Innovation, Sciences et Développement économique Canada
Office de la Propriété Intellectuelle du Canada

Innovation, Science and Economic Development Canada
Canadian Intellectual Property Office

CA 2985550 C 2023/08/22

(11)(21) 2 985 550

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2016/05/18
(87) Date publication PCT/PCT Publication Date: 2016/11/24
(45) Date de délivrance/Issue Date: 2023/08/22
(85) Entrée phase nationale/National Entry: 2017/11/09
(86) N° demande PCT/PCT Application No.: IB 2016/052890
(87) N° publication PCT/PCT Publication No.: 2016/185394
(30) Priorités/Priorities:
2015/05/18 (IT102015000015573 (UB201);
2015/05/18 (IT102015000015578 (UB201);
2015/05/18 (IT102015000015583 (UB201);
2015/05/18 (IT102015000015588 (UB201)

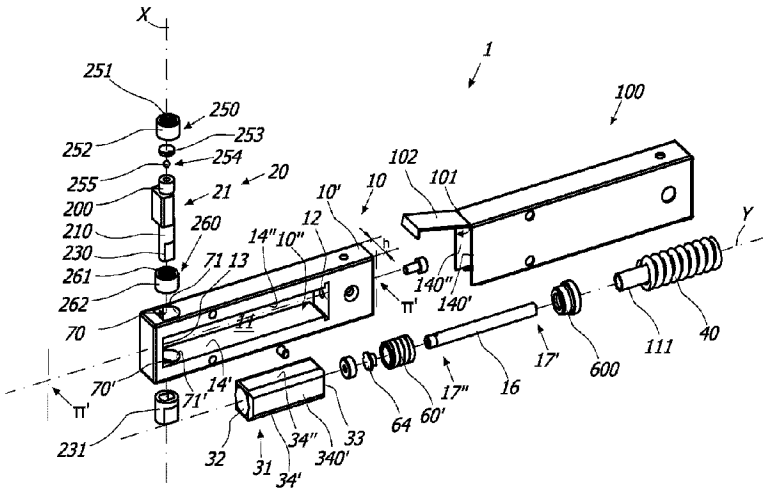
(51) Cl.Int./Int.Cl. *E05D 7/081* (2006.01),
E05D 5/02 (2006.01), *E05D 7/10* (2006.01),
E05F 1/10 (2006.01), *E05F 1/12* (2006.01),
E05F 3/10 (2006.01), *E05F 3/20* (2006.01),
E05D 5/10 (2006.01), *E05D 11/04* (2006.01)

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

(73) Propriétaire/Owner:
IN & TEC S.R.L., IT

(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : CHARNIERE A FAIBLE ENCOMBREMENT
(54) Title: LOW-BULKINESS HINGE



(57) Abrégé/Abstract:
A hinge for cold rooms or glass shutters that comprise a stationary support structure (S) and at least one shutter (A) movable between an open shutter position and a closed shutter position. The hinge comprises a hinge body (10) with a working chamber (11); a pivot (20) defining a first longitudinal axis (X) reciprocally coupled to the hinge body (10) to rotate around the first axis (X) between the open shutter position and the closed shutter position; a cam element (21) integral with the pivot (20); a plunger element (30) sliding in the working chamber (11) along a second axis (Y) substantially perpendicular to the first axis (X), the plunger element (30) comprising a slider (31) with an operative face (32) interacting with the cam element (21); elastic counteracting means (40) acting upon the plunger element (30) to move it along the second axis (Y) between a position proximal to the bottom wall (12) of the working chamber (11) and a position distal therefrom. The hinge body (10) has a substantially plate shape.

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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 November 2016 (24.11.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/185394 A3

(51) International Patent Classification:
E05D 5/02 (2006.01) *E05F 3/20* (2006.01)
E05D 7/10 (2006.01) *E05D 7/081* (2006.01)
E05F 1/10 (2006.01) *E05D 5/10* (2006.01)
E05F 1/12 (2006.01) *E05D 11/04* (2006.01)
E05F 3/10 (2006.01)

(21) International Application Number:
PCT/IB2016/052890

(22) International Filing Date:
18 May 2016 (18.05.2016)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
102015000015573 (UB2015A000767)
18 May 2015 (18.05.2015) IT
102015000015578 (UB2015A000743)
18 May 2015 (18.05.2015) IT
102015000015583 (UB2015A000886)
18 May 2015 (18.05.2015) IT
102015000015588 (UB2015A000771)
18 May 2015 (18.05.2015) IT

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

(72) Inventor: **BACCHETTI, Luciano**; Via Della Fonte, 9/C, 25075 Nave (BS) (IT).

(74) Agents: **AUTUORI, Angelo** et al.; c/o Eureka IP Consulting, Via Monte Cengio, 32, 36100 Vicenza (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))*

— *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))*

[Continued on next page]

(54) Title: LOW-BULKINESS HINGE

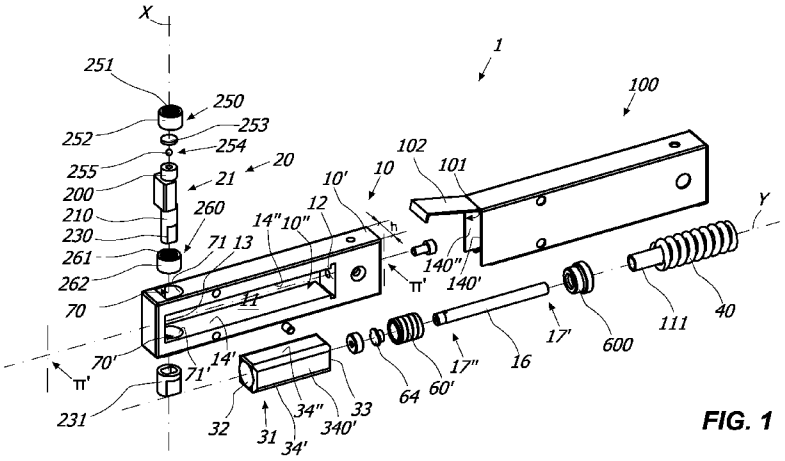


FIG. 1

(57) Abstract: A hinge for cold rooms or glass shutters that comprise a stationary support structure (S) and at least one shutter (A) movable between an open shutter position and a closed shutter position. The hinge comprises a hinge body (10) with a working chamber (11); a pivot (20) defining a first longitudinal axis (X) reciprocally coupled to the hinge body (10) to rotate around the first axis (X) between the open shutter position and the closed shutter position; a cam element (21) integral with the pivot (20); a plunger element (30) sliding in the working chamber (11) along a second axis (Y) substantially perpendicular to the first axis (X), the plunger element (30) comprising a slider (31) with an operative face (32) interacting with the cam element (21); elastic counteracting means (40) acting upon the plunger element (30) to move it along the second axis (Y) between a position proximal to the bottom wall (12) of the working chamber (11) and a position distal therefrom. The hinge body (10) has a substantially plate shape.

WO 2016/185394 A3

WO 2016/185394 A3

(88) Date of publication of the international search report:
5 January 2017

LOW-BULKINESS HINGE

DESCRIPTION

Field of the invention

The present invention is generally applicable to the technical field of hinges for doors, shutter or the like, and it particularly relates to a low-bulkiness hinge.

Background of the invention

As known, hinges generally comprise a movable element, usually fixed to a door, a shutter or the like, pivoted on a stationary element, usually fixed to the support frame thereof.

In particular, the hinges usually used in cold rooms or glass shutters are bulky, unaestethic and not very functional.

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. Consequently, there is the risk that the shutter strongly impacts against the support frame, thus damaging itself.

From documents EP0407150 and FR2320409 door closers are known that include hydraulic damping means to counteract the action of the closing means. Such known devices are extremely bulky and, consequently, have to be necessarily mounted on the floor.

Therefore, the installation of such devices necessarily requires expensive and difficult breaking works of the floor, that have to be made by specialized personnel.

Therefore, it is evident that such door closer is not suitable to be mounted on the stationary support structure or in the shutter of the cold rooms.

From the German patent DE3641214 an automatic closing device is known for window shutters suitable to be mounted externally thereto.

Summary of the invention

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

Another object of the invention is to provide an extremely low-bulkiness hinge.

Another object of the invention is to provide a hinge that may be interposed between the shutter and the frame of the stationary support structure of a cold room.

Another object of the invention is to provide a hinge that ensures the automatic closing of the door from the open door position.

Another object of the invention is to provide a hinge that ensures the controlled movement of the door to which it is bound, both upon the opening and the closing.

Another object of the invention is to provide a hinge that is suitable to support also very heavy doors and frames, without changing the behaviour and without adjustments.

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

Another object of the invention is to provide a hinge suitable to maintain the exact closing position through time.

Another object of the invention is to provide an extremely safe hinge, that, if pulled, does not resist to the closing.

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

Such objects, as well as others which will appear more clearly hereinafter, are fulfilled by a hinge according to what is herein described, shown and / or claimed.

Advantageous embodiments of the invention are defined in accordance with the appended claims.

Brief description of the drawings

Further features and advantages of the invention will become more evident by reading the detailed description of some preferred but not exclusive embodiments of a hinge **1**, shown by way of non-limiting example with the help of the annexed drawing, wherein:

FIG. 1 is an exploded axonometric view of a first embodiment of the hinge **1**;

FIG. 2a is an axonometric view of the first embodiment of the hinge **1** of FIG. 1 before the insertion of the hinge body **10** in the shell **100**;

FIG. 2b is an axonometric view of the first embodiment of the assembled hinge **1** of FIG. 1;

FIGs. 3a and **3b** are respectively side and bottom axonometric views of the first embodiment of the hinge **1** of FIG. 1 inserted in a concealed way in a tubular frame **S** wherefrom the driving fitting **231** comes out;

FIG. 4a is a further axonometric view of the first embodiment of the hinge **1** of FIG. 1

inserted in a concealed way in a tubular frame **S** wherefrom the driving fitting **231** comes out, with some enlarged details in **FIG. 4b**;

FIGs. 5a and **5b** are section axial and radial views with respect to the pivot **20** of the first embodiment of the hinge **1** of FIG. 1 with the shutter **A** closed;

FIGs. 6a and **6b** are enlarged views of some details of the first embodiment of the hinge **1** of FIG. 1 with the shutter **A** closed and open;

FIGs. 7a and **7b** are section axial and radial views with respect to the pivot **20** of the first embodiment of the hinge **1** of FIG. 1 with the shutter **A** open at 90 °;

FIGs. 8a and **8b** are section axial and radial views with respect to the pivot **20** of the first embodiment of the hinge **1** of FIG. 1 with the shutter **A** open over 90 °;

FIG. 9 is an exploded axonometric view of a second embodiment of the hinge **1**;

FIGs. 10 and **11** are section axial and radial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 9 with the shutter **A** closed;

FIGs. 12a and **12b** are section axial and radial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 9 with the shutter **A** open at 90 °;

FIGs. 13a and **13b** are section axial and radial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 9 with the shutter **A** open over 90 °.

FIG. 14 is an exploded axonometric view of another embodiment of the hinge **1**;

FIGs. 15a to **15d** are axonometric views of some steps of the mounting of the pivot **20** in the hinge body **10** of the embodiment of the hinge **1** of FIG. 14;

FIGs. 16a and **16b** are section axial and radial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 14 with the shutter **A** closed;

FIGs. 17a and **17b** are section axial and radial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 14 with the shutter **A** open at 90 °;

FIGs. 18a and **18b** are section axial and radial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 14 with the shutter **A** open over 90 °;

FIG. 19 is an axonometric view of the embodiment of the assembled hinge **1** of FIG. 14;

FIG. 20 is a schematic partially exploded view of the embodiment of the hinge **1** of FIG. 14 mounted on a shutter **A**;

FIGs. 21a and **21b** are respectively front and rear schematic views of the embodiment

of the hinge **1** of FIG. 14 mounted on the shutter **A**;

FIG. 22 is an exploded axonometric view of a further embodiment of the hinge **1**;

FIGs. 23a to **23d** and **23f** are axonometric views of some steps of the mounting of the assembly slider **31** - rod **16** - spring **40** in the working chamber **11** of the hinge body **10** of the embodiment of the hinge **1** of FIG. 22, with in **FIGs. 23e** and **23g** respective section radial views with respect to the pivot **20** of FIGs. 23d and 23f;

FIGs. 24a, **24b** and **24c** are respectively side and section axial and radial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 22 with the shutter **A** closed;

FIGs. 25a and **25b** are respectively side and section radial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 22 with the shutter **A** open at 90 °;

FIG. 25c is a section view of some details of a further embodiment of the hinge **1**;

FIG. 26 is an exploded axonometric view of a further embodiment of the hinge **1**;

FIGs. 27a and **27b** are section axial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 26 respectively with the shutter **A** closed and open at 90°;

FIGs. 28, **29a** and **29b** are schematic views of the embodiment of the hinge **1** of FIG. 26 mounted on a shutter **A**;

FIG. 30 is an exploded axonometric view of a further embodiment of the hinge **1**;

FIGs. 31a and **31b** are schematic views of the application of the embodiment of the hinge **1** of FIG. 30 to shutters **A** with different thickness;

FIG. 32 is an exploded axonometric view of a further embodiment of the hinge **1**;

FIGs. 33a and **33b** are section axial views with respect to the pivot **20** of the embodiment of the hinge **1** of FIG. 32 respectively with the shutter **A** closed and open at 90°;

FIG. 34 is a section axial view of the embodiment of the hinge **1** of FIG. 17a applied to a glass with a relatively high thickness.

Detailed description of some preferred embodiments

With reference to the above mentioned figures, the hinge according to the invention, globally indicated with the number **1**, has low bulkiness and, therefore, it is advantageously used in applications wherein the space to insert the hinge is limited or where for aesthetic reasons it is suitable to use a low-bulkiness hinge.

For example, the hinge **1** may be applicable to cold rooms, or it may be integrated in

the tubular frame thereof. In a further example, the hinge **1** may be applicable to glass shutters, such as those of a showcase or display cabinet.

In general, the hinge **1** is suitable to rotatably couple a stationary support structure, such as a tubular frame **S**, and a closing member, for example a shutter **A**, rotatably movable between an open position, shown for example in FIGs. 7a and 8b, and a closed one, shown for example in FIGs. 5a and 5b, around a rotation axis **X**.

It is understood that even though hereinafter we refer to the frame **S** and to the shutter **A**, the hinge **1** is applicable to any stationary support structure and to any frame without departing from the scope of the appended claims.

Suitably, the hinge **1** may include a hinge body **10** of substantially plate shape defining a plane **π'** and a pivot **20** defining the rotation axis **X**.

In a preferred but not exclusive embodiment, the hinge body **10** may be anchored to the shutter **A** and the pivot **20** to the frame **S**. In this case, the fixed element includes the pivot **20**, while the movable element may include the hinge body **10**.

Suitably, once the hinge body **10** is anchored to the shutter **A**, the plane **π'**defined by the former may be coincident or parallel to the plane **π** defined by the latter.

Viceversa, the hinge body **10** may be anchored to the frame **S**, while the pivot **20** may be anchored to the shutter **A**, without thereby departing from the scope of the appended claims. In this case, the fixed element includes the hinge body **10**, while the movable element may include the pivot **20**.

Advantageously, the hinge body **10** and the pivot **20** may be reciprocally coupled to rotate around the axis **X** between the open and closed shutter **A** positions.

Suitably, the pivot **20** may include a cam element **21** integral therewith interacting with a plunger element **30** sliding along an axis **Y**.

The sliding axis **Y** of the plunger element **30** may be substantially perpendicular to the axis **X**. Furthermore, the axis **X** of rotation of the shutter **A** may be substantially parallel to the plane **π'** or lying thereon.

In any case the plunger element **30**, that may include, respectively, consist of, a slider **31**, may slide in a working chamber **11** inside the hinge body **10** between a retracted end stroke position proximal to the bottom wall **12** of the working chamber **11**, shown for example in FIGs. 7a and 7b, and an extended end stroke position distal therefrom, shown for

example in FIGs. 5a and 5b.

Suitably, such retracted and extended end stroke positions may be any, and they may not necessarily correspond to the maximum distal and / or proximal position o that the plunger element **30** may assume.

In a preferred but not exclusive embodiment of the invention, the working chamber **11** may include counteracting elastic means acting upon the slider **31** to move it along the proximal and distal positions.

In a preferred but not exclusive embodiment, the elastic counteracting means may include, respectively, may consist of, a coil spring **40** of predetermined diameter.

Depending on the configuration, the elastic counteracting means **40** may be of thrust or restore.

In case of thrust elastic counteracting means, the strength thereof is such to automatically return the shutter **A** from the open or closed position that it reaches when the slider **31** is in the proximal position towards the other of the open or closed position that it reaches when the slider **31** is in the distal position.

In this case, depending on whether the position reached by the shutter **A** when the slider **31** is in the proximal position is open or closed, the hinge **1** is an opening hinge or a closing hinge or a door closer hinge.

Conversely, in case of restore counteracting elastic means, the strength thereof is such not to able to push the shutter **A** from the open or closed position that it reaches when the slider **31** is in the proximal position towards the other of the open or closed position that it reaches when the slider **31** is in the distal position. In this case, the shutter **A** has to be moved manually or with actuating means external to the hinge **1**, for example a motor.

However, the strength of the restore elastic means is such to move back the slider **31** from the proximal to the distal position.

In this case, depending on whether the position reached by the shutter **A** when the slider **31** is in the proximal position is open or closed, the hinge **1** is a control hinge upon the opening or the closing.

It is evident that the closing or opening hinge further acts as control upon the opening or the closing, while the opposite is not true.

It is understood that although in the annexed figures it is shown a closing hinge **1** the

same hinge may be a closing or opening hinge, as well as a controlling hinge upon the opening or the closing without departing from the scope of the appended claims .

In a preferred but not exclusive embodiment, the working chamber **11** may further include a rod **16** defining the axis **Y**. In this case, the elastic counteracting means may include, respectively, consist of, a coil spring **40** fitted on the rod **16**, that acts as guide thereof.

Possibly, the spring **40** may be guided by the side walls of the working chamber **11** during the sliding thereof along the axis **Y**, with or without the guiding rod **16**.

Preferably, the elastic counteracting means may consist of a single coil spring **40**, that may be a thrust or restore spring. In other words, the coil spring **40** may be the only elastic counteracting means of the hinge.

Once the coil spring **40** is inserted on the rod **16**, the spring **40** thereof remains interposed between the bottom wall **12** of the chamber **11** and the rear face **33** of the slider **31**, that acts as abutment face for the spring **40** thereof.

The hinge **1** may have both vertical and horizontal low bulkiness. The spring **40** may have an outer diameter **Øe** equal to or slightly lower than the thickness **h** of the hinge body **10**.

Suitably, such thickness **h** may be substantially equal to or slightly greater than that of the slider **31**. Indicatively, such thickness **h** may be lower than 30 mm, and preferably lower than 25 mm and even more preferably lower than 20 mm.

Moreover, the spring **40** may have an inner diameter **Øi** substantially equal to or slightly greater than the diameter of the support rod **16** whereon it is inserted. On the other hand, the inner diameter **Øi** of the spring **40** is appreciably greater than that of the rod **16**, such as shown in FIGs. 33A and 33B.

Advantageously, the slider **31** may comprise an axial blind hole **35** suitable to house the rod **16**, so as the former slides along the axis **Y** with respect to the latter between the distal and proximal positions.

More particularly, the rod **16** may include a first end **17'** operatively coupled to the bottom wall **12** of the chamber **11**, for example by screw means **18**, and a second end **17''** inserted in the axial blind hole **35** to remain faced to the bottom wall **36** of the latter.

Thanks to such a configuration, the hinge **1** is extremely simple and quick to

assemble. In fact, Once the spring **40** is fitted on the rod **16** and the latter is inserted in the axial blind hole **35** of the slider **31** it is sufficient to insert such an assembly in the working chamber **11**, to screw the rod **16** to the bottom wall **12** by means of the screw means **18** and, then, to insert the cam element **21** in the hinge body **10**.

In a preferred but not exclusive embodiment, the screw means **18** may be directly screwed on the rod **16** by means of an abutment plate **18'** of the spring **40**. This maximally simplifies the assembly of the hinge. In fact, once the spring **40** is fitted on the rod **16**, the spring **40** thereof is blocked by the plate **18'** and such an assembly is inserted from the top into the chamber **11**.

Advantageously, the slider **31** may have substantially a plate shape to define a plane **π''** substantially coincident with the plane **π'** defined by the hinge body **10**.

Suitably, the slider **31** may be guided by the walls of the working chamber **11** during the sliding thereof along the axis **Y**.

Preferably, the slider **31** may have a substantially parallelepiped shape with the operative face **32** facing the front wall **13** of the working chamber **11**, the rear face **33** facing the bottom wall **12** of the chamber **11** and side faces **34'**, **34''** facing and preferably in contact with the side walls **14'**, **14''** of the chamber **11** thereof. in this way, the latter act as as guides for the slider **31**.

To contain the costs of the hinge, the slider **31** may include an insert **31'** whereto the operative face **32** belongs. The slider **31** may be made of a first metallic material, for example aluminium, or of a polymeric material, while the insert **31'** may be made of a second metallic material harder than the first, for example steel. In this way, it is possible to realize only the parts actually in contact with the cam element **21** in the "hard" and more expensive material, while the remaining part of the slider **31** may be made of a cheaper material.

Suitably, moreover, the working chamber **11** may further have a pair of shaped facing walls **140'**, **140''** interacting with a respective pair of opposite counter-shaped walls **340'**, **340''** of the slider **31**.

Suitably, the faced walls **140'**, **140''** may be defined by the inner surface **101** of a closing element **100** of the hinge **1**, whose function is better explained hereinafter. Preferably, one or a pair of covers **82**, **83** may be placed on the closing element **100** with

aesthetic and / or protective function.

Preferably, the shaped facing walls **140'**, **140"** may have a flat shape, as the opposite walls **340'**, **340"**, and they may preferably be in reciprocal contact with the latter so as to guide them during the sliding of the slider **31** along the axis **Y**.

In a preferred but not exclusive embodiment, the walls **14'**, **14"** and **34'**, **34"** may be substantially parallel, as the walls **140'**, **140"** and **340'**, **340"**. Preferably, moreover, the walls **14'**, **14"** and **34'**, **34"** may be substantially perpendicular to the plane **π'** defined by the hinge body **10**, while the walls **140'**, **140"** and **340'**, **340"** may be substantially parallel to the plane **π'** defined by the hinge body **10**.

In a preferred but not exclusive embodiment, shown for example in FIGs. 1 to 18b, the cam element **21** of the pivot **20** may have a substantially parallelepiped shape with a first surface **23** susceptible to come in contact with the operative face **32** of the slider **31** when the same slider is in the distal position and a second surface **24** susceptible to come in contact with the operative face **32** of the slider **31** when the same slider is in the proximal position.

Advantageously, both the two surfaces **23** and **24** and the operative face **32** may be substantially flat or slightly curved.

The angle between the two surfaces **23** and **24** may be any, and it determines the opening angle of the shutter **A**.

Suitably, the two surfaces **23** and **24** may be substantially perpendicular to each other. In this case, when the slider **31** is in the proximal position the first and the second surface **23** and **24** may be respectively substantially perpendicular and parallel to the operative face **32**, while when the slider **31** is in the distal position the first and the second surface **23** and **24** may be respectively substantially parallel and perpendicular to the operative face **32** thereof.

Preferably, the second surface **24** of the cam element **21** may include a shock-absorbing portion **25** susceptible to interact with the slider **31** to slightly compress the coil spring **40** from the position of maximum compression in case the user further rotates the glass shutter to open it.

In this way, the coil spring **40** shock-absorbs the further rotary movement imparted by the user, by preventing the damage of the hinge and / or of the glass shutter.

Suitably, the shock-absorbing portion **25** may be interposed between the second surface **24** and a third surface **26** substantially perpendicular thereto and substantially parallel to the first surface **23**.

To block the rotation of the shutter **A**, the hinge **1** may further include an abutment portion suitable to come in contact with the slider **31** when the user further rotates the shutter **A** thereof, as particularly shown for example in FIG. 8a and 8b.

Suitably, such an abutment portion may be defined by the portions **110'**, **110"** of the hinge body **10**.

On the other hand, a tubular element **111** may be provided fitted on the rod **16** to remain interposed between the latter and the coil spring **40** that has a length such as to impact against the rear face **33** of the slider **31**.

To minimize the bulkiness of the hinge **1**, the cam element **21** may have a width **L** such that when the slider **31** is in the distal position the cam element **21** thereof is oriented so as to occupy a major portion of the thickness **h** of the hinge body **10** and that when the slider **31** is in the proximal position, the cam element **21** is rotated substantially of 90 ° in order to occupy a reduced portion of the thickness **h** of the hinge body **10**.

The major portion occupied by the cam element **21** when the slider **31** is in the distal position may have a width **L**, that naturally coincides with that of the cam element **21**, such that when the pivot **20** rotates around the axis **X** the cam element **21** thereof substantially occupies all the thickness **h** of the hinge body **10**. In other words, the edges of the cam element **21**, for example the shock-absorbing portion **25**, pass very close to the side walls **140'**, **140"**, up to brush them.

In this way, it is possible to maximally exploit the little space available for the rotation of the pivot **20**.

To allow the insertion of the pivot **20** in the hinge body **10**, the latter may include a passing-through elongated slot **70**, that may be dimensioned so as to allow the passage of the pivot **20** exclusively when the cam element **21** is rotated substantially of 90 °.

On the other hand, once the pivot **20** has been inserted in the working chamber **11**, the cam element **21** may be rotated in the position wherein it occupies the major portion of the thickness **h** of the hinge body **10**.

In such a position, the cam element **21** may be susceptible to impact against the

hinge body **10**, so as to avoid the reciprocal slippage.

On the other hand, as shown for example in FIG. 1, the hinge body **10** may include two passing-through slots **70**, **70'**. Such an embodiment is simpler to implement, since it only requires a drilling with a vertical drill and a punching with a square punching die for the slot **70**. Even in such a case the pivot **20** may be inserted as above mentioned.

Once inserted into the hinge body **10**, the pivot **20** has an operative portion that coincides with the cam element **21** inside the working chamber **11** and a fastening portion **230** that protrudes from the hinge body **10**.

In a further preferred but not exclusive embodiment, shown for example in FIGs. 22 to 26, the cam element **21** may be realized according to the teachings of the international application PCT / IB2007 / 051663, to which reference is made for consultation.

Due to the limited space available, the hinge **1** may be devoid of the classical thrust bearings.

However, alternative anti-friction and thrust means may be provided especially configured to perform their function in the very limited space available.

In particular, such anti-friction and thrust means may be placed in correspondence of the anchoring areas **210**, **200** of the pivot **20** to the hinge body **10**, that may remain faced to the passing-through slot **70'** and to the seat **70**. In the embodiment with two slots, the latter coincides with the other slot **70**.

Suitably, the distance **d** between the first and the second anchoring areas **200**, **210** may be substantially equal to the height of the cam element **21**. In this way, even the vertical bulkiness of the pivot **20** is minimized.

In a preferred but not exclusive embodiment, the hinge body **10** may include a first and a second annular element **250**, **260** inserted in the seat **70** and in the slot **70'** to come in contact with the first and the second anchoring area **200**, **210** of the pivot **20**.

More particularly, the first and second annular elements **250**, **260** include respective inner surfaces **251**, **261** susceptible to come in contact respectively with the first and the second anchoring area **200**, **210** of the pivot **20**.

In this way, the latter is axially and / or radially blocked, so as to counteract the thrust of the coil spring **40** and / or to avoid the misalignment.

Suitably, the first and the second annular element **250**, **260** may be inserted in the

seat **70** and in the slot **70'** in a removable manner.

More particularly, the first and the second removable annular element **250**, **260** may include respective outer surfaces **252**, **262** susceptible to come in contact with the inner surfaces **71**, **71'** of the seat **70** and of the slot **70'**.

In a preferred but not exclusive embodiment, the annular element **250** may include a bottom wall **253** substantially perpendicular to the plane **π'**. Such a bottom wall **253** may be monolithic with the annular element **250**, as shown for example in FIG. 9, or detachable therefrom, as shown for example in FIG. 1.

The anchoring area **200** of the pivot **20** may include an anti-friction element in contact with the bottom wall **253**, which may be defined by a ball **254** having a curved surface **255** that is in contact both with the pivot **20** and with the bottom wall **253**.

On the other hand, the anchoring area **200** may include the curved surface in contact with the bottom wall **253**.

Suitably, the first and second annular elements **250**, **260** may include further anti-friction elements **320** interposed between the respective outer surfaces **252**, **262** and the inner surfaces **71**, **71'** of the seat **70** and the slot **70'**.

For example, such anti-friction elements **320** may be respective series of cylindrical rollers. Thanks to such a configuration, it is possible to effectively prevent the misalignment of the shutter **A**.

More particularly, as shown in FIG. 25c, at least one of the annular elements, for example the annular element **250**, may include one or more anti-friction elements **320** interposed between the inner surface **251** thereof and the respective anchoring area **200** of the pivot **20** and in contact therewith.

In a preferred but not exclusive embodiment, shown for example in FIGs. 22 to 25c, the hinge body **10** may include a pair of pins **300**, **310** inserted into respective seats **10'''**, **10''''** transverse to the plane **π'** of the hinge body **10** thereof to engage in an annular peripheral groove **215** of the anchoring area **210** of the pivot **20**.

In this way, the annular element **250** and the pins **300**, **310** cooperate with each other to axially and / or radially block the pivot **20** by counteracting the thrust of the coil spring **40** and / or avoiding the misalignment thereof.

The hinge **1** may be fully assembled without screws. This further simplifies the

mounting, in addition to contain costs and bulkiness.

To the object, the hinge body **10** with all the components inserted in the working chamber **11** may be coupled to a box-shaped shell **100** so as the inner surface **101** of the latter remains in contact with the outer surface **10'** of the hinge body **10**.

The box-shaped shell **100** may cooperate with the inner surface **10"** of the hinge body **10** to define the working chamber **11**.

In particular, the hinge body **10** may comprise the first pair of shaped facing walls **14'**, **14"**, while the shell **100** may comprise both shaped facing walls **140'**, **140"**, or only one thereof.

Advantageously, to contain the costs of the hinge **1**, the hinge body **10** may be made of polymeric material, while the shell **100** may be made of metallic material.

In a preferred but not exclusive embodiment, shown for example in FIGs. 26 - 29b, the shell **100** may be opened laterally to allow the lateral insertion of the hinge body **10**. In this case, the wall **140'** belongs to the shell **100**, while the wall **140"** belongs to the hinge body **10**.

In another embodiment, shown for example in FIGs. 1 to 25b, the shell **100** may be an elongated box-shaped body wherein the hinge body **10** may be slidably insertable. In this case, both walls **140'**, **140"** belong to the shell **100**.

In any case, fastening means may be provided to reciprocally block in the operative position the hinge body **10** and the shell **100**. For example, the latter may have a blocking tab **102** or some teeth that are snap-fitted in the hinge body **10**.

FIG. 30 shows another embodiment of the closing element **100**, alternative to the box-shaped shell. In this embodiment, the closing element **100** may be a plate coupled to the hinge body.

The hinge **1** may be of a mechanical type, as shown for example in FIG. 14, or it may include hydraulic damping means, as shown for example in FIG. 1, to hydraulically dampen the sliding along the axis **Y**.

In turn, the mechanical hinge **1** may include the rod **16**, as shown for example in FIG. 1, or it may be devoid of it.

It is evident that the mechanical hinge is devoid of the hydraulic damping means, while the hydraulic hinge may include hydraulic damping means.

Suitably, such hydraulic damping means may be entirely contained within the slider **31**, so as the coil spring **40** and the pivot **20** are not immersed in oil bath.

Suitably, the hydraulic damping means may include, respectively, they may consist of, a working fluid, for example oil, entirely contained in a hydraulic circuit **50** inside the slider **31**. To the object, the hydraulic circuit **50** may include the blind hole **35**.

This maximally simplifies the hinge structure **1**, while minimizing the costs thereof. In fact, all the hydraulics of the hinge is entirely contained in the slider **31**, the remaining parts remaining dry and, therefore, being much simpler to realize and manage.

Suitably, the second end **17"** of the rod **16** may divide the blind hole **35** in a first and a second variable volume compartment **51'**, **51"** fluidly communicating and adjacent therebetween.

To the object, the second end **17"** of the rod **16** may include a cylindrical separation element **60** of the variable volume compartments **51'**, **51"**.

In a preferred but not exclusive embodiment, shown for example in FIG. 1, the cylindrical separation element **60** may be a cylinder open to be coupled to the second end **17"** of the rod **16**.

The separation element **60** may include an inner chamber **65** with a bottom wall **19'**, a side wall **63** and a front wall **61**.

The latter may have a front surface **62'** faced to the bottom wall **36** of the blind hole **35** and a rear surface **62"** faced to the bottom wall **19'** of an axial blind hole **19** made in correspondence of the second end **17"** of the rod **16**.

Suitably, the cylindrical separation element **60** may have the cylindrical wall **63** interposed between the side wall **19"** of the second end **17"** of the rod **16** and the side wall **37** of the blind hole **35** of the slider to act as a spacer therebetween.

Advantageously, the first compartment **51'** may be defined by the bottom wall **36** of the axial blind hole **35**, by the side wall **37** thereof and by the front surface **62'** of the front wall **61**, while the second compartment **51"** may be defined by the axial blind hole **19** of the rod **16** and by the interspace between the cylindrical separation element **60** and an oil-seal **600** faced thereto and coupled to the slider **31** to close the axial blind hole **35**. The first and the second compartment **51'**, **51"** are fluidly communicating therebetween by means of the passage **59**.

With regards to the second compartment **51''**, the axial blind hole **19** has constant volume, while the tubular interspace **52** varies in volume at the passage of the slider **31** from the distal position to the proximal one and vice versa.

Suitably, the compartments **51'**, **51''** may be configured to have in correspondence of the closed shutter **A** position respectively the maximum and the minimum volume.

To allow the fluid communication between the two compartments **51'**, **51''**, controlling means of the flow of the working fluid may be provided to allow the passage thereof from the first compartment **51'** to the second compartment **51''** upon one of the opening or the closing of the shutter **A** and to allow the passage from the second compartment **51''** to the first compartment **51'** upon the other of the opening or the closing of the shutter **A**.

In a preferred but not exclusive embodiment, the controlling means of the flow of the working fluid may comprise an opening **53** passing through the separation element **60** in correspondence of the wall **61** and valve means to allow the controlled passage of the working fluid between the two compartments **51'**, **51''**.

Suitably, the valve means may comprise a plug element **64** movable in a seat **65** defined by the inner chamber of the cylindrical separation element **60**. The valve seat **65** may be interposed between the passing-through opening **53** and the blind hole **19** of the end **17''** of the rod **16** and it allows the plug **64** to move between a first working position, shown for example in FIG. 6b, wherein the plug element **64** is in contact with the passing-through opening **53** and a second working position, shown for example in FIG. 6a, wherein the plug element **64** thereof is spaced thereto.

Depending on the configuration of plug **64**, when the same plug is in the first working position the two compartments **51'**, **51''** are or are not in fluid communication by means of the passing-through opening **53** of the cylindrical separation element **60**.

In a first embodiment, the plug element **64** may include a calibrated opening **54**, preferably in a central position, to allow the passage of the working fluid between the two compartments **51'**, **51''** by means of the passing-through opening **53** when the plug element **64** thereof is in the first working position.

The calibrated opening **54** may have a diameter lower than 1 mm, and preferably lower than 0,5 mm. Indicatively, such a calibrated opening **54** may have a diameter of 1 - 3

tenths of millimetre.

Therefore, when the plug element **64** is in the first working position, corresponding to the distal position of the slider **31**, the working fluid exclusively passes through the calibrated opening **54**, while when the plug element **64** thereof is in the second working position, corresponding to the proximal position of the slider **31**, the working fluid passes both through the calibrated opening **54** and through a plurality of peripheral passages **55** thereof. Therefore, in such an embodiment, the hydraulic circuit **50** may be entirely contained inside the blind hole **35** of the slider **31**.

In a preferred but not exclusive embodiment, shown for example in FIGs. 11a and 11b, the valve seat **65** may include a pin **650** passing through a hole **640** of the plug element **64**.

In this case, the calibrated opening **54** may be defined by the interspace between the hole **640** of the plug element **64** and the passing-through pin **650**.

In any case, the calibrated opening **54** may have a passage section lower than 2 mm^2, preferably lower than 1 mm^2, even more preferably lower than 0,5 mm^2 and ideally lower than 0,35 mm^2.

Advantageously, the pin **650** may be inserted through a hole **610** of the front wall **61** of the chamber **65**.

In this case, the passing-through opening **53** may be defined by the interspace between the hole **610** of the front wall **61** of the chamber **65** and the passing-through pin **650**.

Suitably, the pin **650** may be inserted through the plug element **64** and the front wall **61** of the chamber **65** to freely move along the axis **Y**.

To the object, the bottom wall **19'** of the chamber **65** may include a seat for the pin **650**, the seat thereof may be defined by the axial blind hole **19**.

Suitably, the pin **650** and the axial blind hole **19** may be reciprocally dimensioned so as in the distal position of the slider **31** the pin **650** is within the seat **19** thereof upon the interaction with the bottom wall **36** of the blind hole **35**, and in the proximal position of the slider **31** thereof, the pin **650** telescopically exits from the seat **19** thereof, remaining partially inserted therein, so as not to slip off.

Thanks to the above mentioned features, the free sliding of the pin **650** during the

sliding of the slider **31** maintains the passing-through opening **53** and the calibrated opening **54**, that are very low-bulky, free from any dirt and / or foreign bodies.

Suitably, slip-preventing means may be provided to prevent the slippage of the pin **650** from the seat **651** during the sliding. For example, the seat **651** may have ends that may be chamfered, that may act as abutments for the pin **650**.

In a second embodiment, shown for example in FIGs. 6a and 6b, the plug element **64** is devoid of the calibrated central hole **54**. Therefore, when the plug element **64** is in the first working position the working fluid may not pass through the passing-through opening **53** of the cylindrical separation element **60**.

To allow the fluid communication between the compartments **51'**, **51''** when the plug element **64** is in the first working position, a channel **60'** may be provided encompassing the separation element **60**.

As stated above, the hinge **1** is particularly suitable for glass shutters **A** or shutters of cold rooms.

In particular, in the embodiments of FIGs. 1 to 21b the hinge **1** once assembled as shown for example in FIG. 2b has a parallelepiped shape suitable to be inserted in the tubular frame of the shutter **A**, as shown for example in FIGs. 4a and 4b.

Moreover, the low-bulkiness of the hinge **1** further makes it suitable to be inserted between the two glass plates of a double-glazing glass, as for example shown in FIGs. 3a and 3b.

On the other hand, the hinge **1** may cooperate with one or more fastening plate-shaped elements **120** to fasten from opposite sides a glass shutter **A** so as the latter remains interposed therebetween.

More particularly, in the embodiment shown in FIGs. 26 to 29b the hinge **1** may include a portion **130** suitable to interact with a corresponding first portion **A1** of the glass shutter **A**, while the fastening element **120** may comprise a portion **131** faced to the portion **130** suitable to interact with a corresponding second portion **A2** of the glass shutter **A** opposite to the first portion **A1**. Suitably, the glass shutter **A** may be protected by suitable seals **160**, **160'**.

In the embodiments shown in FIGs. 14 to 25b, the hinge **1** may include portions **130**, **130'** extending from opposite sides of the hinge body **10** to interact with a corresponding

pair of first portions **A1**, **A1'** of the glass shutter **A**, while the fastening elements **120**, **120'** may have respective second portions **131**, **131'** suitable to interact with a corresponding pair of second portions **A2**, **A2'** of the glass shutter **A** opposite to the first portions **A1**, **A1'**.

Suitably, the first portions **130**, **130'** may extend from the hinge body **10** in correspondence of a side wall thereof, while the fastening elements **120**, **120'** may be dimensioned so as to remain flush with the opposite side wall of the hinge body **10**, so that the glass shutter **A** is placed in a substantially central position with respect to the hinge body **10** thereof.

Advantageously, the box-shaped shell **100** may leave free the portions **130** or **130**, **130'** of the hinge body **10** for the fastening of the glass shutter **A**.

In a preferred but not exclusive embodiment, one of the covers **83** may be couplable to the hinge body **10**, while the other of the covers **82** may be couplable to the fastening elements **120**, **120'**. In this way, as shown in FIGs. 31a, 31b and 34, the cover **82** may always remain in contact with the glass shutter **A** regardless of the thickness thereof.

For the reciprocal blocking of the hinge **1** and of the fastening plate-shaped elements **120** or **120**, **120'** that include a pair of screws **150**, **150'** insertable in a corresponding pair of seats **155**, **155'**, the latter possibly passing through a corresponding pair of passing-through holes **F1**, **F2** of the glass shutter **A**.

Thanks to the above mentioned features, the hinge **1** practically acts as "*patch*" for the glass shutter **A**, and, therefore, it has minimal visual impact thereon.

In a further preferred but not exclusive embodiment, shown for example in FIGs. 32, 33a and 33b, the hinge **1** may include a pressing element **400** coupled to the rod **16** to adjust the pre-loading of the coil spring **40**, preferably screwed on the rod **16** thereof.

To the object, the pressing element **400** may be coupled to the rod **16** by means of a sliding coupling element **410** having one operation end **411** controlled by a user and an opposite end **412** screwable on the rod **16**.

The coupling element **410** may include a smooth portion **413** for the idle sliding of the pressing element **400** and a portion **414** susceptible to abut against the latter.

In this way, the screwing / unscrewing of the coupling element **410** with respect to the rod **16** may determine the greater or lower pre-loading of the coil spring **40**.

From the above description, it appears evident that the hinge according to the

invention fulfils the intended objects.

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

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

Claims

1. A low-bulkiness hinge for a door anchored to a stationary support structure, one of the door or the stationary support structure defining a first plane, the low-bulkiness hinge comprising:

a plate-shaped hinge body defining a second plane, the hinge body being anchorable to the one of the door or the stationary support structure so that the first plane and the second plane are coincident or parallel to each other, the hinge body including an inner surface; and

a pivot defining a first longitudinal axis parallel to the second plane or lying thereon, the pivot being anchorable to the other one of the door or the stationary support structure, the pivot and the hinge body being reciprocally coupled so as to rotate around the first axis between an opening position and a closing position,

wherein the hinge body includes a lateral opening and a closing element for closing the lateral opening, the inner surface of the hinge body and the closing element reciprocally cooperating to define a working chamber extending along a second longitudinal axis perpendicular to the first axis,

wherein the working chamber includes a slider sliding along the second axis, a first pair of guiding facing walls and a second pair of guiding facing walls interacting or being in reciprocal contact with the slider, the hinge body comprising the first pair of guiding facing walls, the closing element comprising at least one of the guiding facing walls of the second pair, and

wherein the pivot further includes a cam element integrally rotatable therewith, the slider comprising an operative face interacting with the cam element.

2. The low-bulkiness hinge according to claim 1, wherein the guiding walls of the first pair are substantially transversal with respect to the guiding walls of the second pair.

3. The low-bulkiness hinge according to claim 1, wherein the closing element includes one of the guiding walls of the second pair, the hinge body including the other guiding walls of the second pair.

Date Reçue/Date Received 2022-12-09

4. The low-bulkiness hinge according to claim 1, wherein the closing element has walls with a thickness lower than a thickness of the hinge body.

5. The low-bulkiness hinge according to claim 4, wherein a ratio between the thickness of the closing element walls and the thickness of the hinge body is greater than 1:5.

6. The low-bulkiness hinge according to claim 4, wherein a ratio between the thickness of the closing element walls and the thickness of the hinge body is greater than 1:10.

7. The low-bulkiness hinge according to claim 4, wherein a ratio between the thickness of the closing element walls and the thickness of the hinge body is greater than 1:15.

8. The low-bulkiness hinge according to claim 1, wherein the closing element is a plate coupled to the hinge body.

9. The low-bulkiness hinge according to claim 1, wherein the closing element is a box-shaped shell coupled to the hinge body.

10. The low-bulkiness hinge according to claim 9, wherein the box-shaped shell has an inner surface, an outer surface of the hinge body being in contact with the inner surface of the box-shaped shell.

11. The low-bulkiness hinge according to claim 9, wherein the box-shaped shell has an open side to allow a lateral insertion of the hinge body therein.

12. The low-bulkiness hinge according to claim 9, wherein the box-shaped shell is open in a front or rear side thereof to allow an axial insertion of the hinge body therein, the shell including both guiding facing walls of the second pair.

Date Reçue/Date Received 2022-12-09

13. The low-bulkiness hinge according to claim 1, wherein one of the closing element or the hinge body includes a fastening member to fasten to the other one of the closing element or the hinge body.

14. The low-bulkiness hinge according to claim 1, wherein the hinge body is made of a polymeric material, the closing element being made of a metallic material.

15. A low-bulkiness hinge for closing a door anchored to a stationary support structure, one of the door or the stationary support structure defining a first plane, the low-bulkiness hinge comprising:

a plate-shaped hinge body defining a second plane, the hinge body being anchorable to the one of the door or the stationary support structure so that the first plane and the second plane are coincident or parallel to each other, the hinge body including an inner surface, and

a pivot defining a first longitudinal axis parallel to the second plane or lying thereon, the pivot being anchorable to the other one of the door or the stationary support structure, the pivot and the hinge body being reciprocally coupled so as to rotate around the first axis between an opening position and a closing position,

wherein the hinge body includes a lateral opening and a closing element for closing the lateral opening, the inner surface of the hinge body and the closing element reciprocally cooperating to define a working chamber extending along a second longitudinal axis perpendicular to the first axis,

wherein the working chamber includes a front wall, a bottom wall and a slider sliding along the second axis between a position distal from the bottom wall and a position proximal thereto, the working chamber further including a first pair of guiding facing walls and a second pair of guiding facing walls interacting or in reciprocal contact with the slider, the hinge body comprising the first pair of guiding facing walls, the closing element comprising at least one of the guiding facing walls of the second pair, and

Date Reçue/Date Received 2022-12-09

wherein the pivot further includes a cam element integrally rotatable therewith, the slider comprising an operative face interacting with the cam element so as upon the opening or the closing of the door a rotation of the pivot around the first axis corresponds to the sliding of the slider along the second axis from the distal to the proximal position, the working chamber further comprising an elastic member interposed between the bottom wall of the working chamber and the slider to act on the slider so as to move the slider from the proximal to the distal position.

16. The low-bulkiness hinge according to claim 15, wherein the elastic member has an outer diameter equal to a thickness of the hinge body.

17. The low-bulkiness according to claim 15, wherein the cam element of the pivot has an substantially parallelepiped shape with a first surface disposed to come in contact with an operative face of the slider when the slider is in the distal position and a second surface disposed to come in contact with the operative face of the slider when the slider is in the proximal position, the first and second surfaces being reciprocally transverse.

18. The low-bulkiness according to claim 17, wherein the first surface and the second surface are substantially flat, the operative face being substantially flat.

19. The low-bulkiness according to claim 18, wherein the first and second surface are substantially perpendicular to each other, the cam element of the pivot having an substantially rectangular parallelepiped shape, and wherein, when the slider is in the proximal position, the first and second surfaces are respectively substantially perpendicular and parallel to the operative face, and, when the slider is in the distal position, the first and second surfaces are respectively substantially parallel and perpendicular to the operative face.

20. The low-bulkiness according to claim 19, wherein the elastic member is a coil spring that has a maximum compression in the proximal position, the second surface of the cam element including a shock-absorbing portion adapted to interact with the slider to compress the coil spring from the maximum compression when a user

Date Reçue/Date Received 2022-12-09

imparts a further rotation the door from the open position toward a direction opposite to the closed position, the coil spring shock-absorbing the further rotation, the cam element including a third surface substantially perpendicular to the second surface and substantially parallel to the first surface, the shock absorbing portion being interposed between the second and the third surface.

Date Reçue/Date Received 2022-12-09

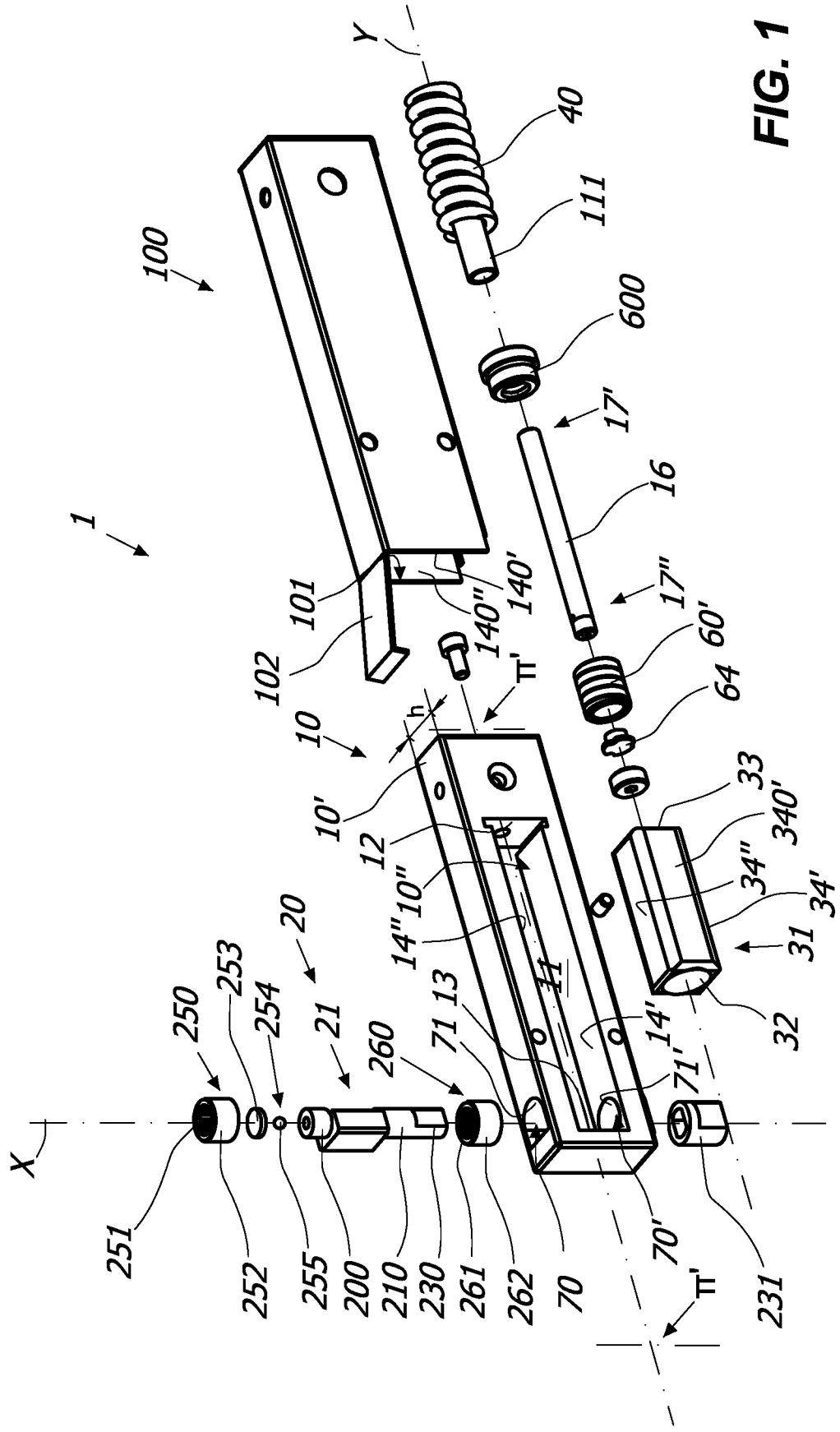

Y
40
111
100
600
17"
16
1
101
140'
140"
17'''
102
Π'
60'
64
h
10
10'
33
340'
12
10"
34"
14"
34'
20
31
253
250
254
21
260
71
13
11
14'
32
71'
X
251
252
255
200
210
230
261
262
70
70'
Π'
231

FIG. 1

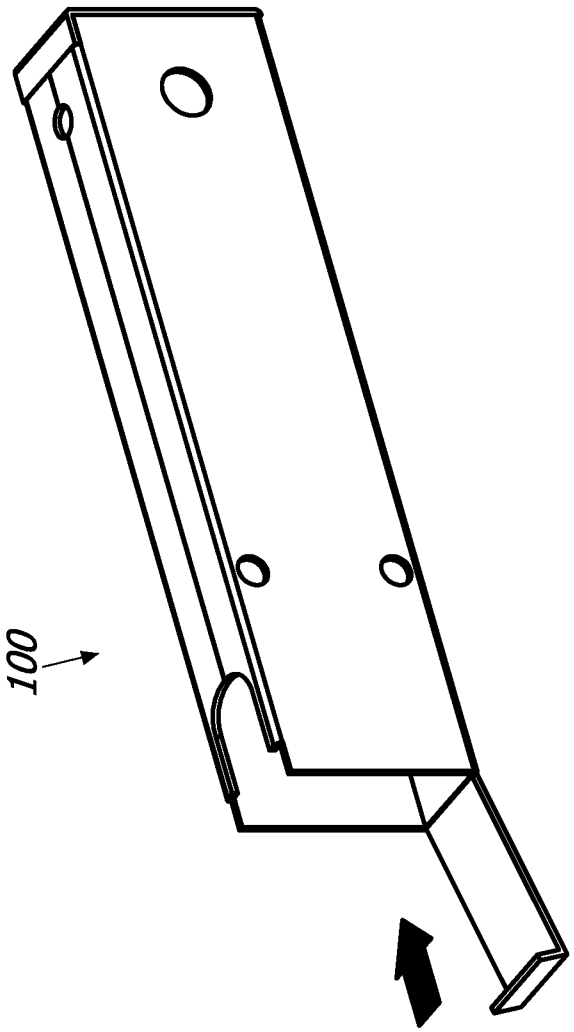


FIG. 2a

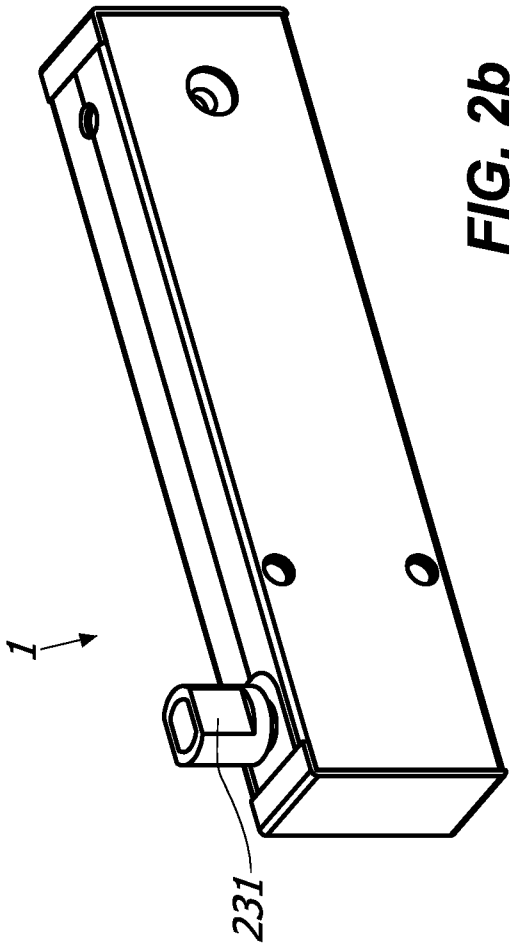
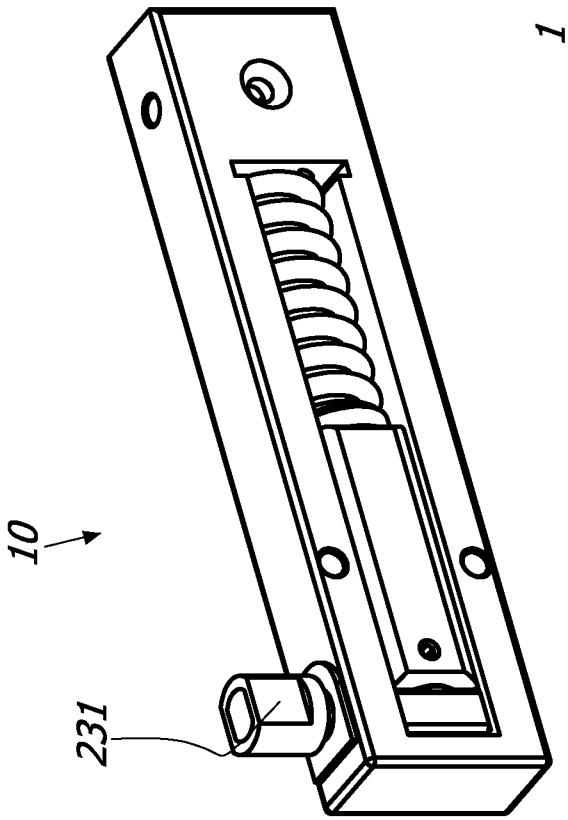


FIG. 2b



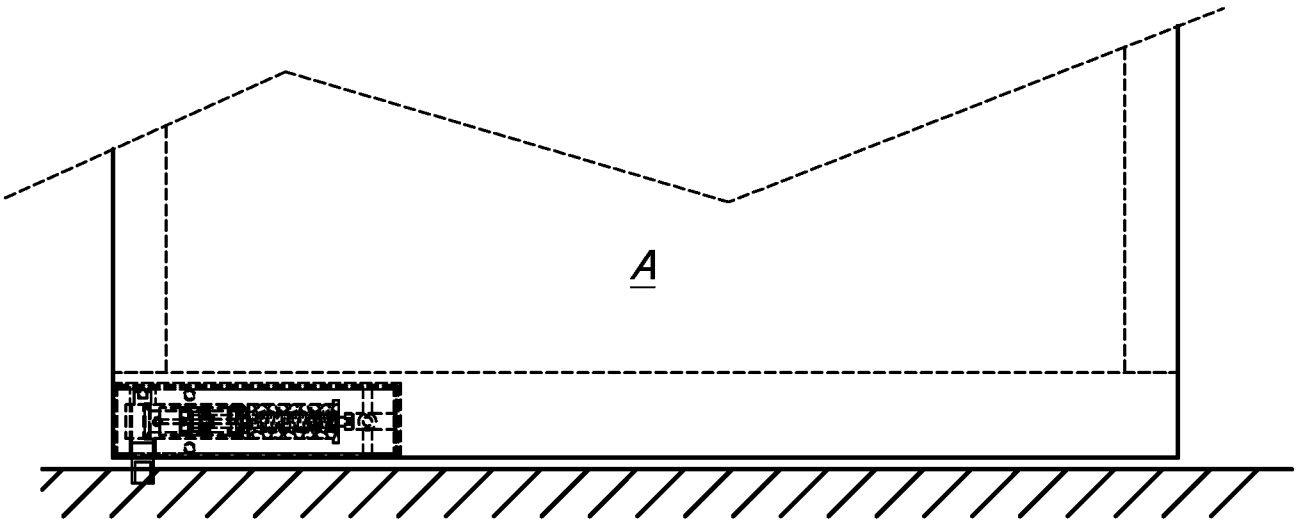


FIG. 3a

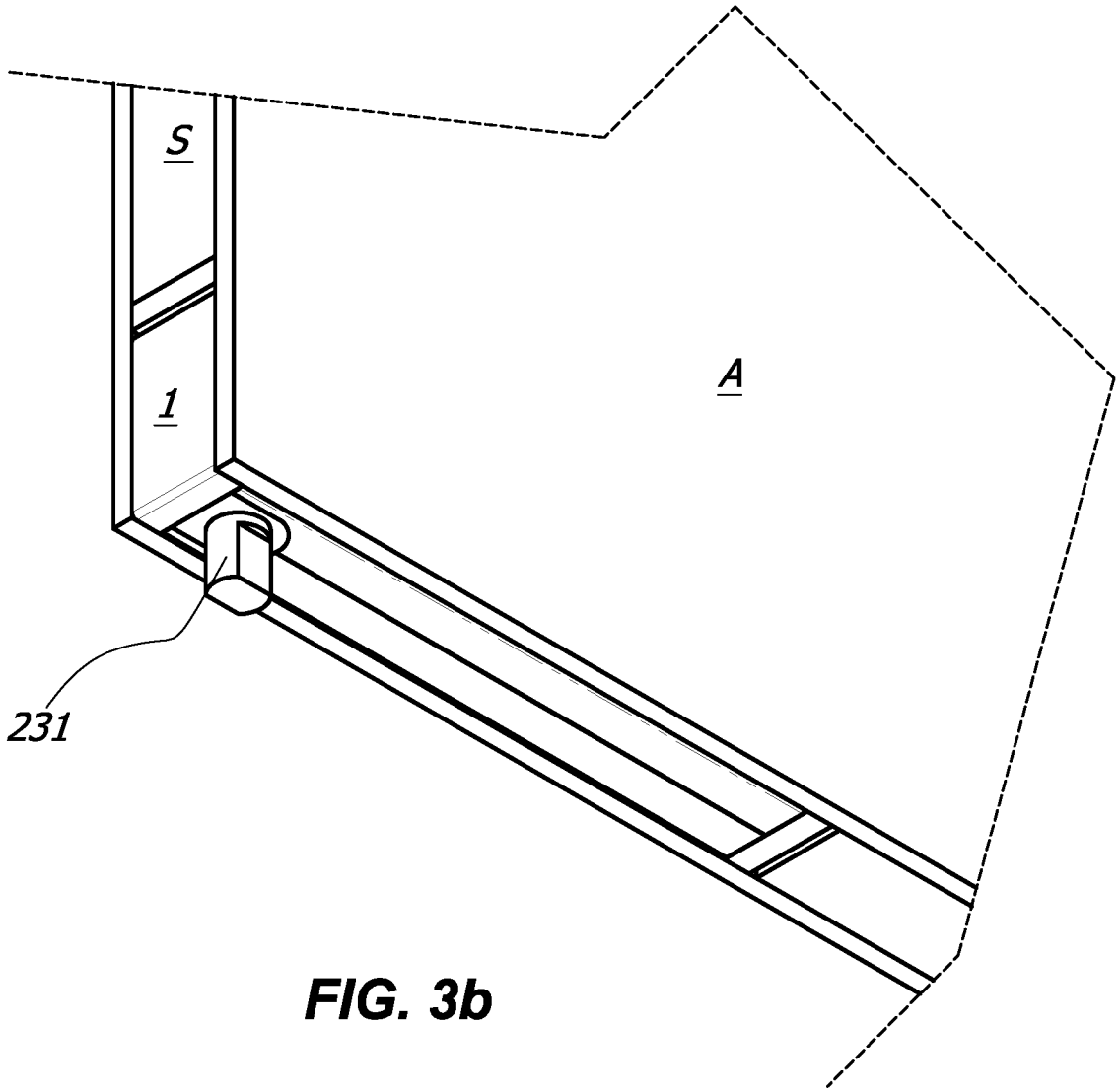


FIG. 3b

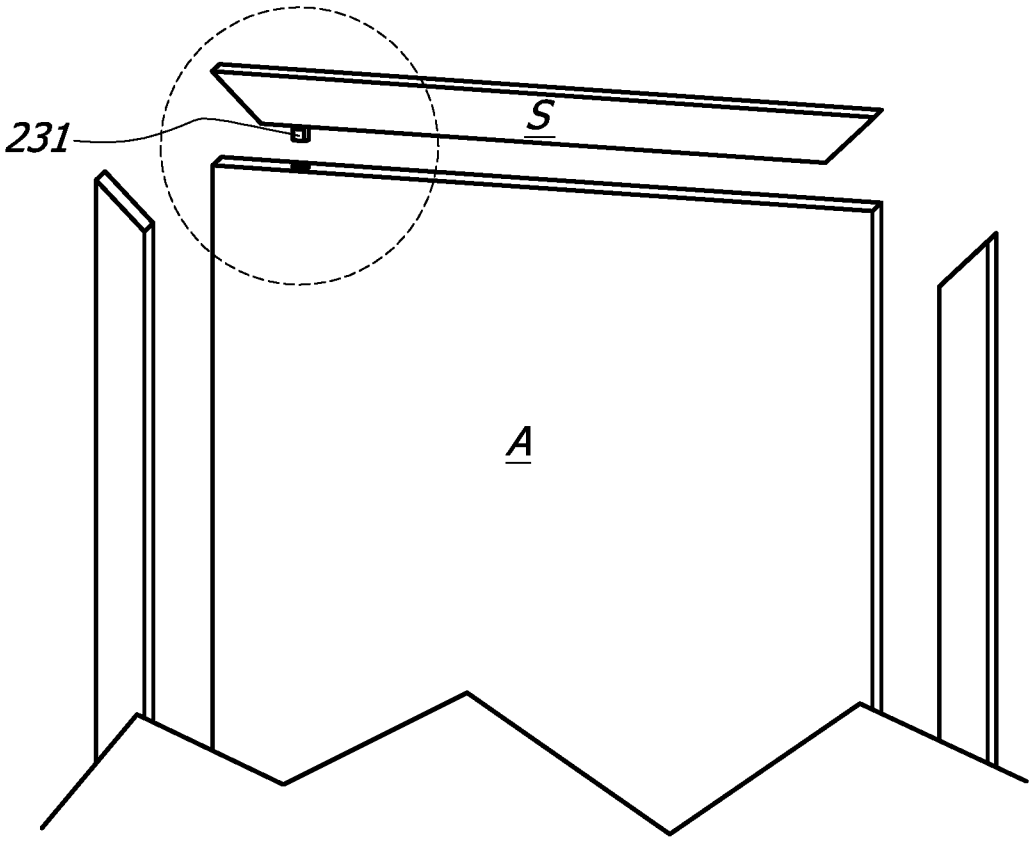


FIG. 4a

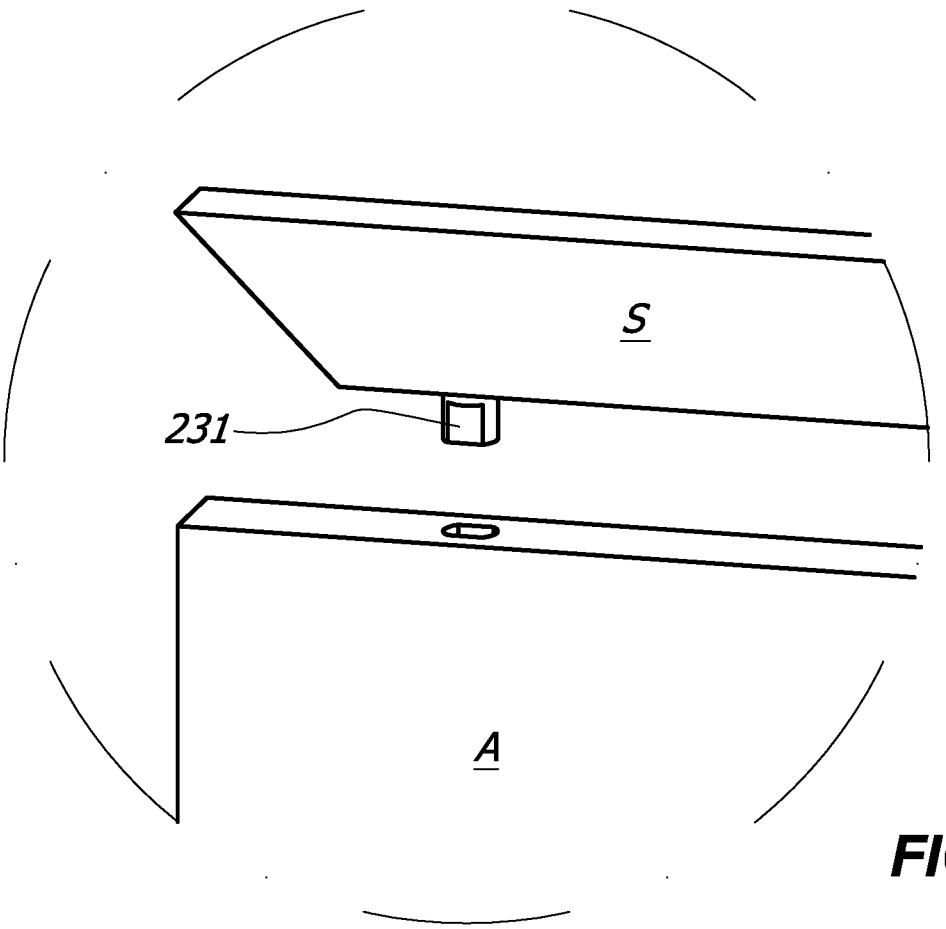


FIG. 4b

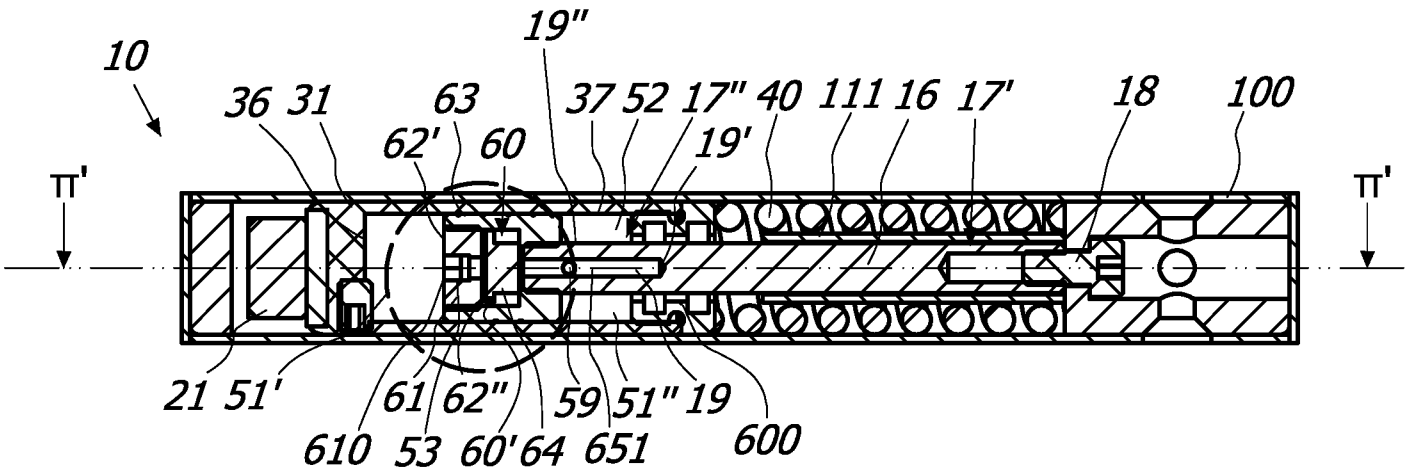

10
19"
36
31
63
37
52
17"
40
111
16
17'
18
100
62'
60
19'
II'
II'
21
51'
61
62"
59
51"
19
610
53
60'
64
651
600

FIG. 5a

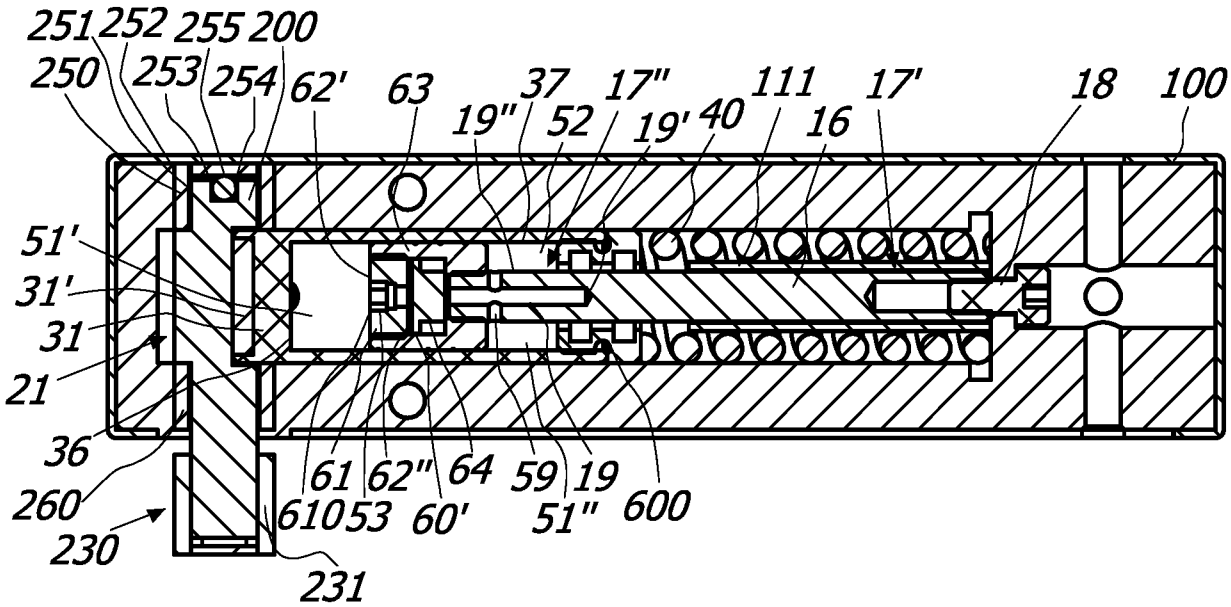

251
252
255
200
250
253
254
62'
63
37
17"
111
17'
18
100
19"
52
19'
40
16
51'
31'
31
21
36
260
230
61
62"
64
59
19
610
53
60'
51"
600
231

FIG. 5b

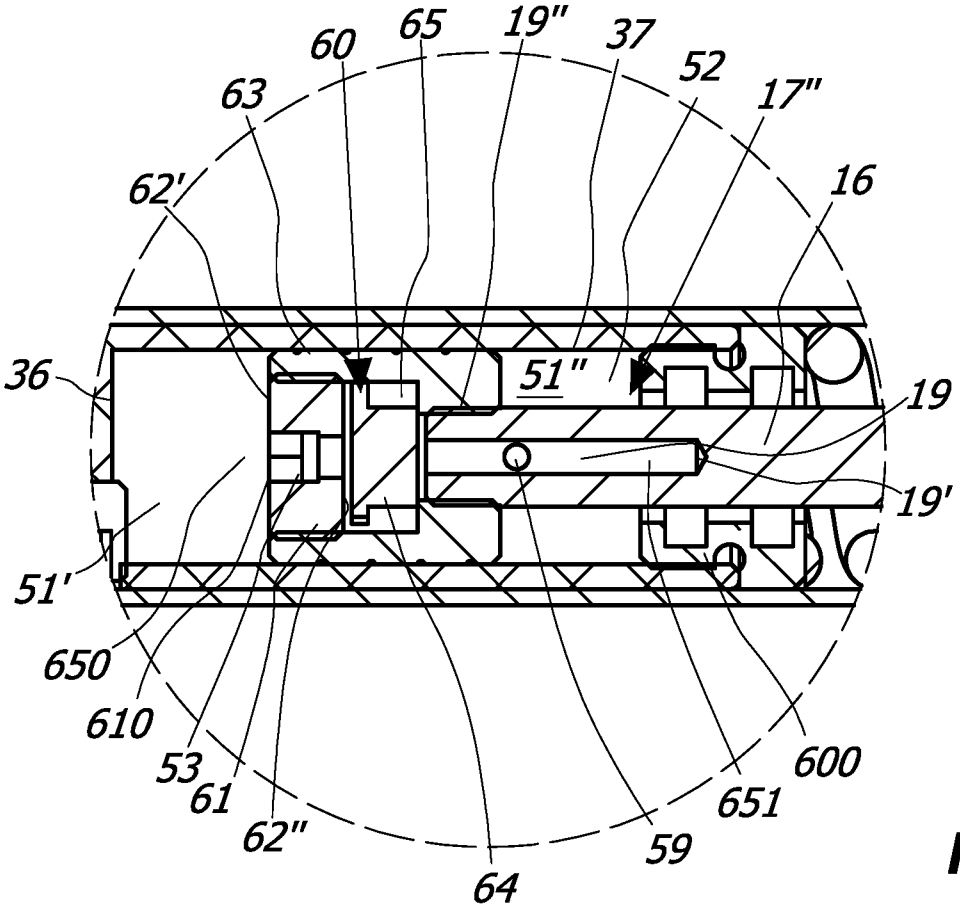

60
65
19"
37
52
17"
63
62'
16
36
51"
19
19'
51'
650
610
53
61
62"
64
59
651
600

FIG. 6a

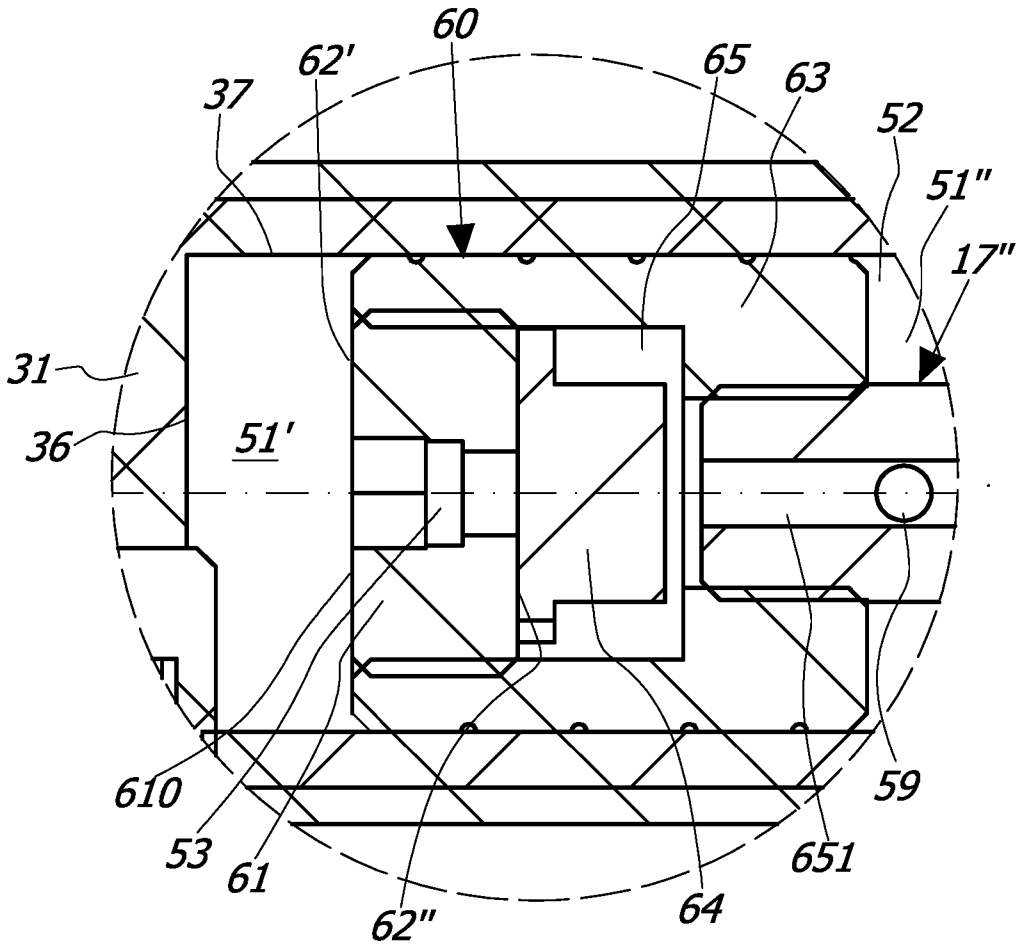

60
62'
65
63
37
52
51"
17"
31
36
51'
610
53
61
62"
64
651
59

FIG. 6b

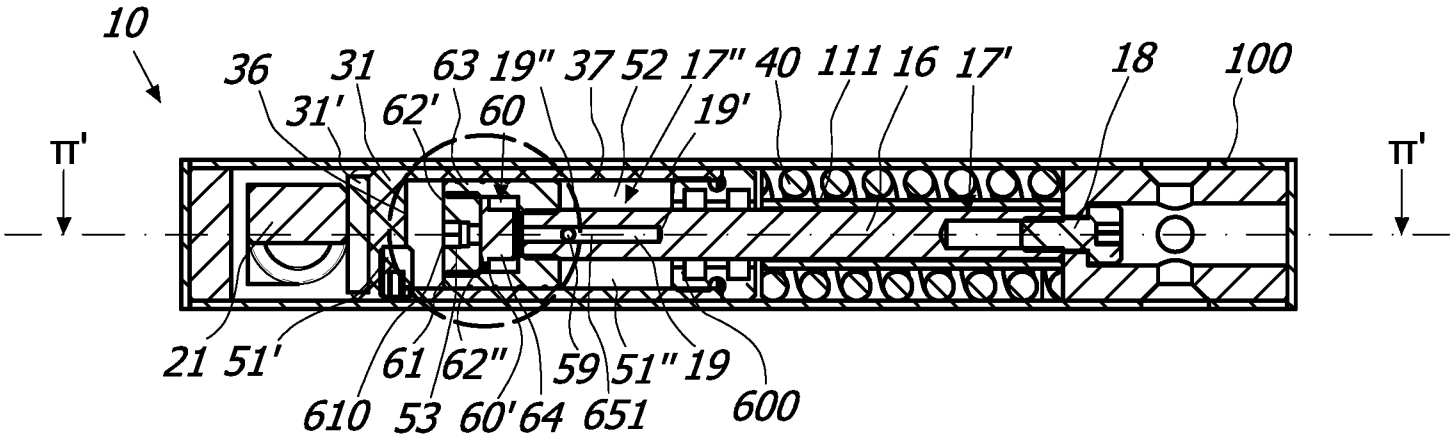

10
36
31
63
19"
37
52
17"
40
111
16
17'
18
100
31'
62'
60
19'
II'
II'
21
51'
61
62"
59
51"
19
610
53
60'
64
651
600

FIG. 7a

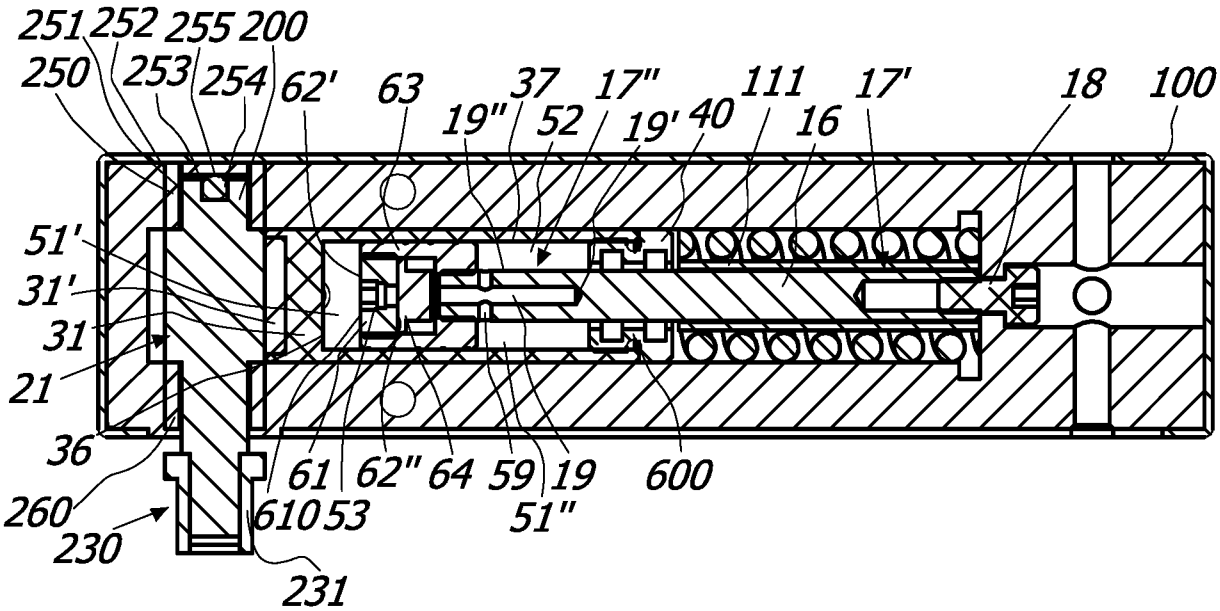

251
252
255
200
250
253
254
62'
63
37
17"
111
17'
18
100
19"
52
19'
40
16
51'
31'
31
21
36
260
230
231
61
62"
64
59
19
600
610
53
51"

FIG. 7b

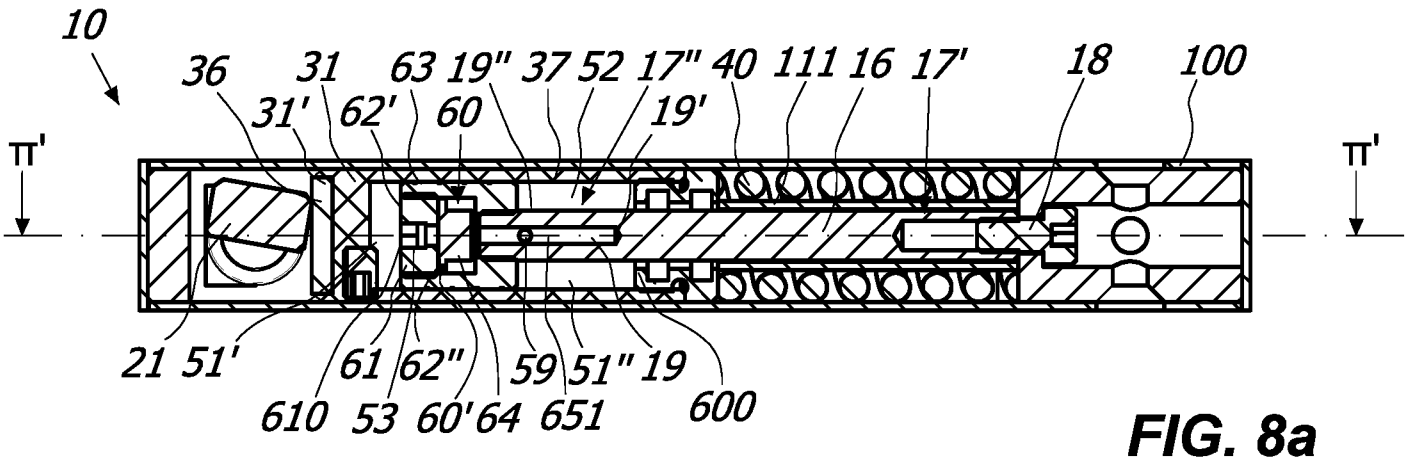

10
36
31
63
19"
37
52
17"
40
111
16
17'
18
100
31'
62'
60
19'
π'
π'
21
51'
61
62"
59
51"
19
610
53
60'
64
651
600

FIG. 8a

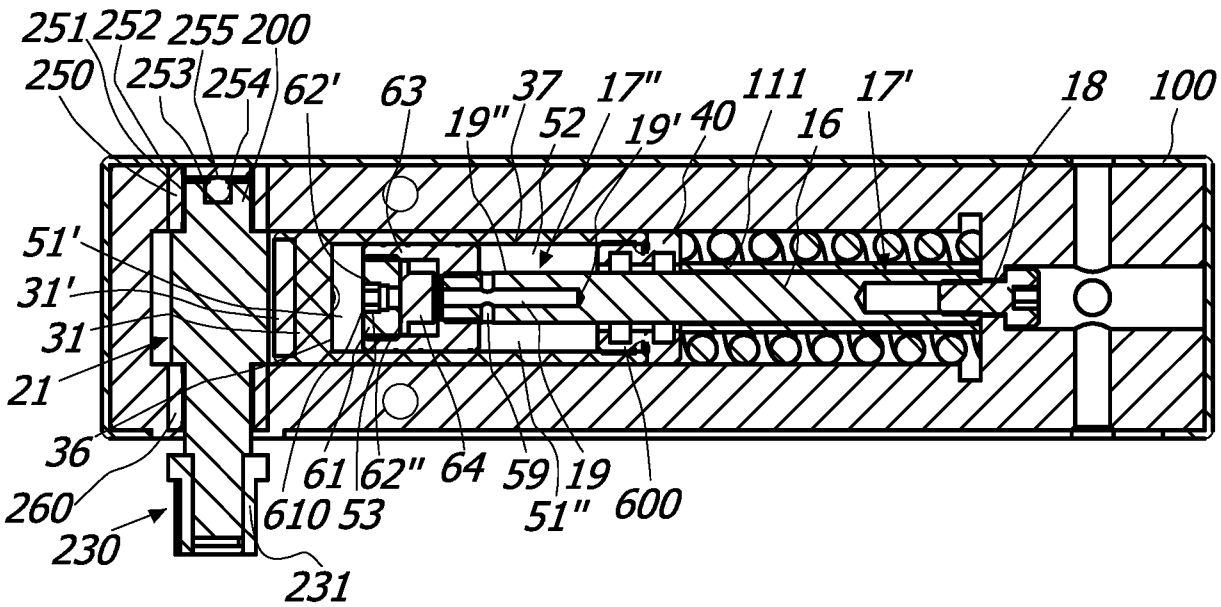

251
252
255
200
250
253
254
62'
63
37
17"
111
17'
18
100
19"
52
19'
40
16
51'
31'
31
21
36
260
230
231
610
53
61
62"
64
59
19
51"
600

FIG. 8b

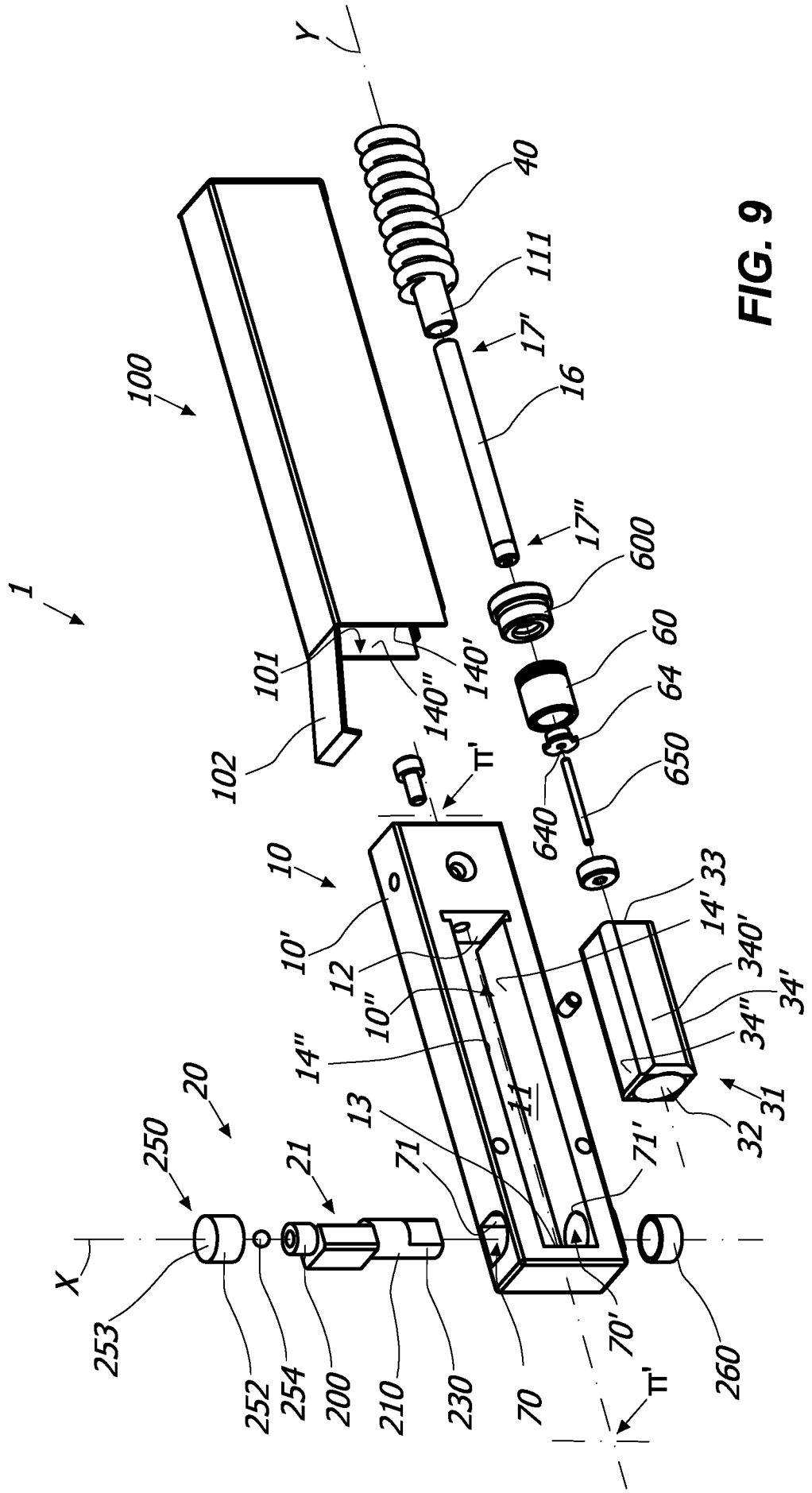

Y
40
111
17'
16
100
17"
600
1
60
64
650
101
140'
140"
102
640
π'
10
10'
14' 33
12
340'
34'
10"
14"
34"
20
11
13
31
32
250
21
71
71'
X
253
252
254
200
210
230
70
70'
π'
260

FIG. 9

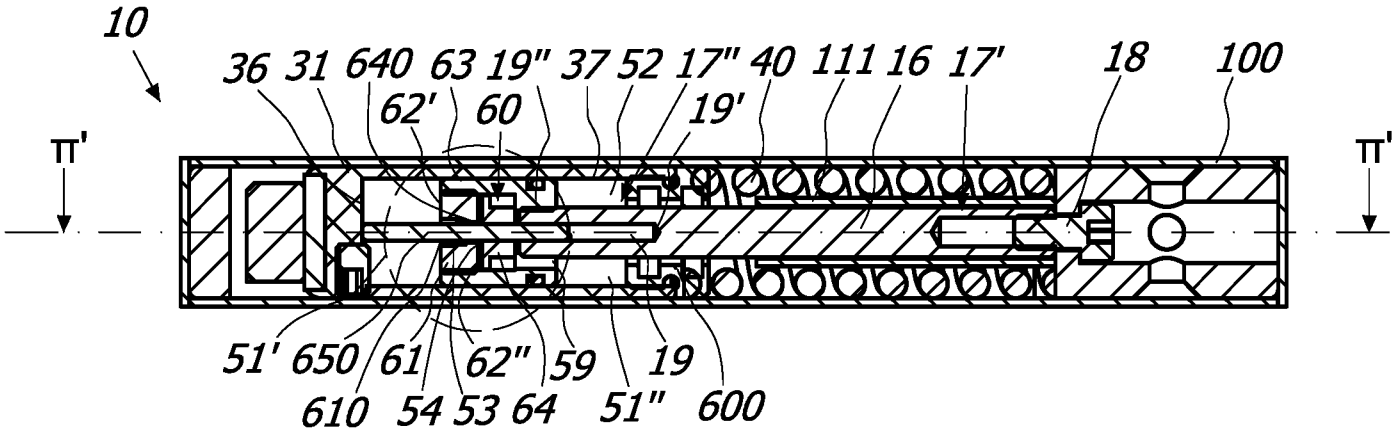

10
36 31 640 63 19" 37 52 17" 40 111 16 17' 18 100
62' 60 19'
II'
II'
51' 650 61 62" 59 19
610 54 53 64 51" 600

FIG. 10

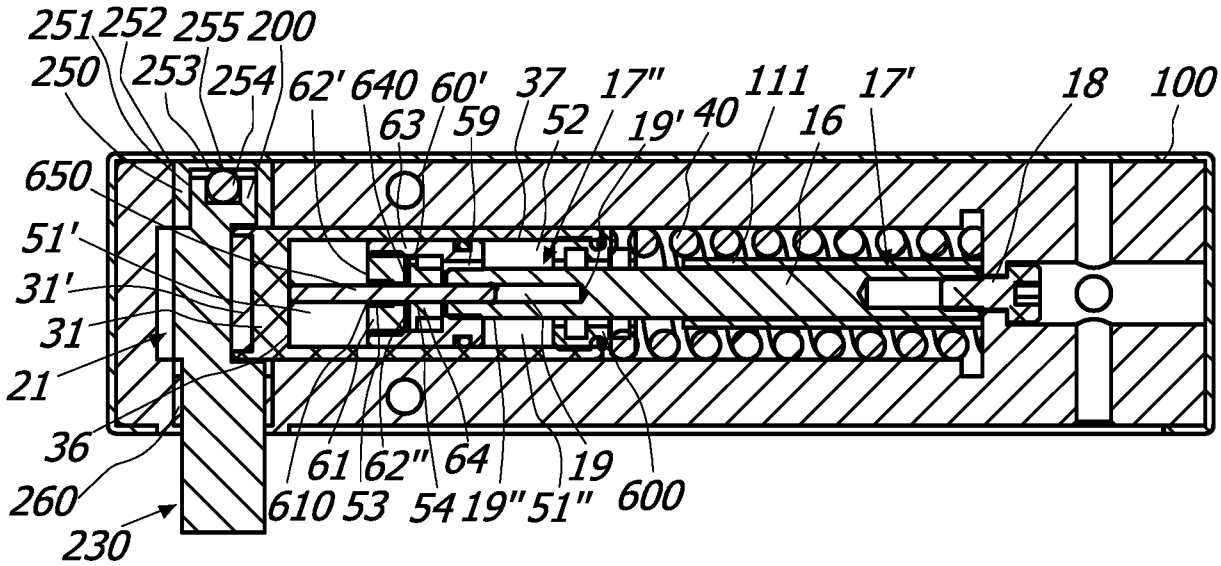

251 252 255 200
250 253 254 62' 640 60' 37 17" 111 17' 18 100
63 59 52 19' 40 16
650
51'
31'
31
21
36
260
230
61 62" 64 19
610 53 54 19" 51" 600

FIG. 11

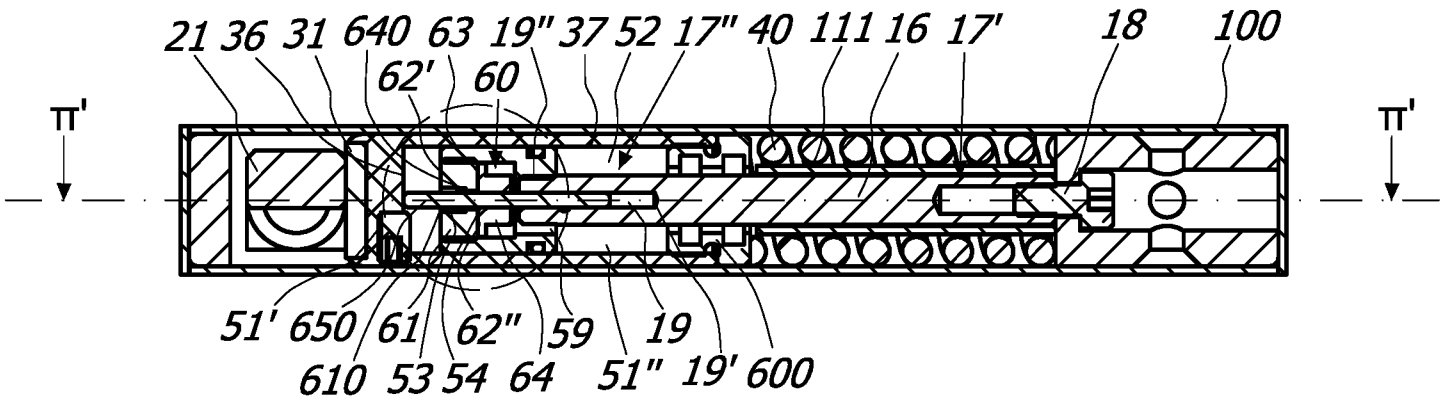


FIG. 12a

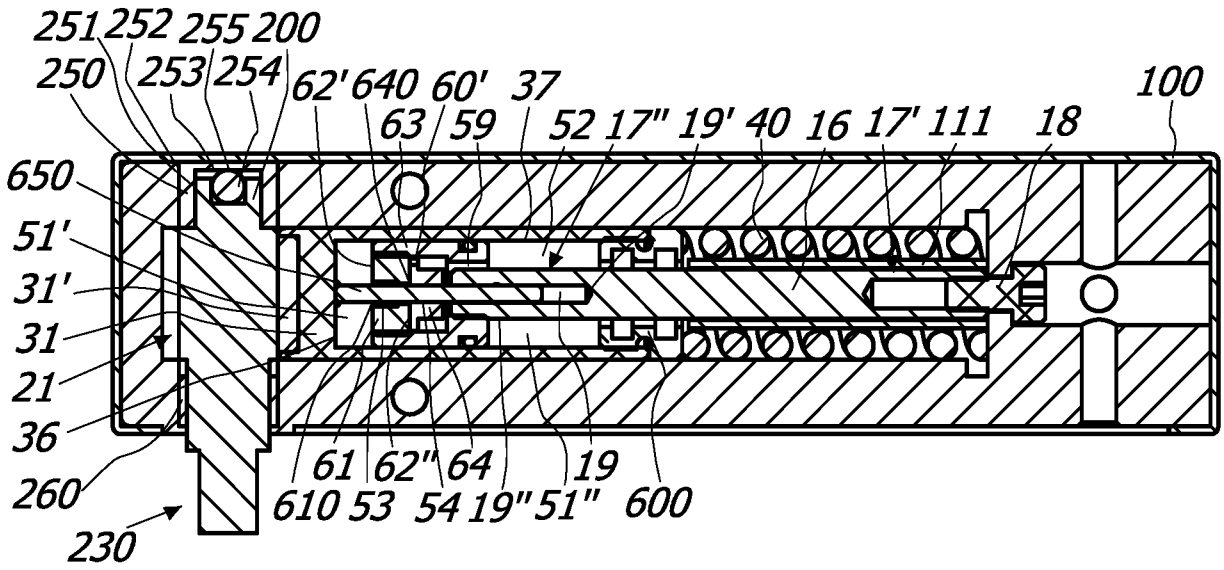


FIG. 12b

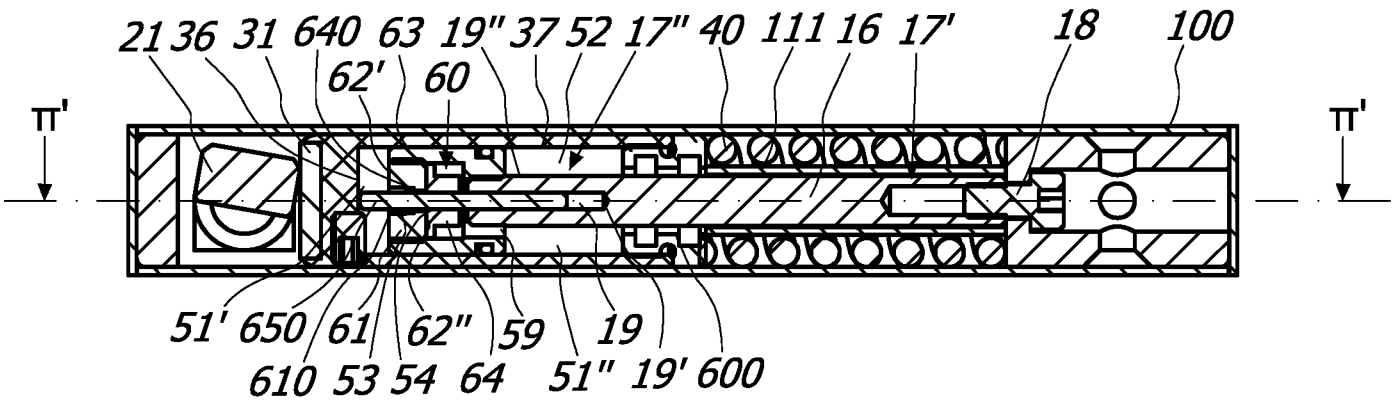


FIG. 13a

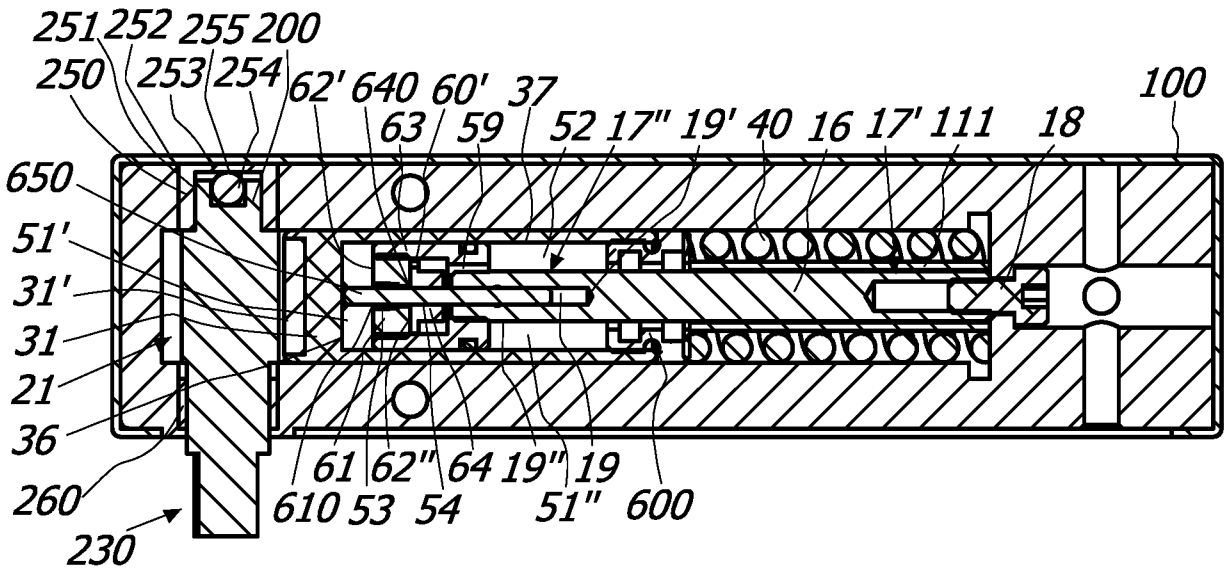


FIG. 13b

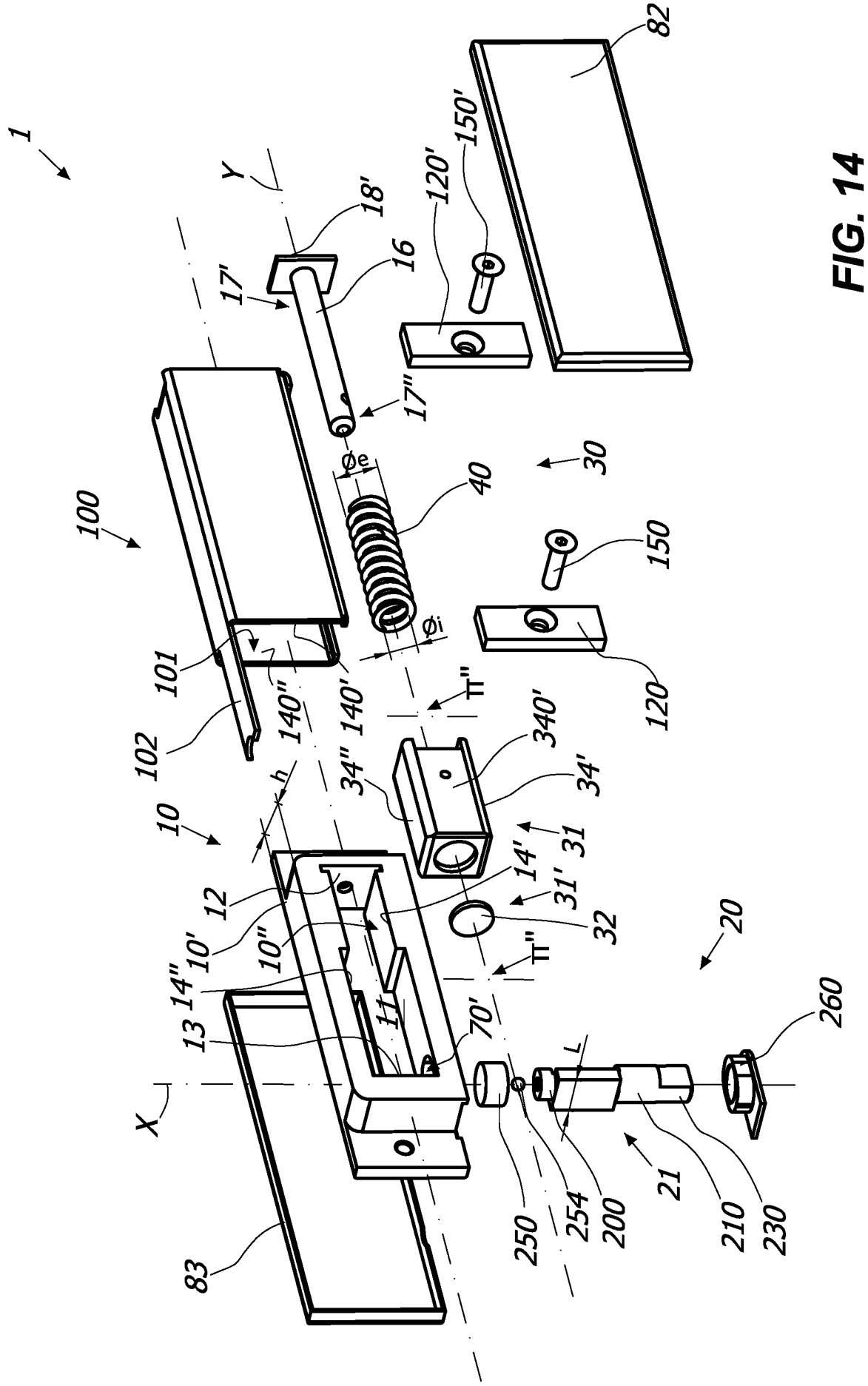

1
Y
18'
16
17'
17"
120'
150'
82
Øe
40
30
100
150
Øi
101
102
140"
140'
II"
340'
34"
34'
h
10
12
14'
31
31'
32
10'
10"
14"
13
11
70'
II"
20
260
L
X
83
250
254
200
21
210
230

FIG. 14

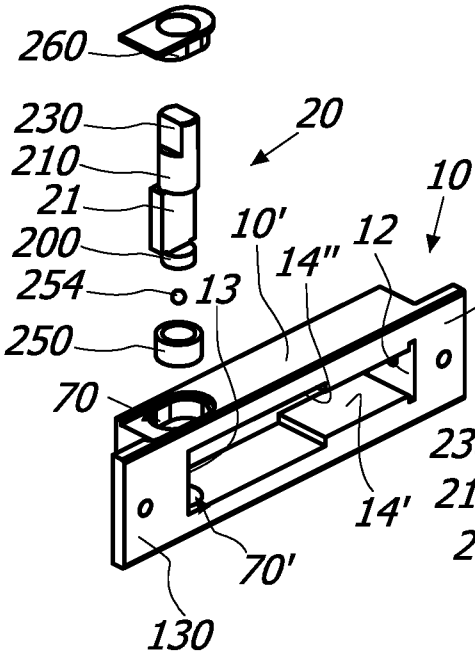


FIG. 15a

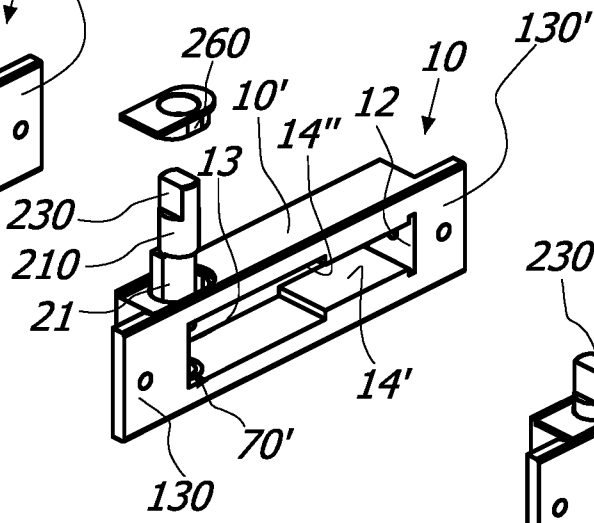


FIG. 15b

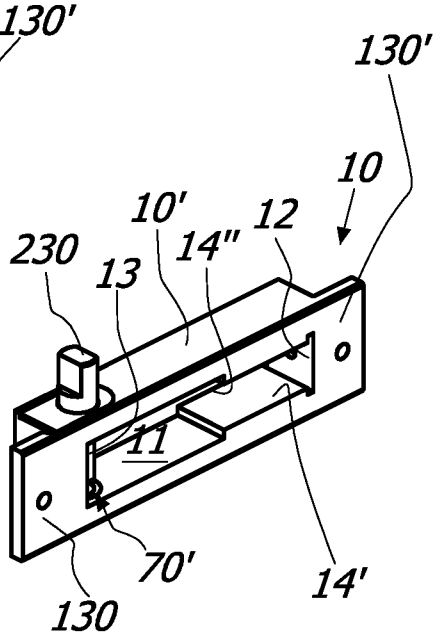


FIG. 15d

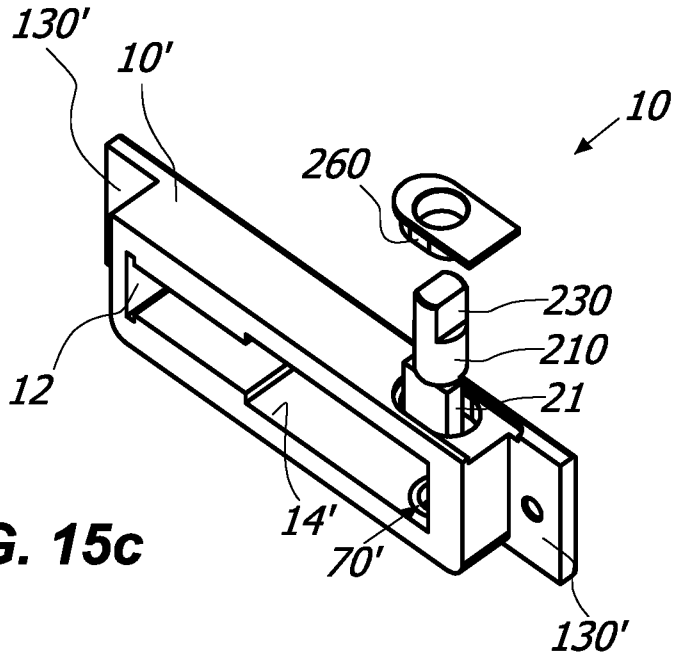


FIG. 15c

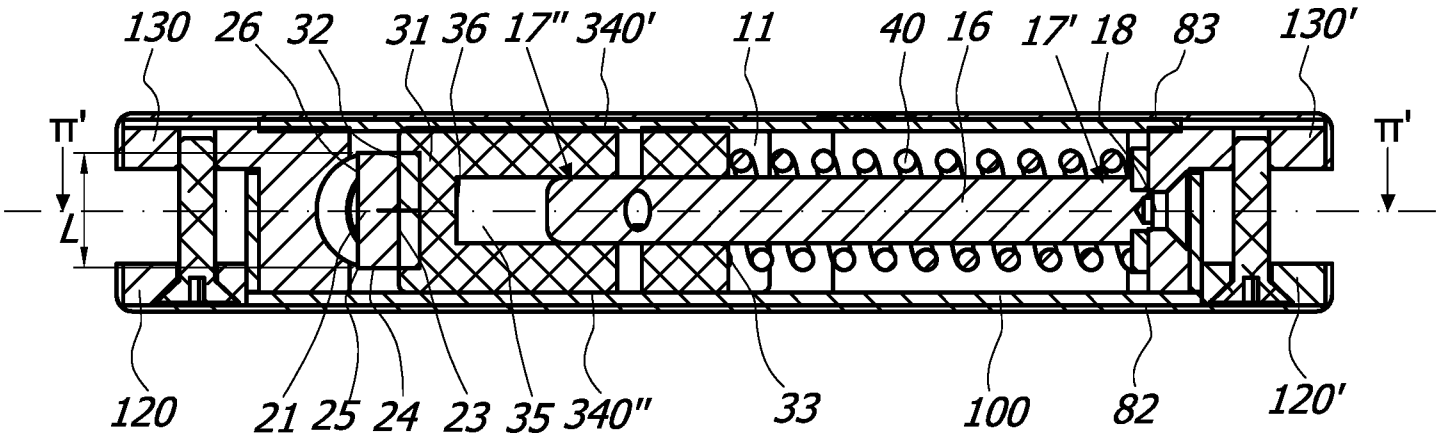


FIG. 16a

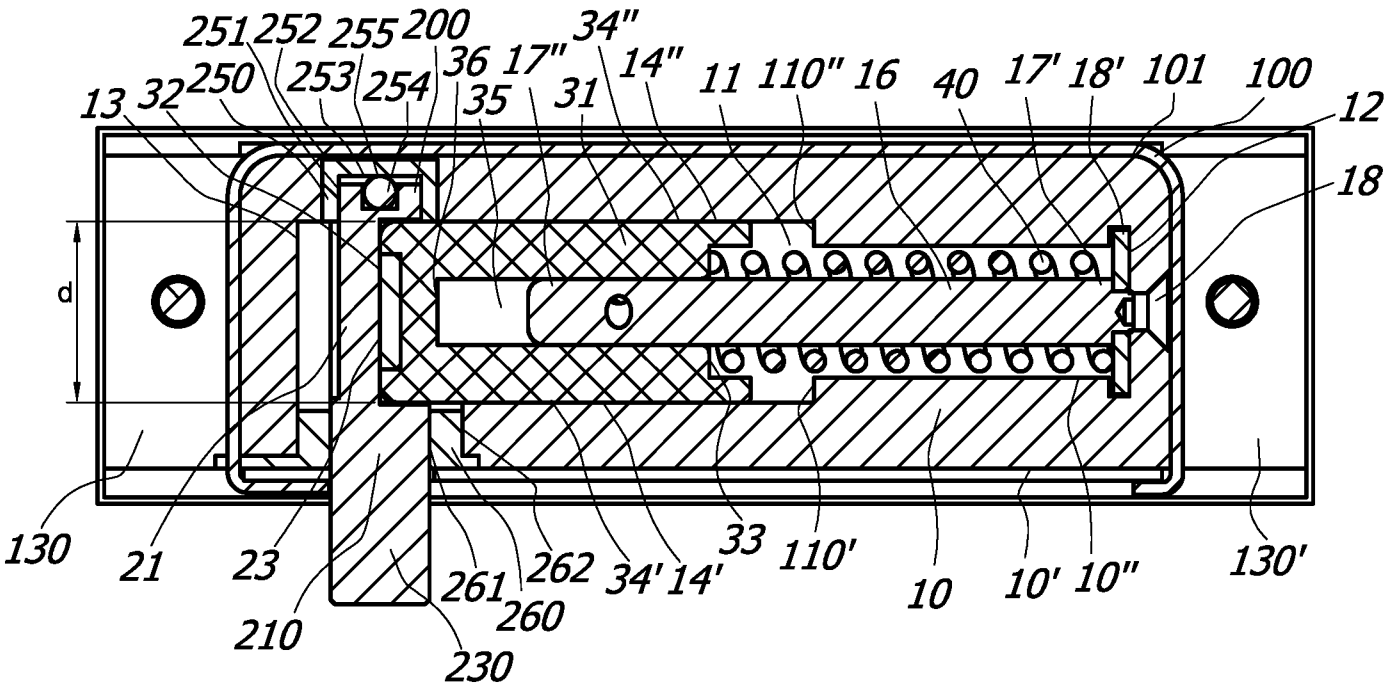


FIG. 16b

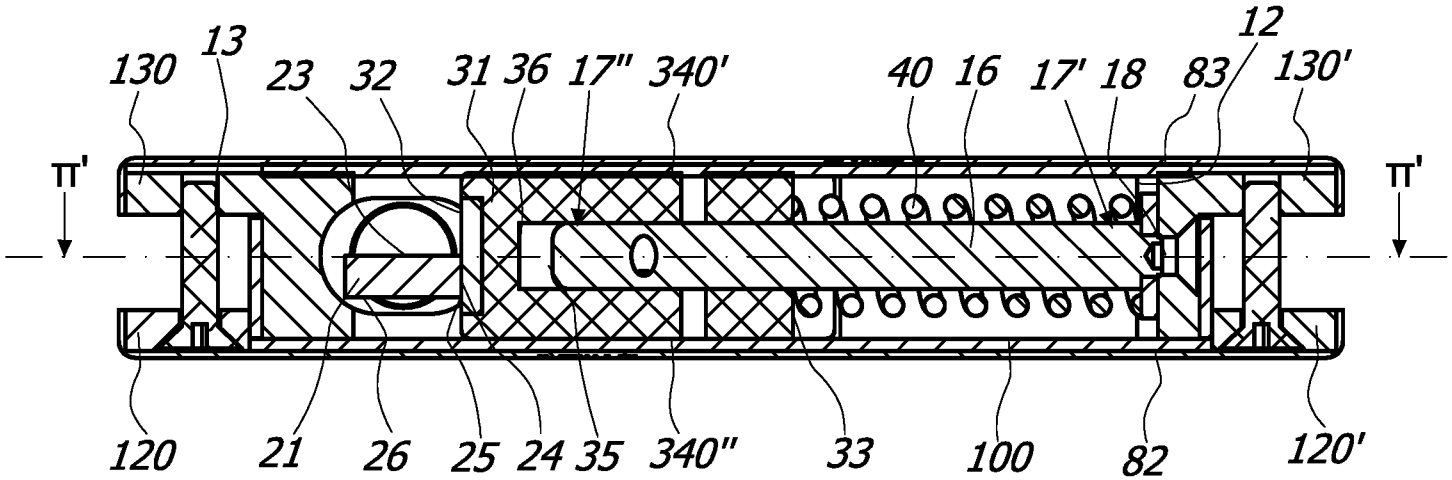


FIG. 17a

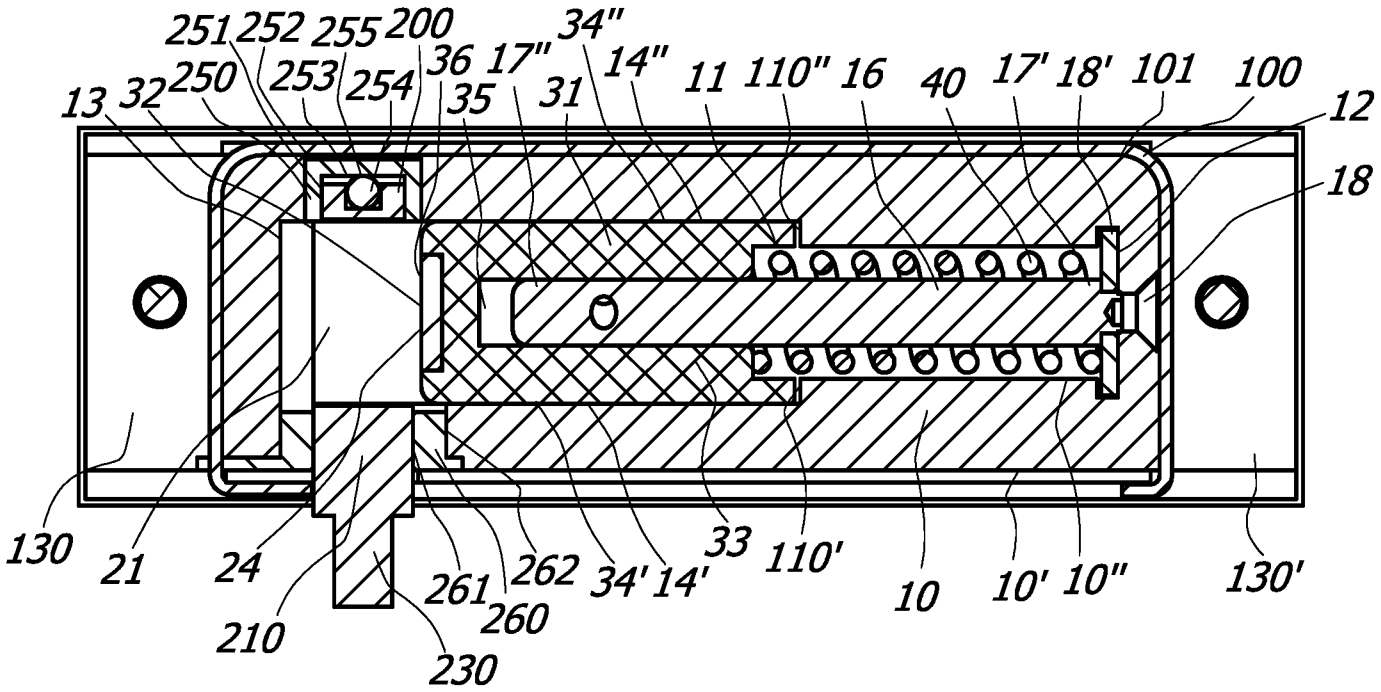


FIG. 17b

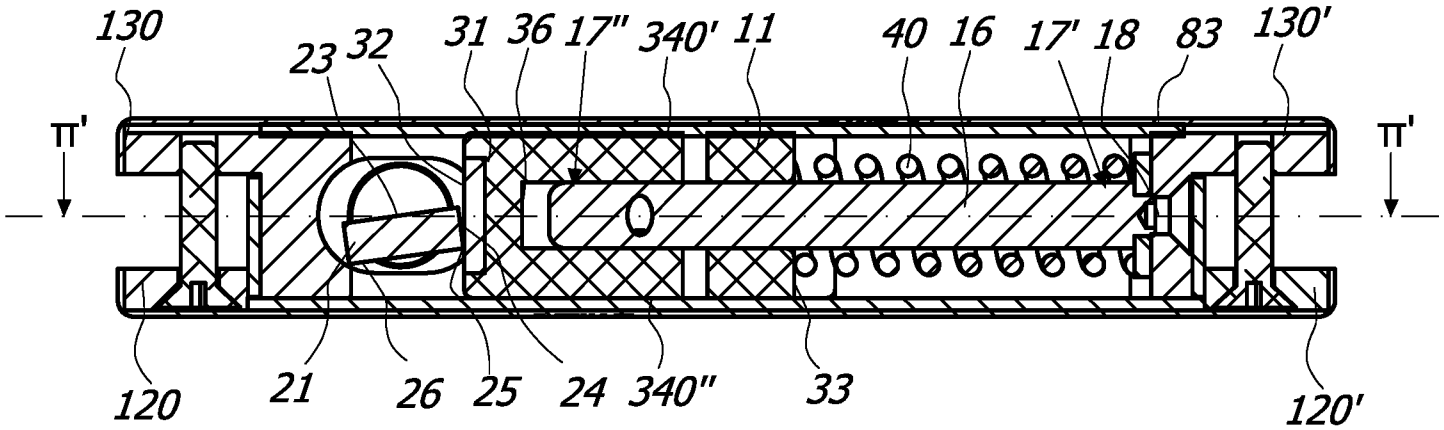


FIG. 18a

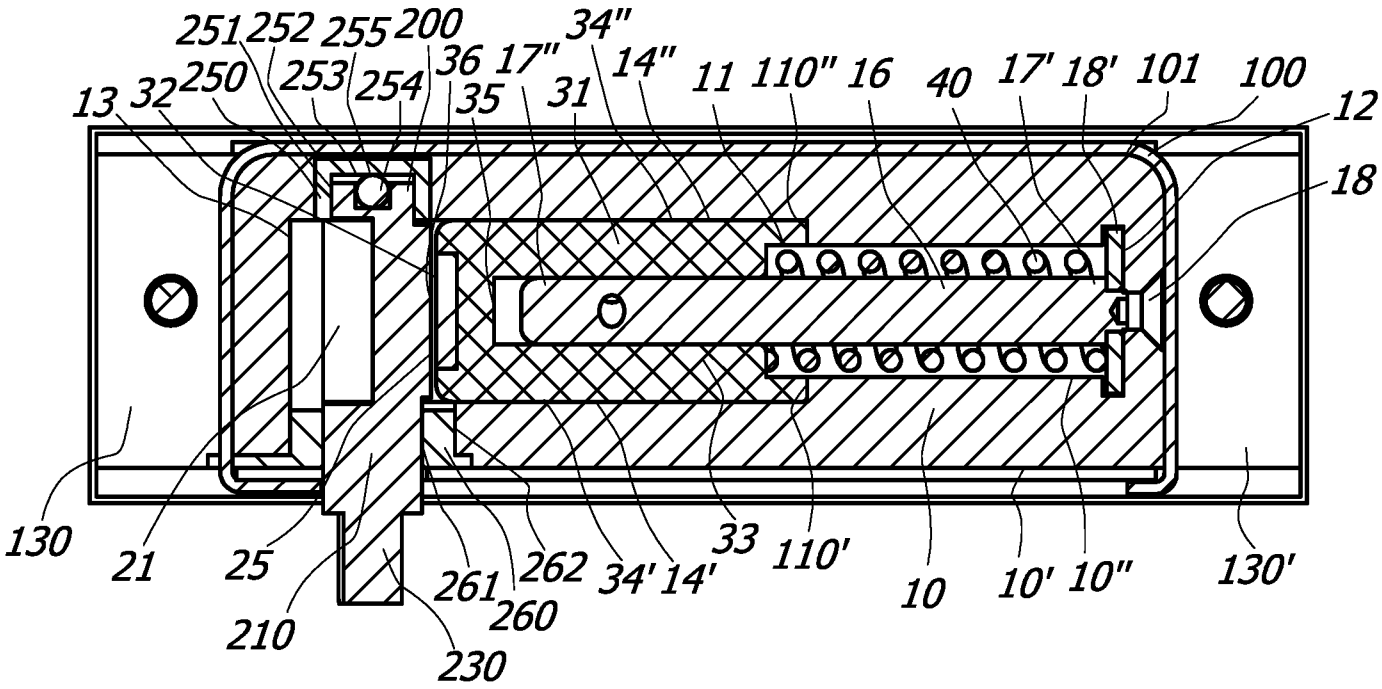


FIG. 18b

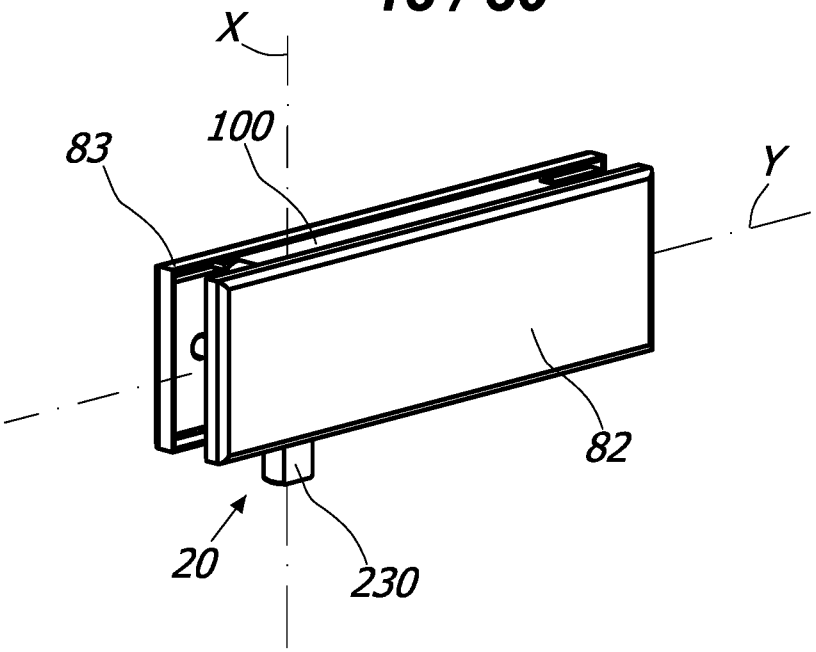


FIG. 19

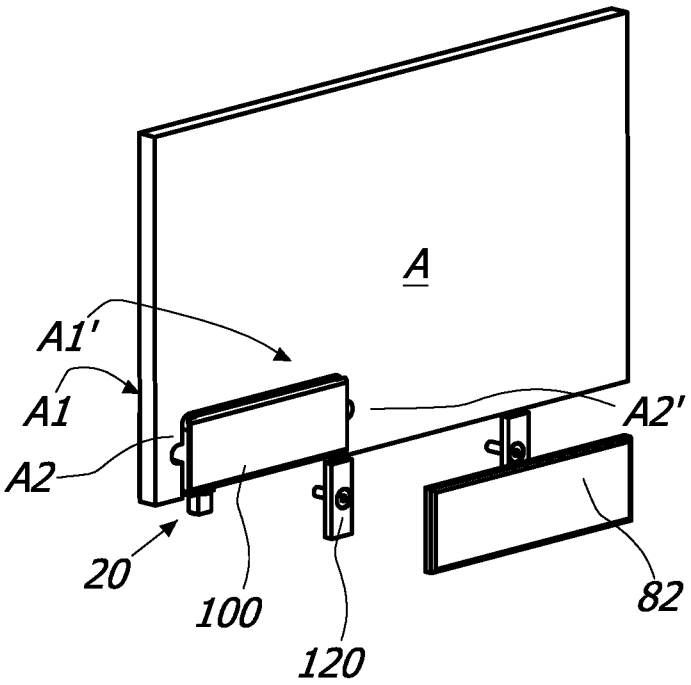


FIG. 20

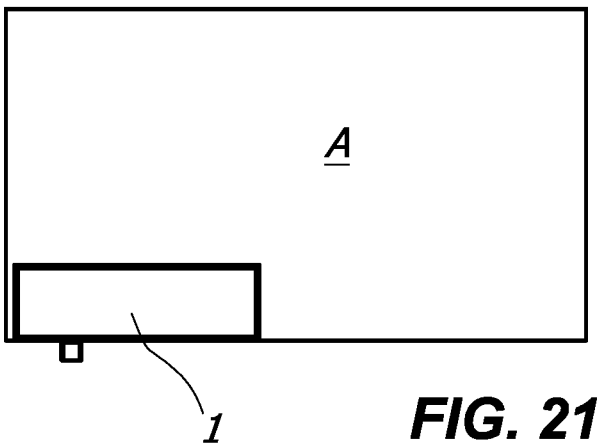


FIG. 21a

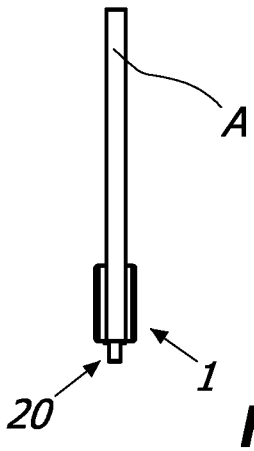


FIG. 21b

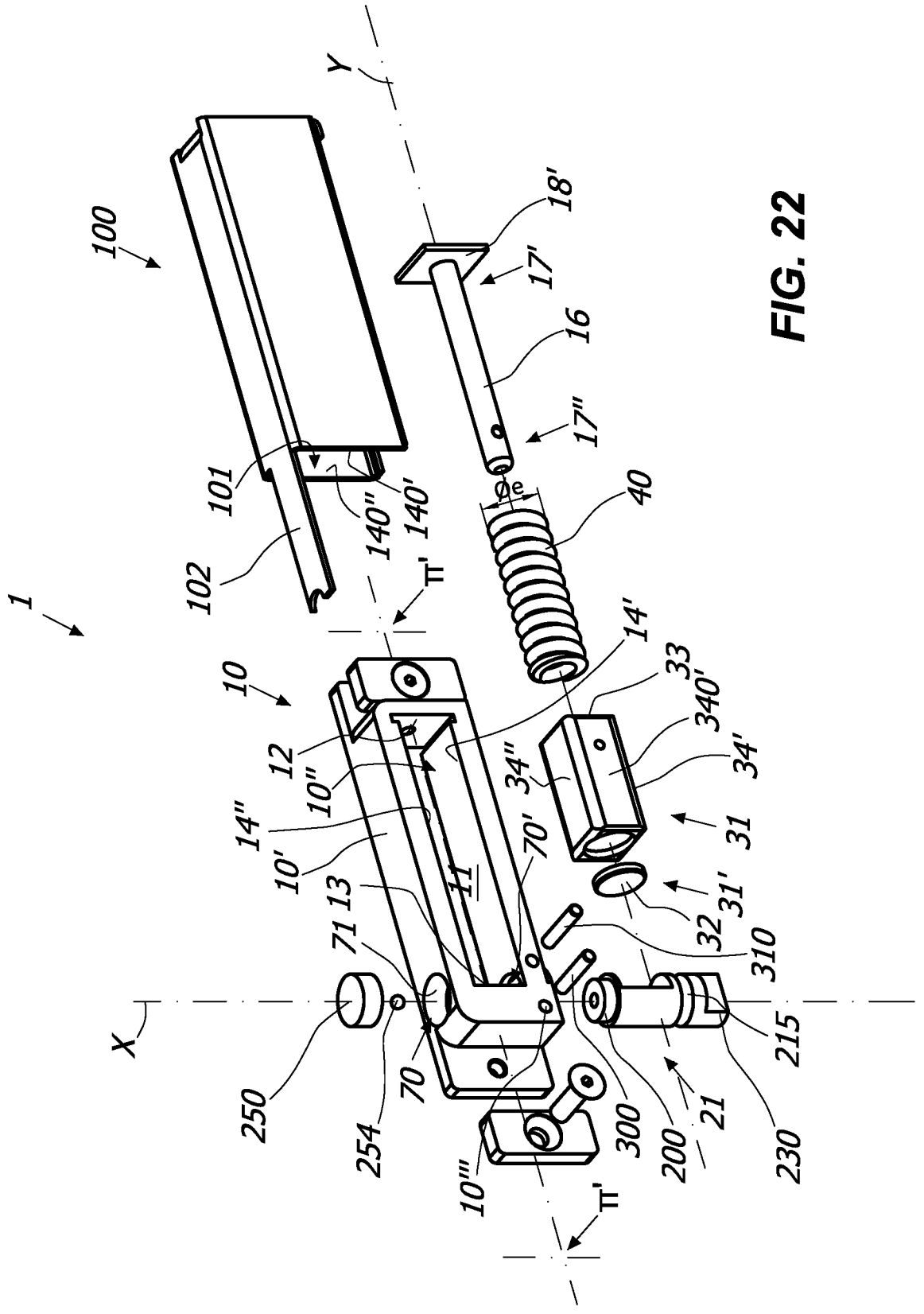

Y
100
18'
17'
16
17"
101
140"
140'
Øe
40
102
T'
1
14'
10
33
340'
12
34"
34'
10"
14"
10'
70'
31
11
13
31'
71
32
310
X
215
250
70
254
300
200
21
230
10"'
T'

FIG. 22

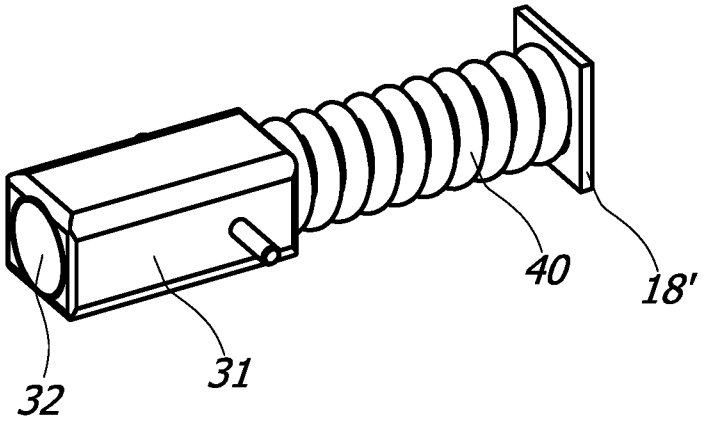


FIG. 23a

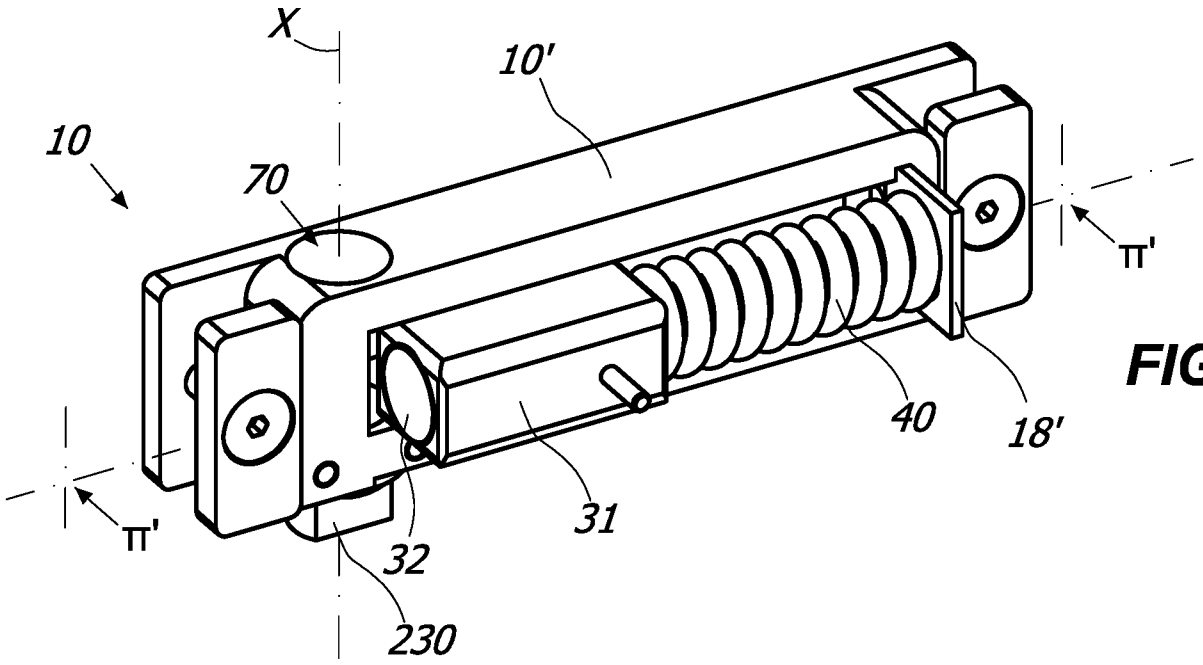


FIG. 23b

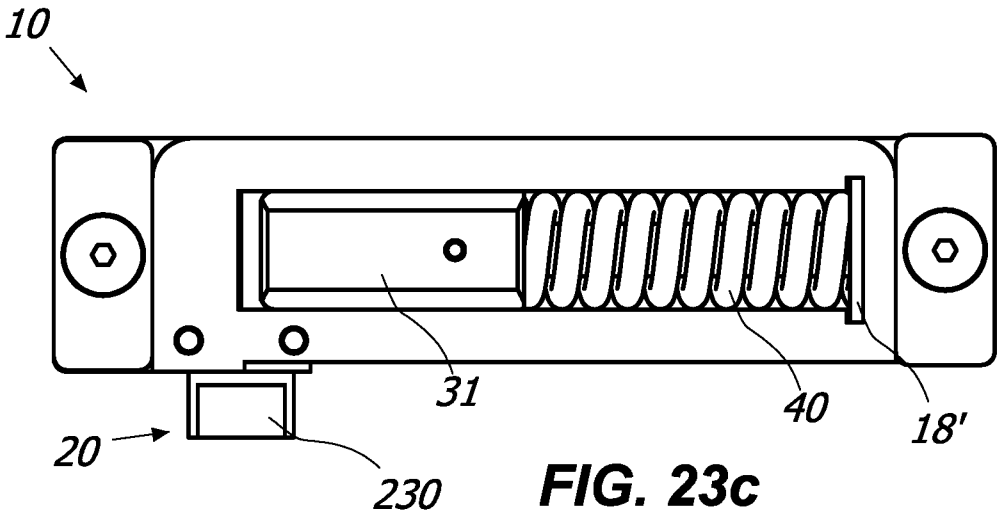


FIG. 23c

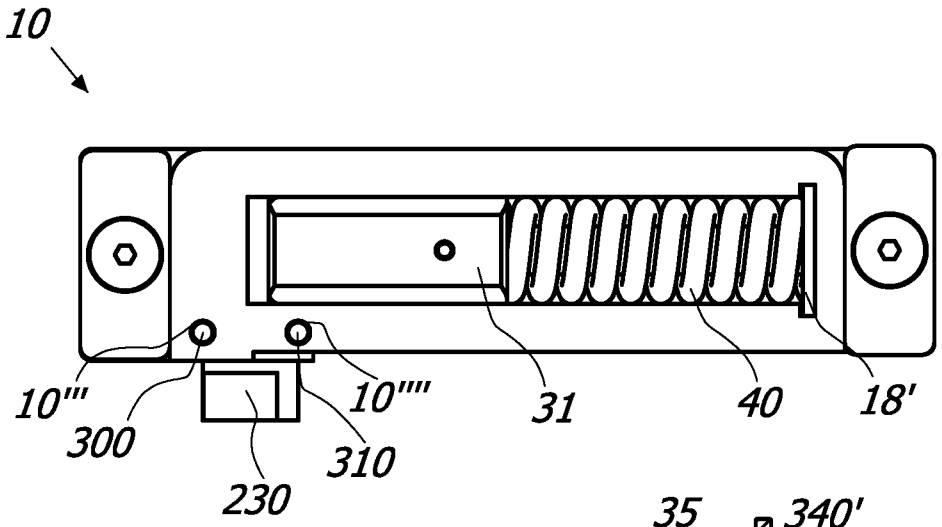


FIG. 23d

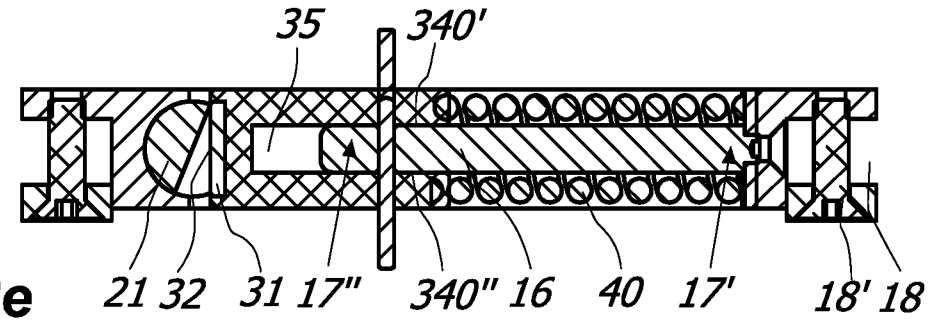


FIG. 23e

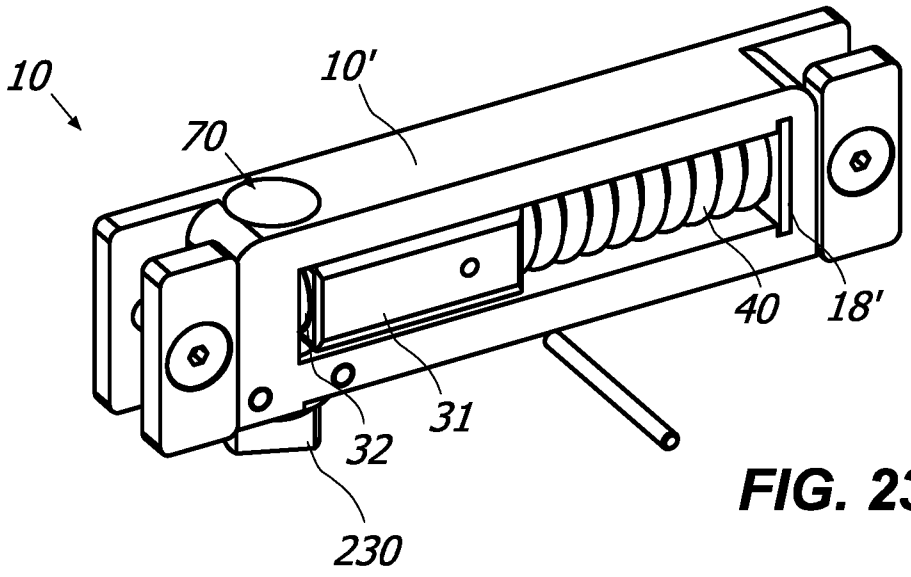


FIG. 23f

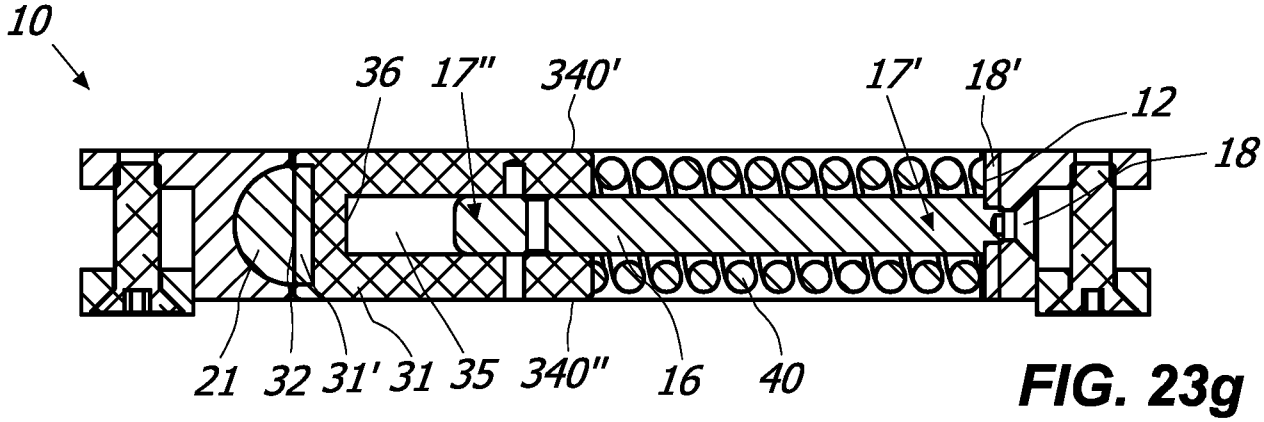


FIG. 23g

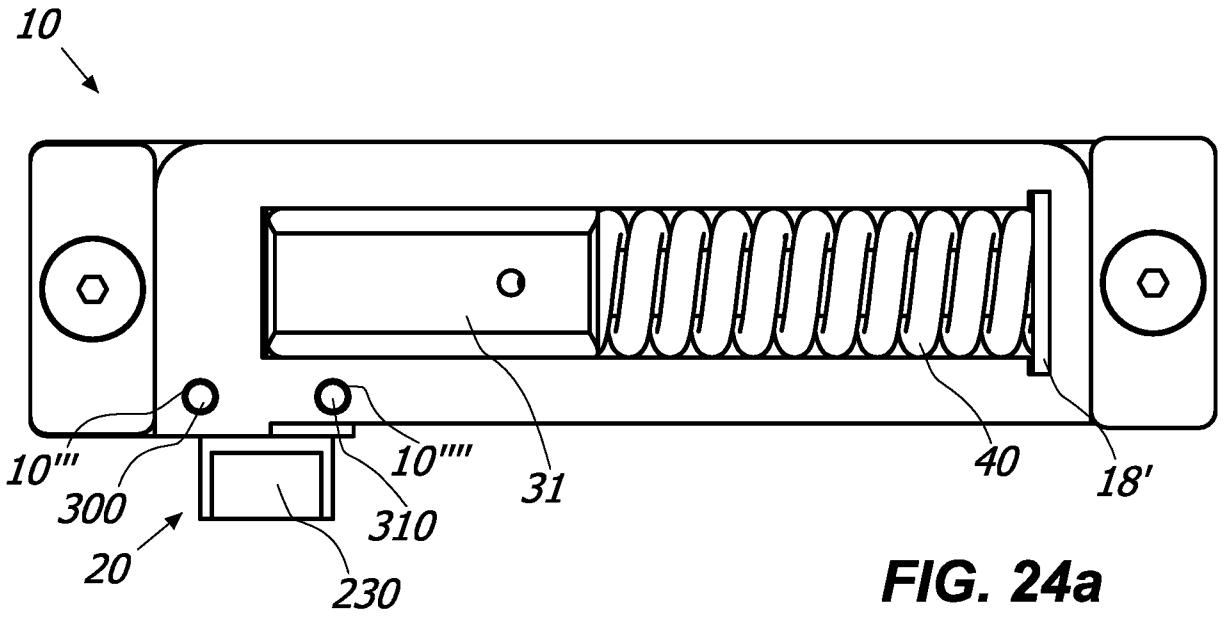


FIG. 24a

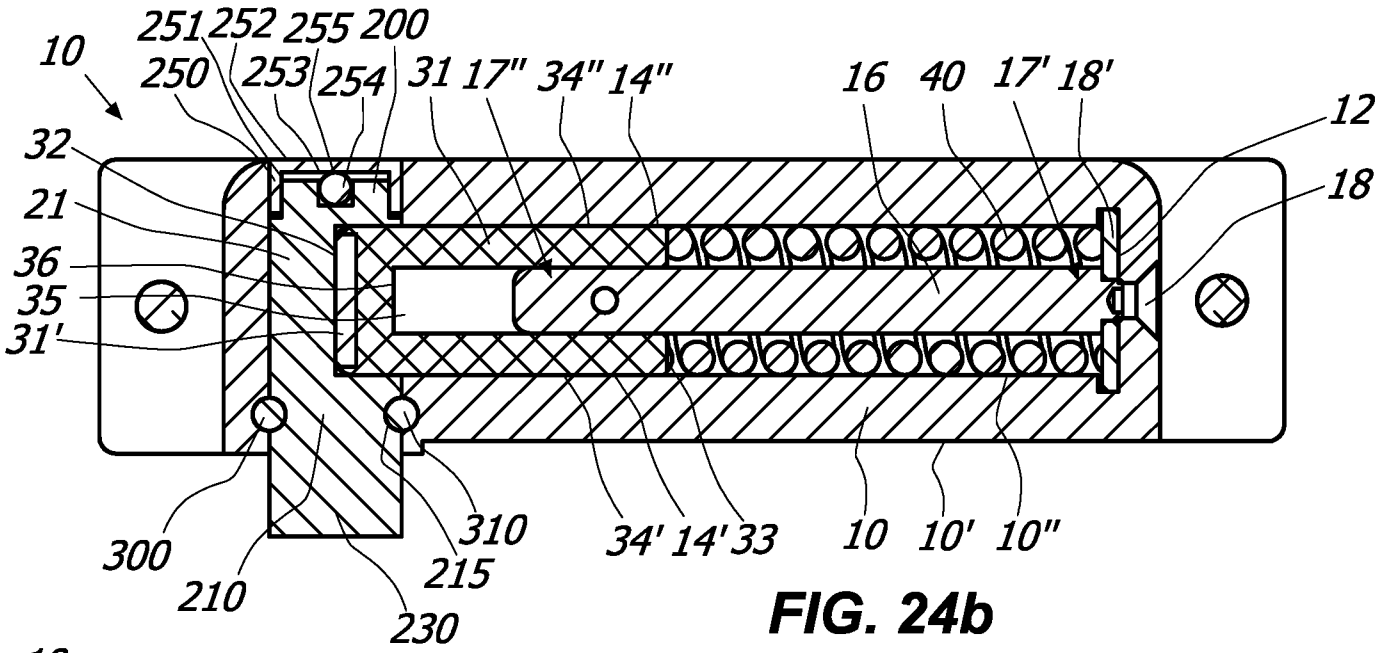


FIG. 24b

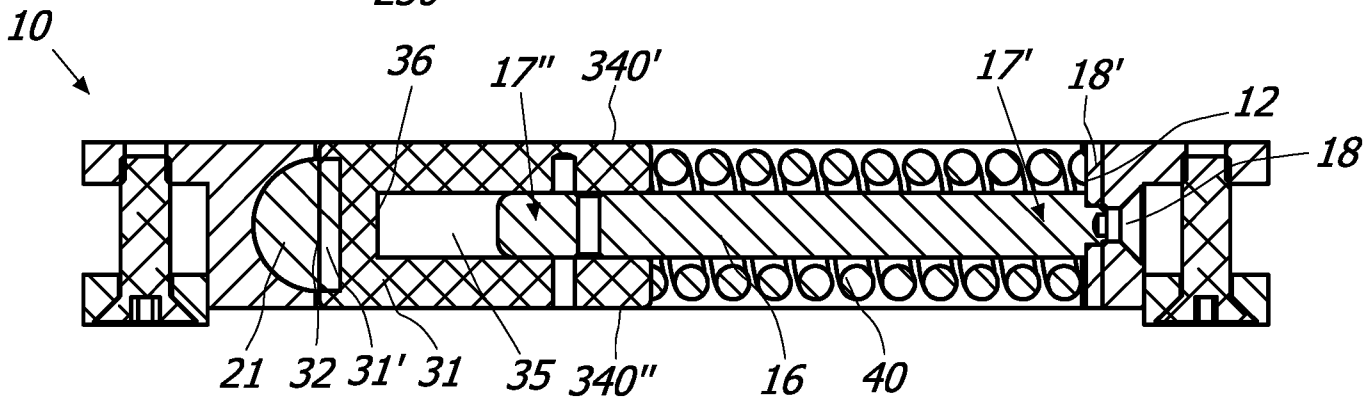


FIG. 24c

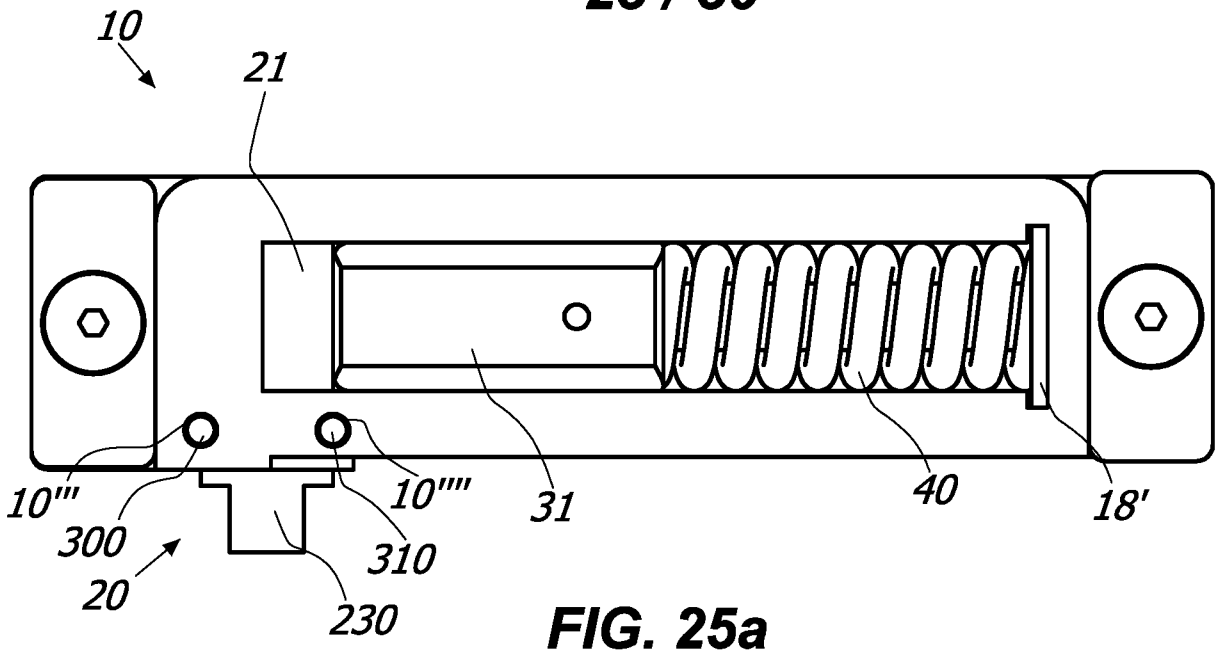


FIG. 25a

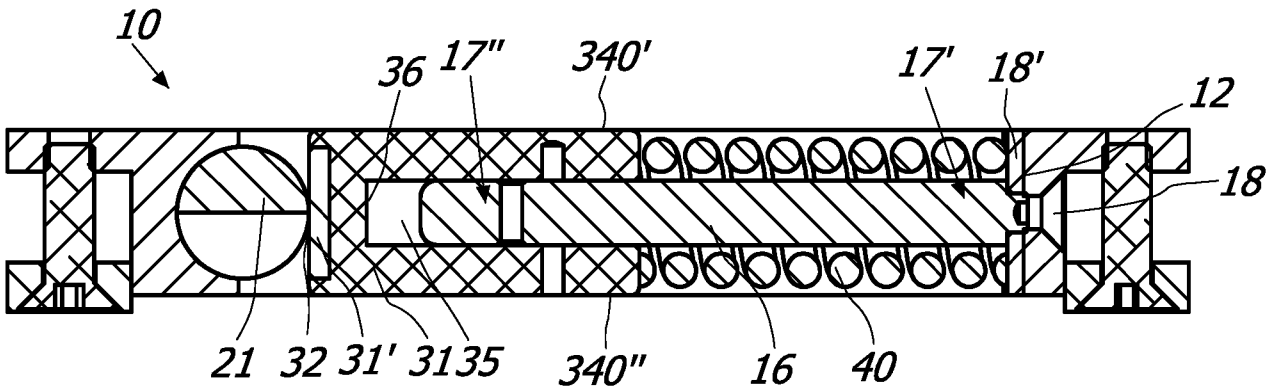


FIG. 25b

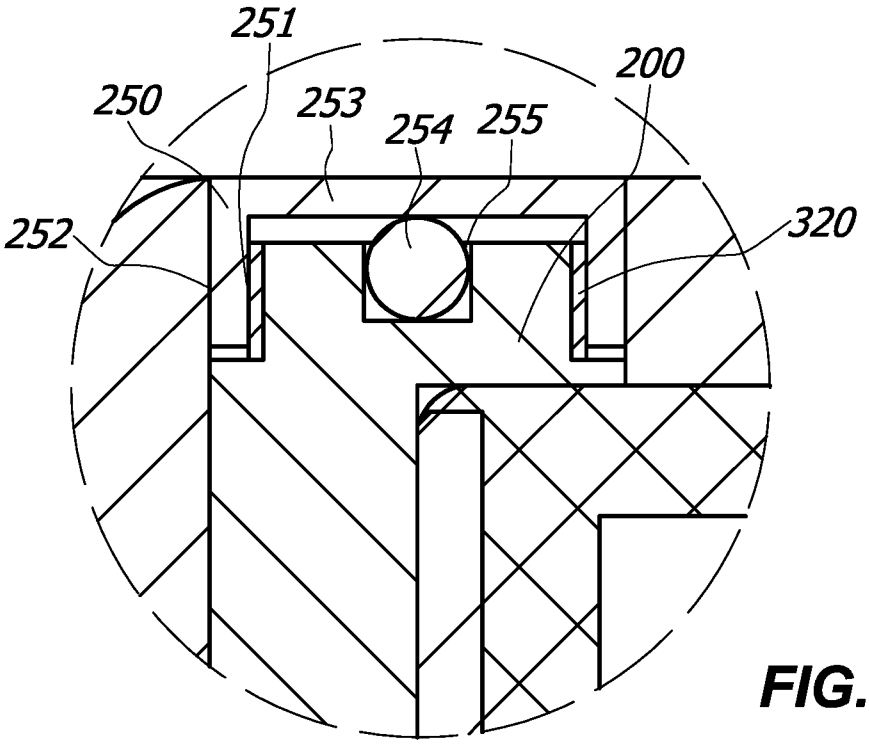


FIG. 25c

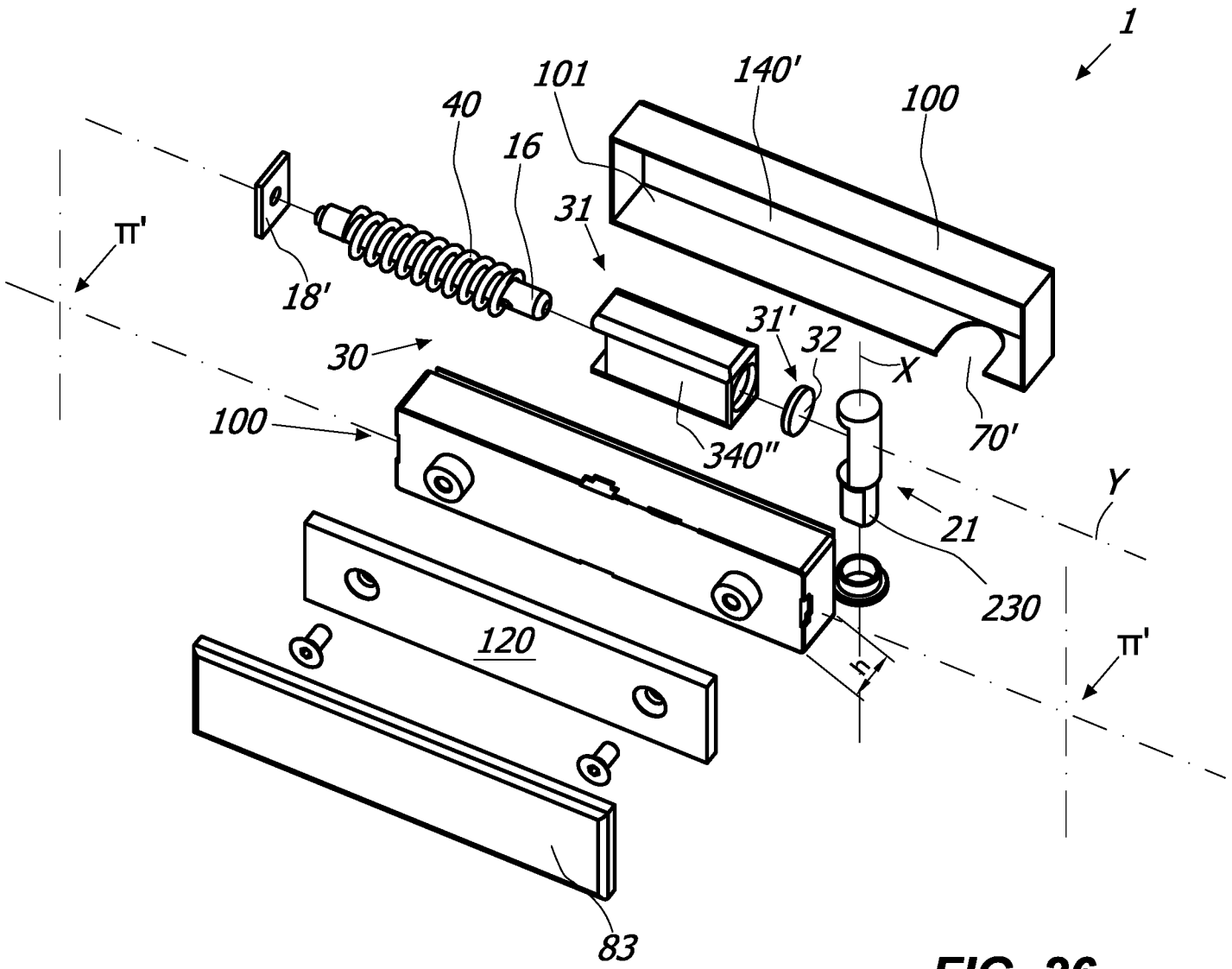


FIG. 26

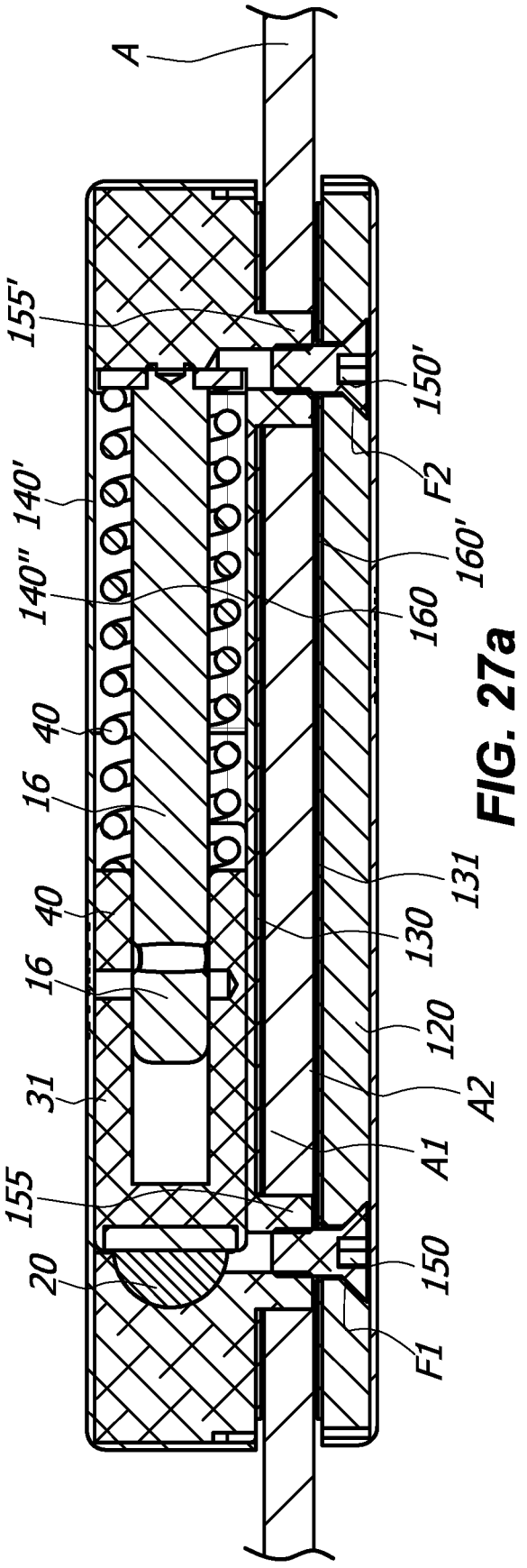


FIG. 27a

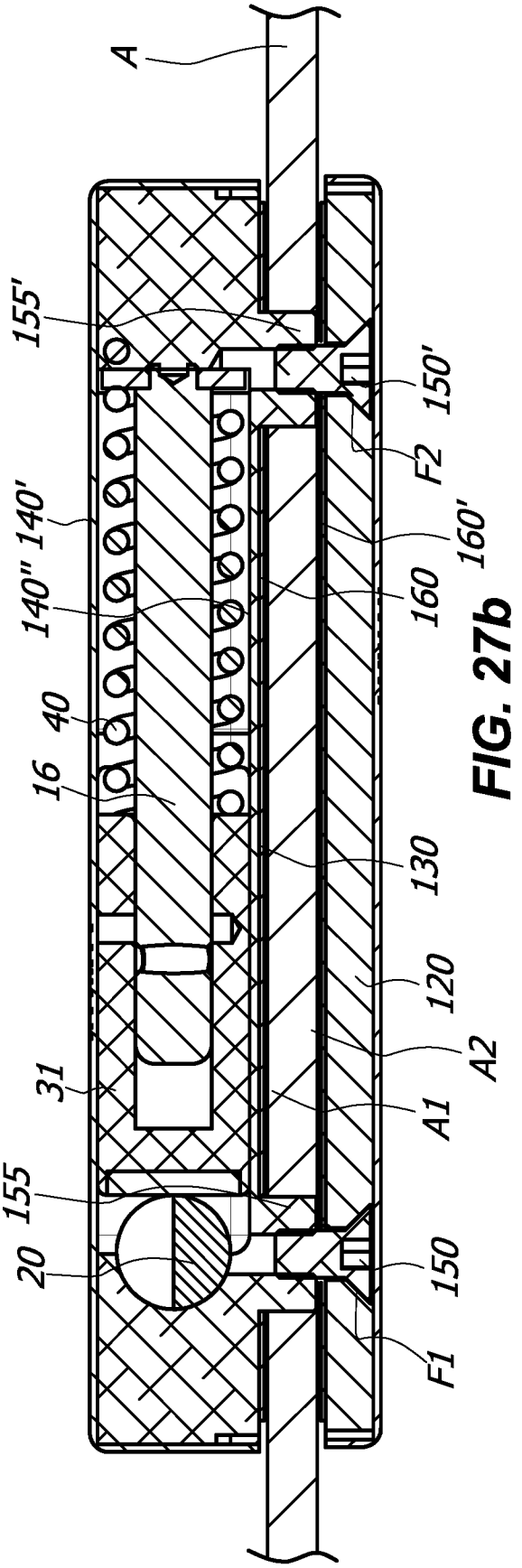


FIG. 27b

FIG. 29a

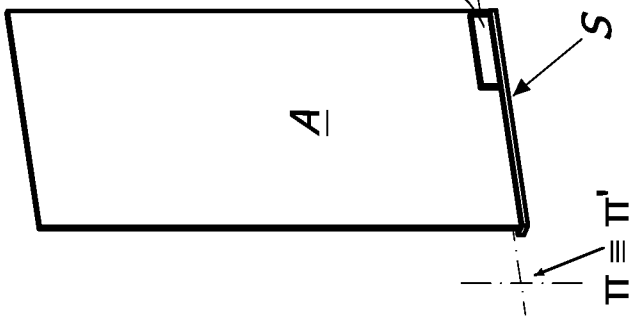


FIG. 29b

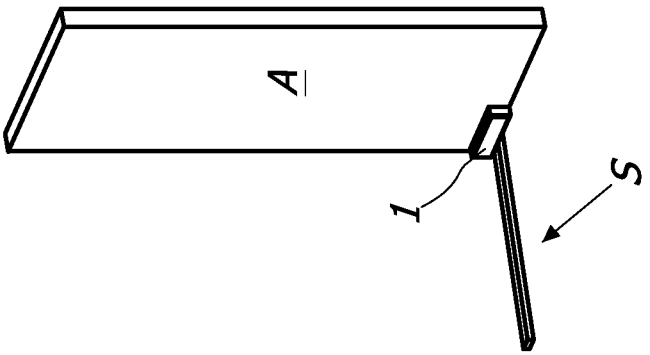
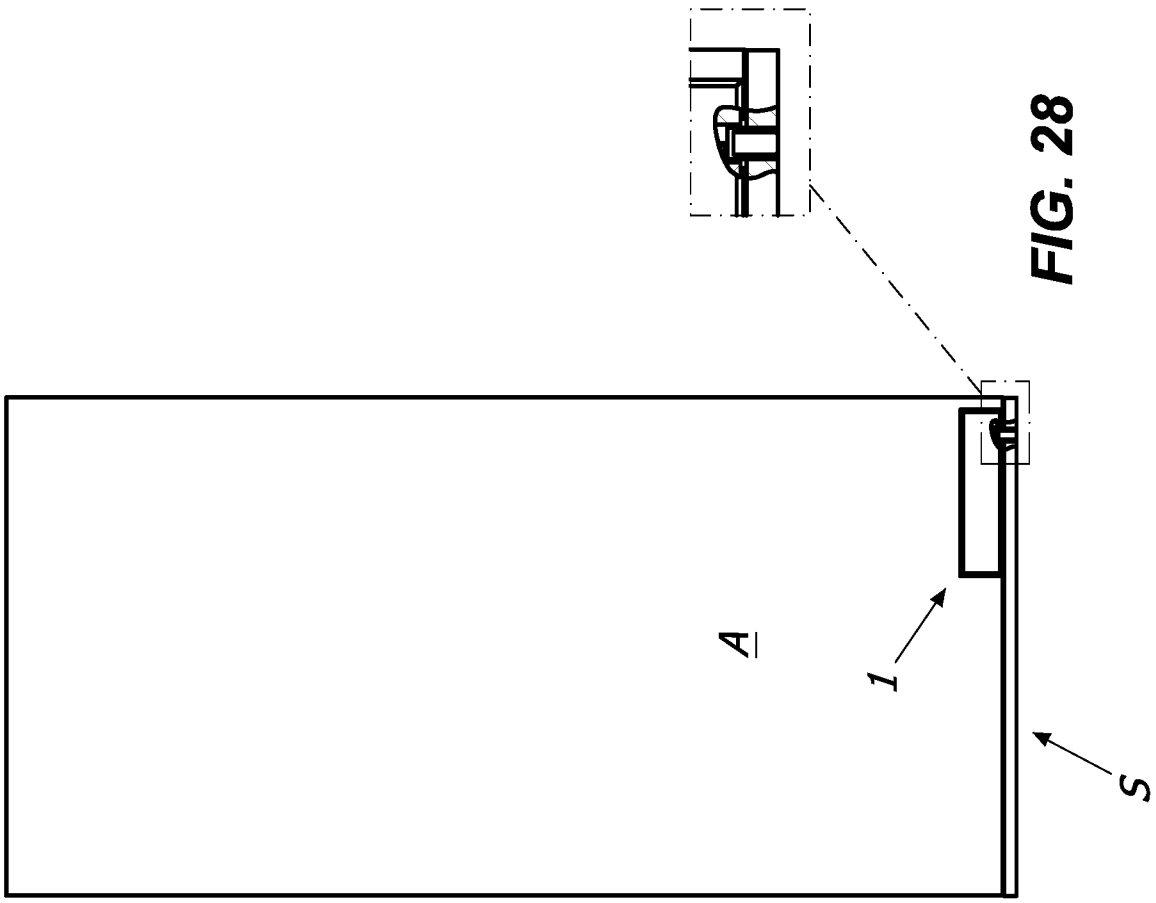


FIG. 28



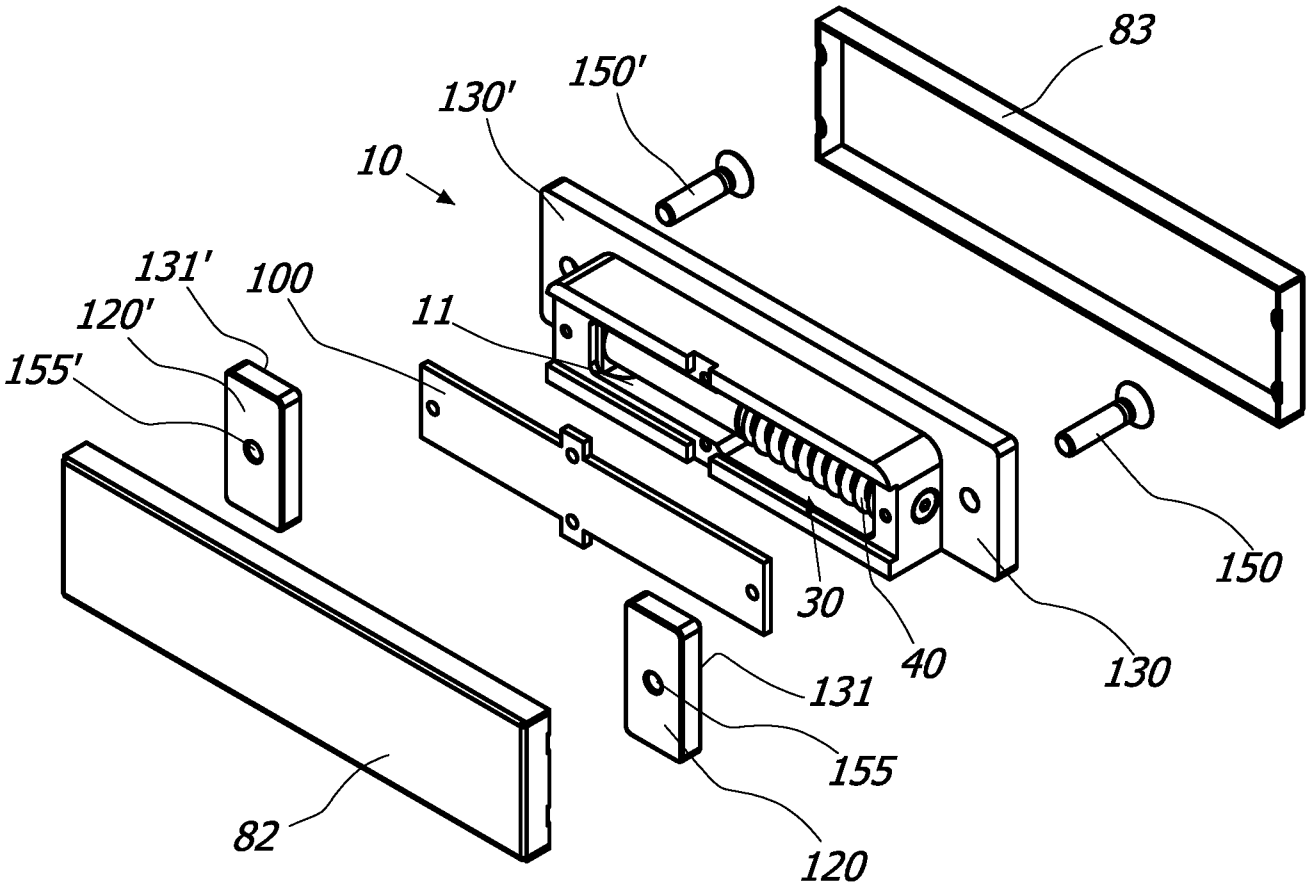


FIG. 30

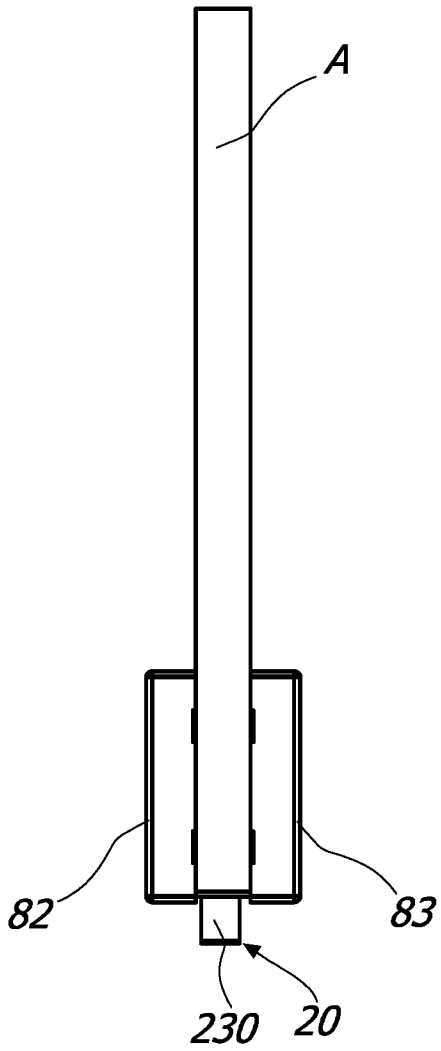


FIG. 31A

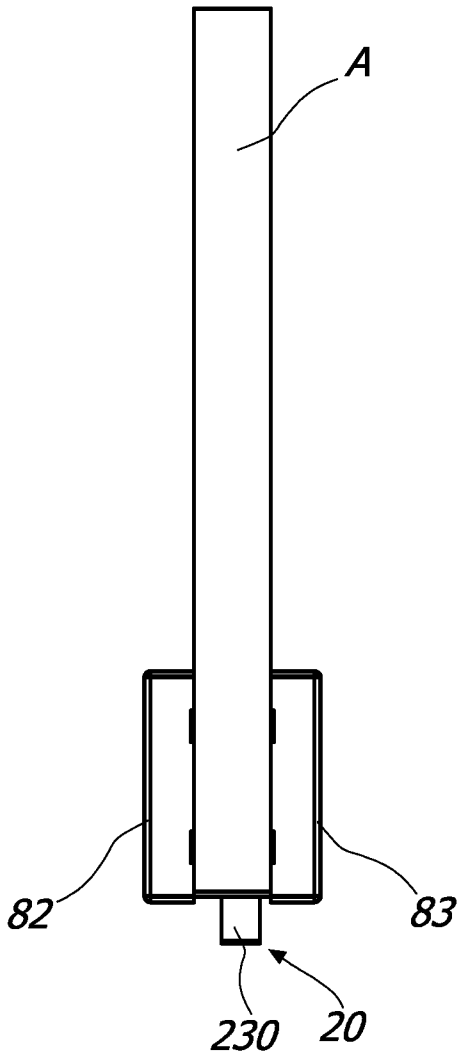


FIG. 31B

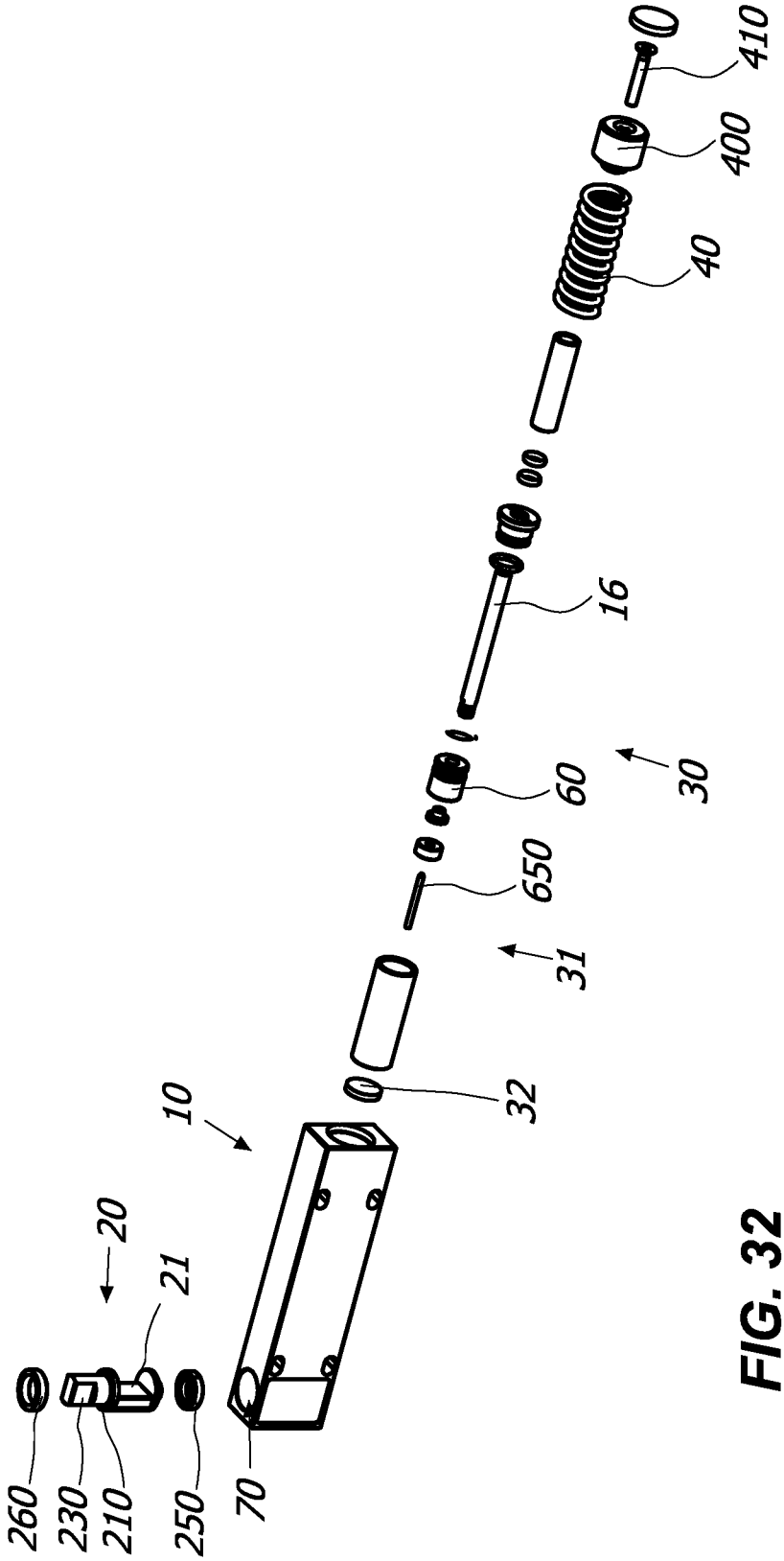


FIG. 32

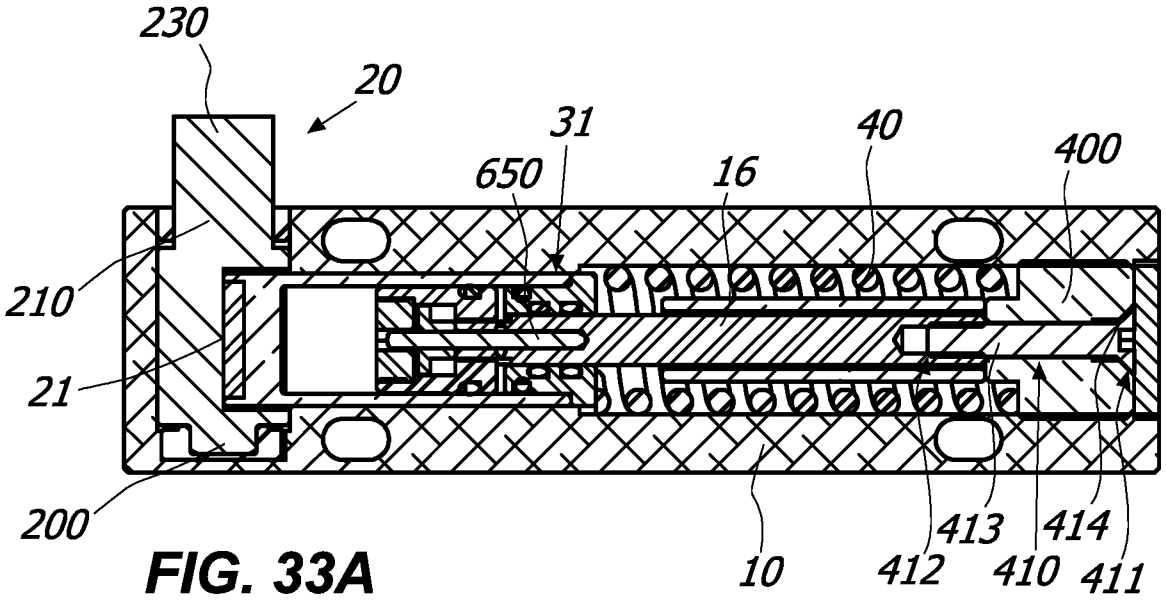


FIG. 33A

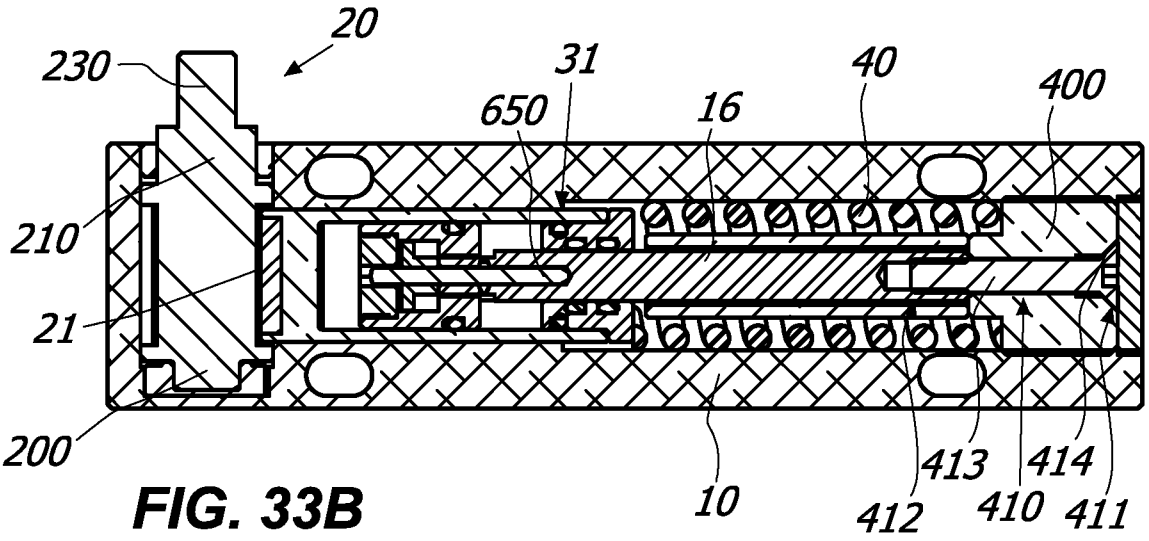


FIG. 33B

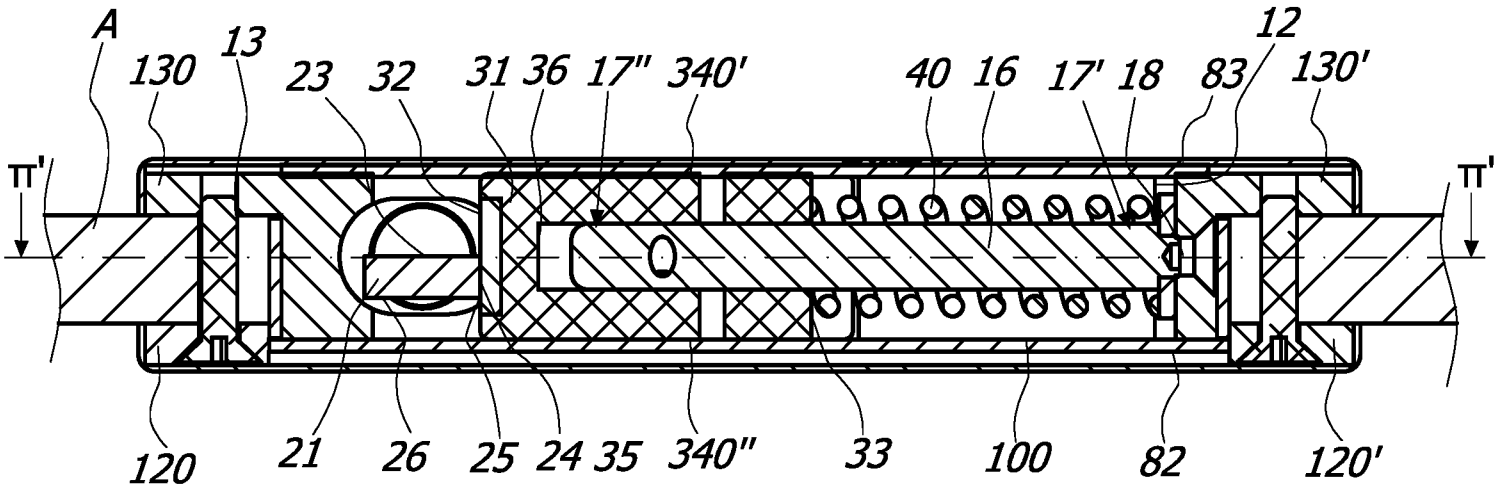
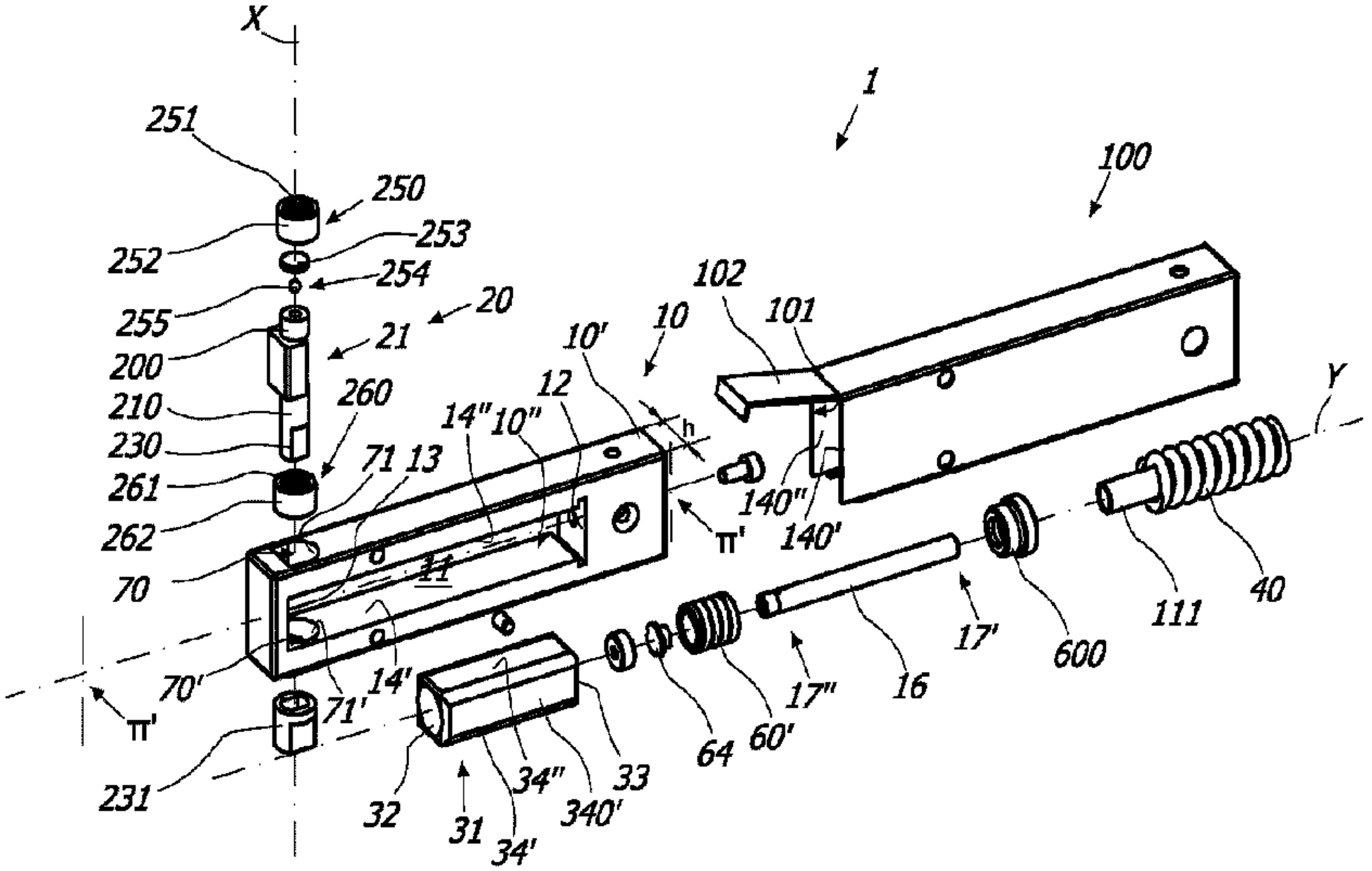


FIG. 34


X
1
100
251
250
253
252
254
255
20
21
200
260
210
230
261
262
70
71
13
14"
10"
12
10'
10
102
101
h
140"
140'
π'
Y
111
40
600
17'
16
17"
64
60'
14'
70'
71'
231
32
31
34'
34"
340'
33