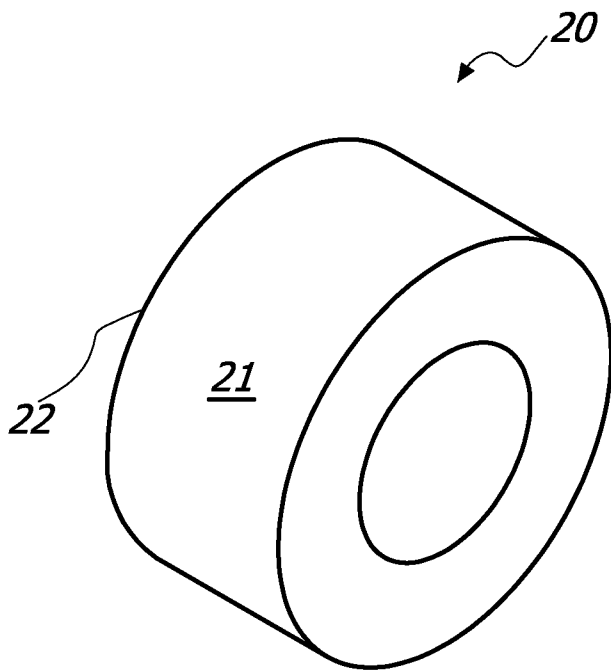


FIG. 20c

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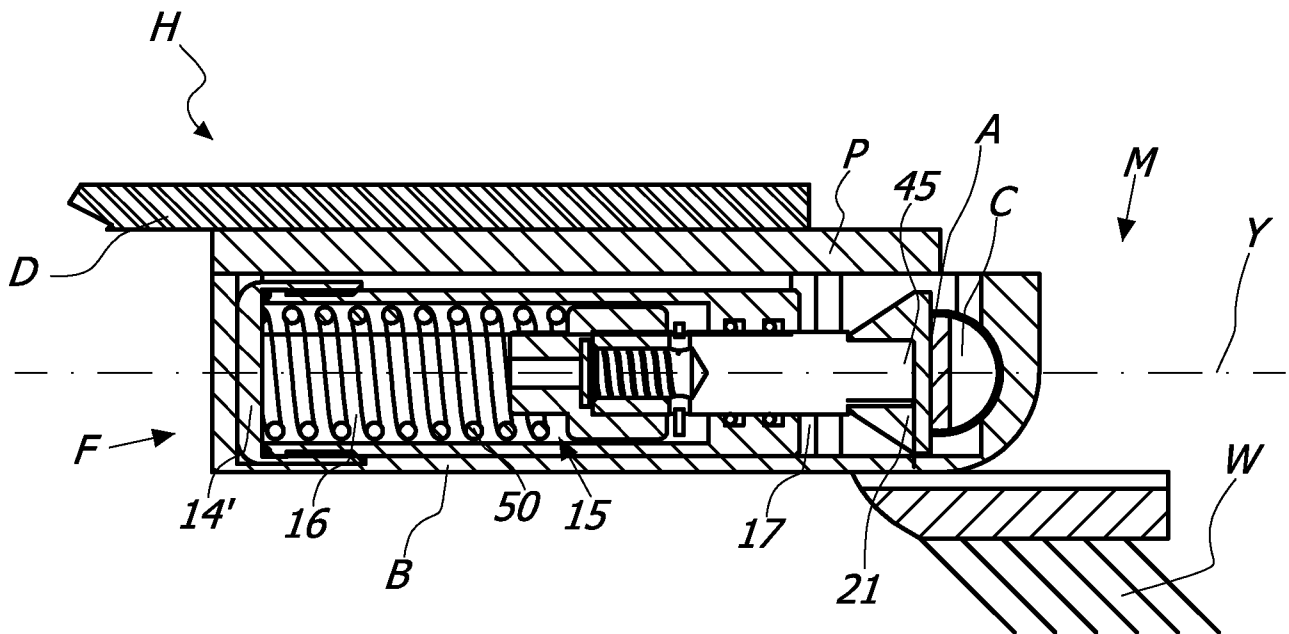


FIG. 21a

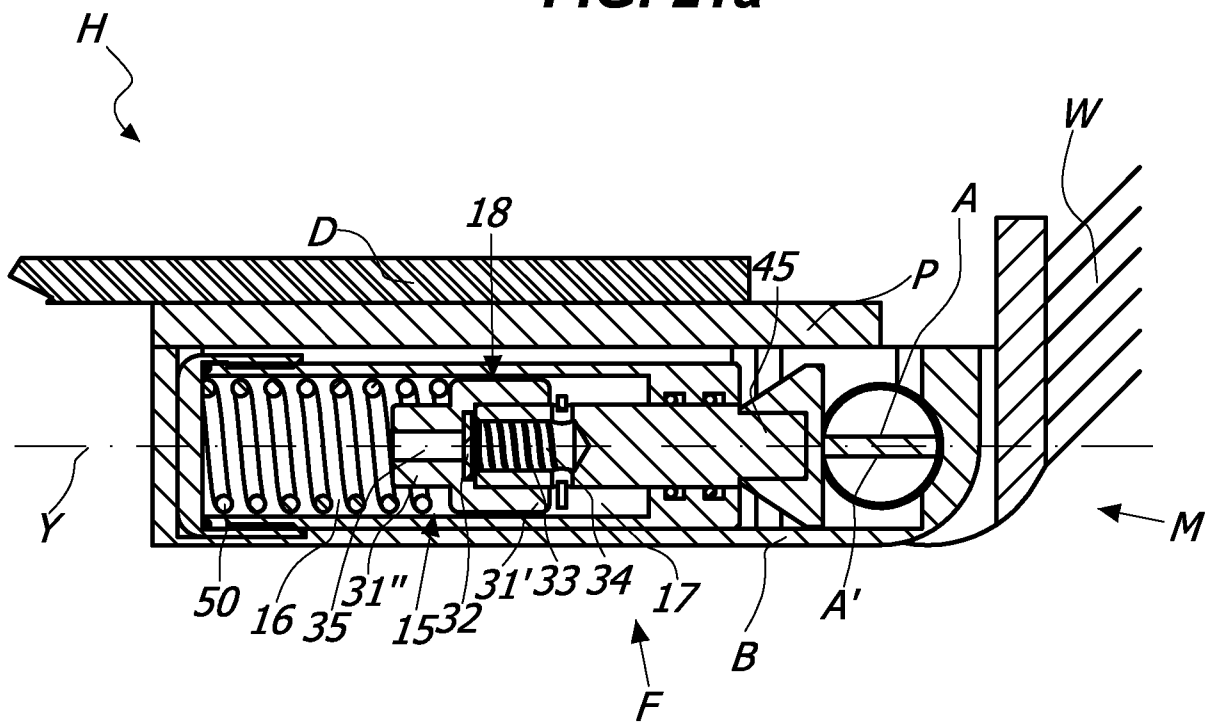


FIG. 21b