

(51) International Patent Classification:
H02B 1/28 (2006.01) *H02B 1/38* (2006.01)(21) International Application Number:
PCT/US2012/022503(22) International Filing Date:
25 January 2012 (25.01.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/436,515 26 January 2011 (26.01.2011) US(71) Applicant (for all designated States except US): **ABB TECHNOLOGY AG** [CH/CH]; Affolternstrasse 44, CH-8050 Zurich (CH).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KARANDIKAR, Harshavardhan, M.** [IN/US]; 113 Fox Valley Court, Longwood, FL 32779 (US). **DOLEZAL, Radim** [CZ/CZ]; Bzenecka 6, 628 00 Brno (CZ). **KARNBACH, Robert** [US/US]; 148 Estates Circle, Lake Mary, FL 32746 (US). **PAWAR, Rahul** [IN/US]; 675 Pasatiempo Point, Apt 209,Lake Mary, FL 32746 (US). **FISCHER-CARNE, Patrick** [US/US]; 2513 Glenhaven Street, New Smyrna Beach, FL 32168 (US).(74) Agent: **NUPP, Robert, P.**; ABB Inc., 29801 Euclid Avenue, Wickliffe, OH 44092 (US).

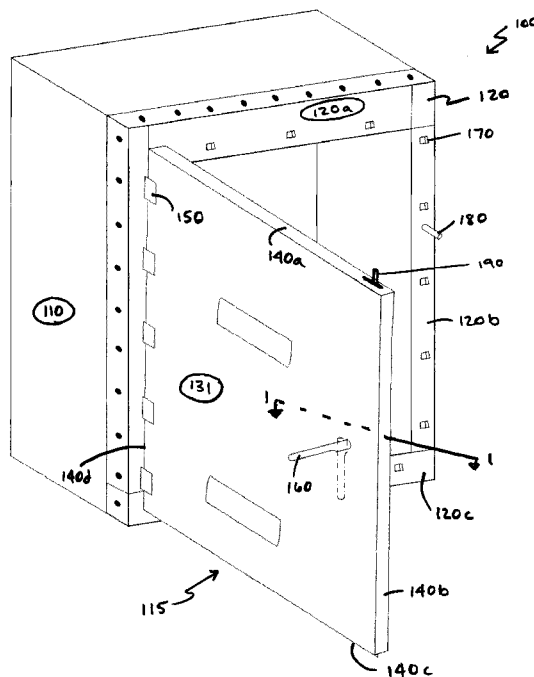
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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,

[Continued on next page]

(54) Title: SWITCHGEAR ENCLOSURE WITH IMPROVED DOOR ASSEMBLY

Fig. 1



(57) Abstract: A multipoint door latch apparatus for use in a switchgear enclosure comprising a door assembly, a latch handle and latch handle mechanism, a plurality of catch tabs affixed to the face frame of the enclosure. Top, side, and bottom latch bars in latch bar chambers are provided, each having at least one latch tooth and being linked by latch bar linkages such that a displacement of one latch bar along results in the same magnitude displacement in the other two latch bars. The catch tabs or latch teeth, or both, are tapered to provide a suitable seal between the door assembly and the enclosure when the door assembly is latched.



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, —
GW, ML, MR, NE, SN, TD, TG).

*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))*

Published:

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

SWITCHGEAR ENCLOSURE WITH IMPROVED DOOR ASSEMBLY**Field of Invention**

[0001] The present application is directed to arc resistant metal enclosures for switchgear, and more particularly, to a switchgear enclosure having a multipoint door latch apparatus. The present application is also directed to methods for providing a switchgear enclosure that is resistant to arc fault damage utilizing the multipoint door latch apparatus.

Background

[0002] It is common to house switchgear in metal enclosures that are resistant to arc fault damage. Arc-resistant switchgear enclosures must withstand high internal pressure due to expanding gases and high temperatures generated by an internal arc fault. Arc-resistance test standards require that no arc gases escape the switchgear enclosure compartments. This problem is particularly acute in the smaller switchgear compartments such as the circuit breaker compartment.

[0003] The interface between the switchgear compartment door and the switchgear frame is a relatively weak point that may potentially allow arc fault gases to escape. To prevent this, a door design is needed that is held tightly against the frame along all of its edges. Also, for ease-of-use, it is preferable to provide a latched door. However, it is a challenge to have a latched door that can be held tightly against the frame and that will resist the high internal pressures of an arc fault.

Summary

[0004] Described herein is a multipoint door latch apparatus for use in a switchgear enclosure. The apparatus comprises a door assembly having inside and outside plates, and inner, outer, top, and bottom edges having flanges extending inwardly, and top, outer, bottom and inner brackets that are secured to the inside plate so as to form a substantially square loop on the interior side of the inside plate. The door assembly is pivotally attached to the face frame of the enclosure along its

inner edge. The top, outer, and bottom flanges and the top, outer, and bottom brackets cooperate to form latch bar chambers. A gasket is mounted on the brackets. A plurality of catch tabs are affixed to the face frame of the enclosure.

[0005] Additionally, the apparatus has top, side, and bottom latch bars that each have at least one latch tooth and that are each seated in a latch bar chamber. The apparatus also includes a latch handle having a latched position and an open position and a latch handle mechanism configured to displace one of the latch bars a latching distance along the line of the longitudinal axis of the latch bar as the latch handle is moved between the latched position and the open position. Two latch bar linkages mechanically connect to the top and bottom ends of the side latch bar to the outer ends of the top and bottom latch bars, respectively, such that displacement of one latch bar by the latch handle mechanism causes a corresponding displacement of the same magnitude in the other two latch bars. A latch status visual indicator is affixed to a latch bar, and an interlock mechanism is configured to prevent the latch handle from being moved to a latched position when the door assembly is in an open position.

[0006] Moreover, the catch tabs and latch teeth are tapered such that the door assembly is firmly pressed against the face frame when the door assembly is closed and the latch handle is moved to the latched position. And, the gasket provides a seal, when the door assembly is closed and the latch handle is moved to the latched position, sufficient to prevent gases from escaping during an arc fault.

[0007] The present application also describes a method for providing a switchgear enclosure that is resistant to arc fault damage, comprising the steps of providing a switchgear box having a case and a face frame, providing a plurality of catch tabs affixed to the face frame, and providing the door assembly and latch assembly described herein.

Brief Description Of The Drawings

[0008] In the accompanying drawings, structural embodiments are illustrated that, together with the detailed description provided below, describe exemplary embodiments of a multipoint door latch apparatus for use in a switchgear enclosure.

One of ordinary skill in the art will appreciate that a component may be designed as multiple components or that multiple components may be designed as a single component.

[0009] Further, in the accompanying drawings and description that follow, like parts are indicated throughout the drawings and written description with the same reference numerals, respectively. The figures are not drawn to scale and the proportions of certain parts have been exaggerated for convenience of illustration.

[0010] **Figure 1** is a perspective view of a switchgear enclosure having a partially opened door assembly.

[0011] **Figure 2A** is a front elevational view of the outside surface of the door assembly shown in **Figure 1**.

[0012] **Figure 2B** is a perspective view of the inside surface of the door assembly shown in **Figure 1**.

[0013] **Figure 2C** is a partial exploded view of the inside surface of the door assembly shown in **Figure 2B**, showing a latch status visual indicator.

[0014] **Figures 3A** and **3B** are perspective views of a latch bar arrangement of the door assembly shown in **Figure 1**.

[0015] **Figures 3C** and **3D** are partial exploded views of the latch bar arrangement of **Figures 3A** and **3B**, showing a latch bar linkage.

[0016] **Figures 3E** and **3F** are partial exploded cutaway views of a corner section of the door assembly shown in **Figure 2B**, showing a latch bar linkage.

[0017] **Figure 3G** is a partial exploded view of the latch bar arrangement of **Figures 3A** and **3B**, showing the latch handle and the latch handle mechanism.

[0018] **Figure 4** is a horizontal section taken along line 2—2 in **Figure 2C**.

[0019] **Figures 5A, B, and C** are horizontal sections taken along line 1—1 in **Figure 1**.

Detailed Description

[0020] The principles disclosed in this application are applicable to various switchgear enclosures. For example, the principles discussed below can be applied to medium voltage switchgear breaker boxes, and the like.

[0021] Referring to **Figures 1** and **2A**, a switchgear enclosure **100** embodied in accordance with the present invention is shown. Switchgear enclosure **100** generally includes an enclosure case **110** and a door assembly **115**. The enclosure case **110** has a face frame **120** and defines an interior space for holding switchgear, such as a circuit breaker. Access to the interior space is provided through an enlarged opening closed by the door assembly **115**. The door assembly **115** is pivotally attached to the enclosure case **110** and is movable between open and closed positions. Door assembly **115** includes a door structure **130** comprised of an outside plate **131** and an inside plate **132** (shown in **Figure 2B**), and having top, outer, bottom, and inner edges **140a-d**, respectively. The outside and inside plates **131**, **132** are rigid and may be formed from metal. Door structure **130** is pivotally attached to face frame **120** at inner edge **140d**. In the embodiment shown, door structure **130** is attached to the face frame by five hinges **150**, although any suitable pivotal attachment means may be used. Latch handle **160** is affixed to door structure **130** proximate outer edge **140b**, although other suitable latch handle configurations may be used.

[0022] With continued reference to **Figures 1** and **2A**, catch tabs **170** are attached to face frame **120** and extend forwardly from front surfaces **120a,b,c** thereof. In the embodiment shown, three catch tabs **170** extend from the upper front surface **120a**, five catch tabs **170** extend from the side front surface **120b**, and three catch tabs **170** extend from the lower front surface **120c**. However, any suitable number of catch tabs **170** may be affixed to face frame **120** and still fall within the scope of the present application. In general, catch tabs **170** are located on the face frame at positions that correspond with the positions of the latch teeth of the latch bars, described in more detail below, such that the catch tabs **170** are capable of engaging the latch teeth when door assembly **115** is closed and when the latch handle is in the latched position (the position shown in **Figure 1** using a dashed

line). Handle lock pin **180** is affixed to face frame **120** in a suitable location to trip the latch handle interlock mechanism, described in detail below.

[0023] A latch status visual indicator **190** is affixed to one or more of the latch bars (described below) and arranged such that it protrudes through a slotted hole in a visible surface of door structure **130** such as, in this example, top edge **140a**. In general, the latch status visual indicator is any bar, pin, or other indicator means that is integral with or affixed to a latch bar and that protrudes through a surface of the door structure such that it provides an indication of the relative position of the latch bar to which it is affixed. Preferably, latch status indicator **190** is sufficiently rigid and strong itself, and in its mechanical connection to the latch bar, to allow for it to serve as a means for manually moving the latch bar to which it is affixed. Suitably, latch status indicator **190** may be a metal pin.

[0024] **Figures 2B and 2C** illustrate the inside portion of door assembly **115**. As shown, the top, outer, bottom, and inner edges **140a-d** of door assembly **115** are inwardly flanged, so as to form top, outer, bottom, and inner flanges **200a-d**, respectively. Referring now also to **Figure 5B**, door assembly **115** also includes L-shaped top, outer, bottom and inner brackets **202** that are secured to inside plate **132**. The top, outer, and bottom flanges **200a-c** and the top, outer, and bottom brackets **202** cooperate to help define top, outer, and bottom latch bar chambers **132**, respectively (best shown in **Figure 5B**) that house the latch bars, described in more detail below. Each of the top, outer, and bottom flanges **200a-c** has one or more apertures **210** formed therein. The number of apertures **210** is the same as the number of catch tabs **170**, shown in **Figure 1**. The location of the apertures **210** is such that each aperture allows corresponding catch tabs **170** to access the latch teeth of the latch bars, described in more detail below, when door assembly **115** is in the closed position.

[0025] Additionally, one or more of the flanges **200a-c** contains an interlock aperture **220** that allows handle lock pin **180**, affixed to the face frame and shown in **Figure 1**, to access and trip the latch handle interlock mechanism, (described in more detail below) and thereby allow latch handle **160** to be moved into a latched position from an open position (shown in **Figure 1** using a continuous line). A gasket **230** (in

one or more pieces or sections) is mounted to the brackets **202** so as to form a substantially square loop on the interior side of the door structure **130**. A narrow gap is formed between the gasket **230** and inner edges of the flanges **200**. This placement of the gasket **230** and its sizing is such that, when the door assembly **115** is closed and latched, the gasket **230** provides a seal sufficient to prevent gases from escaping during an arc fault.

[0026] The door assembly **115** also includes a latch bar assembly **300**, which is shown in **Figures 3A** and **3B**. In general, latch bar assembly **300** comprises top, side, and bottom latch bars **310a-c**, respectively. Each latch bar **310** is a longitudinal member that is relatively flat (i.e., has width that is greater than depth) and includes at least one latch tooth **320**. With cross-reference to **Figure 2B**, latch bar arrangement **300** is arranged such that top, side, and bottom latch bars **310a-c** are situated within the top, outer, and bottom latch bar chambers that are defined by top, outer, and bottom flanges **200a-c**, respectively. Moreover, side latch bar **310b** is situated such that it has a top end proximate top edge **140a** of door assembly **115** and a bottom end proximate bottom edge **140c**. Top latch bar **310a** is situated such that it has an inner end proximate inner edge **140d** and an outer end proximate the outer edge **140b**. Bottom latch bar **310c** is situated such that it has an inner end proximate inner edge **140d** and an outer end proximate outer edge **140b**.

[0027] With continued reference to **Figures 3A** and **3B**, and with additional reference to **Figures 3C** and **3D**, it may be seen that latch bars **310** are mechanically connected by latch bar linkages **330**. In general, latch bar linkages **330** are mechanical connectors that function to allow the displacement of a first latch bar to cause approximately the same magnitude displacement in the latch bar(s) to which it is directly attached, and to change the direction of the displacement (as used herein, the term “displacement” refers to movement of a component along a line parallel to the longitudinal axis of the component). Preferably, latch bar linkages **330** are configured such that the displacement of a first latch bar causes a displacement in the latch bar(s) to which it is directly attached that is of the same magnitude, but that is in a direction that is perpendicular to the direction of the first latch bar. In one non-limiting example, latch bar linkages **330** are flat rigid pieces containing a

first through-hole **340** that allows for a rotatable connection to the door structure **130**. For example, with reference to **Figures 3E** and **3F**, the latch bar linkage **330a** is shown attached to inside plate **132** of door assembly **115** via a sliding pivot point **360**, which allows rotation of the link during displacement of the latch bars. In addition, latch bar linkages **330** contain at least two slots **350** that allow for a slidable connection, such as a pin connection, with two latch bars. It should be appreciated that other configurations and designs of latch bar linkages **330** are contemplated herein. In the embodiment shown, the outer end of top latch bar **310a** is connected to the top end of side latch bar **310b** by latch bar linkage **330a** and the outer end of bottom latch bar **310c** is connected to the bottom end of side latch bar **310b** by latch bar linkage **330b**.

[0028] Also illustrated in **Figure 3F** are latch bar guides **380**, **390**. In general, latch bar guides **380**, **390** are rigid components affixed to inside plate **132** and in slidable contact with latch bars **310** so as to maintain the cross-sectional placement of the latch bar **310** and to prevent angular movement of the latch bars.

[0029] With reference to **Figures 3A**, **3B** and **3G**, latch handle mechanism **370** is illustrated. In general, latch handle mechanism **370** may be any handle mechanism capable of causing a suitable displacement of a latch bar **310**. As shown, latch handle mechanism **370** is generally a lever-type mechanism that is connected at one end to latch handle **160** and at another end to latch bar **310**. Preferably, latch handle mechanism **370** is connected to side latch bar **310b**. In operation, when a user (not shown) moves latch handle **160** from an open position (not shown) to a latched or closed position (shown), latch handle mechanism **370** causes side latch bar **310b** to be displaced upwardly (vertically) a latching distance, along the vertical axis of side latch bar **310b**. A latching distance is generally a pre-determined distance calculated to result in a secure latch between latch teeth **320** and catch tabs **170**. In alternative embodiments, latch handle mechanism **370** may be connected to top or bottom latch bars **310a,c**. Furthermore, through operation of latch bar linkages **330**, the vertical displacement (of a latching distance) of side latch bar **310b** causes the horizontal displacement (of a latching distance) of top and bottom latch bars **310a,c**.

[0030] The cross section shown in **Figure 4** illustrates a latch connection between catch tab **170** and latch tooth **320**. As shown, when latch handle **160** (not shown) is moved to a latched position, latch bar **310** is displaced from its previous (unlatched) position to a latched position (shown), such that latch tooth **320** engages catch tab **170** and, through the operation of the taper on either latch tooth **320** or catch tab **170**, or both, flange **200** and gasket **230** are firmly pressed against face plate **120**, forming a seal that is resistant to arc-fault damage. A non-limiting example of arc-fault damage includes permanent or partial deformation of any of the top, outer and bottom flanges **200a-c**. In general, methods for adjusting the resistance to arc-fault damage according to the present application include but are not limited to adjusting the number of latch teeth / catch tabs and adjusting the taper of either the latch teeth or catch tabs, or both.

[0031] In **Figures 5A, 5B, and 5C**, is shown an embodiment of an interlock mechanism that is configured to prevent latch handle **160** from being moved to a latched position when door assembly **115** is open, according to the present invention. Preferably, the interlock mechanism comprises a spring element **500**, the majority of which is located in chamber **510**. Chamber **510** is a space bounded by inside and outside plates **132, 131** of door assembly **115**. Spring element **500** is configured such that a portion **500a** is biased to protrude through an aperture **520** in inside plate **132** of door assembly **115**. Without any obstruction, spring element portion **500a** protrudes through aperture **520** and extends a distance into a latch bar chamber—*e.g.*, the outer latch bar chamber that is defined by outer flange **200b** and the proximate L-shaped brackets **202**—and into notch **530** that is formed in the adjacent latch bar (*e.g.*, side latch bar **310b**), thereby preventing movement of the latch bar and therefore latch handle **160**, as shown in **Figure 5B**. In other words, once latch handle **160** is moved to an open position and portion **500a** is biased into notch **530**, latch handle **160** is thereafter prevented from moving to any other position.

[0032] With reference to **Figure 5C**, and cross-referencing **Figures 1 and 5B**, it may be seen that, when door structure **130** is closed, handle lock pin **180** extends through interlock aperture **220**, making contact with and pushing spring element

portion **500a**, such that portion **500a** is backed out of notch **530** and allowing the user (not shown) to move handle latch **160** into a latched position (or any other position).

[0033] To the extent that the term “includes” or “including” is used in the specification or the claims, it is intended to be inclusive in a manner similar to the term “comprising” as that term is interpreted when employed as a transitional word in a claim. Furthermore, to the extent that the term “or” is employed (*e.g.*, A or B) it is intended to mean “A or B or both.” When the applicants intend to indicate “only A or B but not both” then the term “only A or B but not both” will be employed. Thus, use of the term “or” herein is the inclusive, and not the exclusive use. *See*, Bryan A. Garner, *A Dictionary of Modern Legal Usage* 624 (2d. Ed. 1995). Also, to the extent that the terms “in” or “into” are used in the specification or the claims, it is intended to additionally mean “on” or “onto.” Furthermore, to the extent the term “connect” is used in the specification or claims, it is intended to mean not only “directly connected to,” but also “indirectly connected to” such as connected through another component or components.

[0034] While the present application illustrates various embodiments, and while these embodiments have been described in some detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention, in its broader aspects, is not limited to the specific details, the representative embodiments, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the applicant’s general inventive concept.

CLAIMS

What is claimed is:

1. A multipoint door latch apparatus for use in a switchgear enclosure, the switchgear enclosure comprised of a case and a face frame that defines an opening, the apparatus comprising:

a door assembly comprising

inside and outside plates, and inner, outer, top, and bottom edges;

top, outer, and bottom flanges extending inwardly from the top, outer, and bottom edges;

top, outer, bottom and inner brackets that are secured to the inside plate so as to form a substantially square loop on the interior side of the inside plate, and wherein the top, outer, and bottom flanges and the top, outer, and bottom brackets cooperate to form top, outer, and bottom latch bar chambers,

a gasket mounted on the top, outer, bottom, and inner brackets;

a latch handle having a latched position and an open position;

a plurality of catch tabs affixed to the face frame;

a top latch bar seated in the top latch bar chamber and having an end proximate the inner edge of the door assembly and an end proximate the outer edge;

a side latch bar seated in the outer latch bar chamber and having an end proximate the top edge of the door assembly and an end proximate the bottom edge;

a bottom latch bar seated in the bottom latch bar chamber and having an end proximate the inner edge of the door assembly and an end proximate the outer edge;

a latch handle mechanism configured to displace one of the latch bars a latching distance along the line of the longitudinal axis of the latch bar as the latch handle is moved between the latched position and the open position;

two latch bar linkages;

a latch status visual indicator affixed to a latch bar; and

an interlock mechanism configured to prevent the latch handle from being moved to a latched position when the door assembly is in an open position;

wherein the door assembly is pivotally attached to the face frame along the inner edge,

wherein the side, top, and bottom latch bars each have at least one latch tooth,

wherein the outer end of the top latch bar is mechanically connected to the top end of the side latch bar by a latch bar linkage and the outer end of the bottom latch bar is mechanically connected to the bottom end of the side latch bar by a latch bar linkage, such that displacement of one latch bar by the latch handle mechanism causes a corresponding displacement of the same magnitude in the other two latch bars,

wherein the catch tabs and latch teeth are tapered such that the door assembly is firmly pressed against the face frame when the door assembly is closed and the latch handle is moved to the latched position, and

wherein the gasket provides a seal, when the door assembly is closed and the latch handle is moved to the latched position, sufficient to prevent gases from escaping during an arc fault.

2. The multipoint door latch apparatus in Claim 1, wherein the latch handle mechanism is configured to displace the side latch bar.
3. The multipoint door latch apparatus in Claim 1, wherein the latch handle mechanism is configured to displace the bottom latch bar.
4. The multipoint door latch apparatus in Claim 1, wherein the top and bottom latch bars each contain three to five latch teeth, and wherein the side latch bar contains five to nine latch teeth.
5. A method for providing a switchgear enclosure that is resistant to arc fault damage, comprising the steps of:

providing a switchgear box comprising a case and a face frame;

providing a plurality of catch tabs affixed to the face frame;

providing a door assembly comprising

inside and outside plates, and inner, outer, top, and bottom edges;

top, outer, and bottom flanges extending inwardly from the top, outer, and bottom edges;

top, outer, bottom and inner brackets that are secured to the inside plate so as to form a substantially square loop on the interior side of the inside plate, and wherein the top, outer, and bottom flanges and the top, outer, and bottom brackets cooperate to form top, outer, and bottom latch bar chambers,

a gasket mounted on the top, outer, bottom, and inner brackets;

providing a latch assembly comprising

a latch handle having a latched position and an open position;

a top latch bar seated in the top latch bar chamber and having an end proximate the inner edge of the door assembly and an end proximate the outer edge;

a side latch bar seated in the outer latch bar chamber and having an end proximate the top edge of the door assembly and an end proximate the bottom edge;

a bottom latch bar seated in the bottom latch bar chamber and having an end proximate the inner edge of the door assembly and an end proximate the outer edge;

a latch handle mechanism configured to displace one of the latch bars a latching distance along the line of the longitudinal axis of the latch bar as the latch handle is moved between the latched position and the open position;

two latch bar linkages;

a latch status visual indicator affixed to a latch bar; and

an interlock mechanism configured to prevent the latch handle from being moved to a latched position when the door assembly is in an open position;

wherein the door assembly is pivotally attached to the face frame along the inner edge,

wherein the side, top, and bottom latch bars each have at least one latch tooth,

wherein the outer end of the top latch bar is mechanically connected to the top end of the side latch bar by a latch bar linkage and the outer end of the bottom latch bar is mechanically connected to the bottom end of the side latch bar by a latch bar linkage, such that displacement of one latch bar by the latch handle mechanism causes a corresponding displacement of the same magnitude in the other two latch bars,

wherein the catch tabs and latch teeth are tapered such that the door assembly is firmly pressed against the face frame when the door assembly is closed and the latch handle is moved to the latched position, and

wherein the gasket provides a seal sufficient when the door assembly is closed and the latch handle is moved to the latched position, such that gases are prevented from escaping during an arc fault.

6. The method of Claim 5, wherein the latch handle mechanism is configured to displace the side latch bar.
7. The method of Claim 5, wherein the latch handle mechanism is configured to displace the bottom latch bar.
8. The method of Claim 5, wherein the top and bottom latch bars each contain three to five latch teeth, and wherein the side latch bar contains five to nine latch teeth.

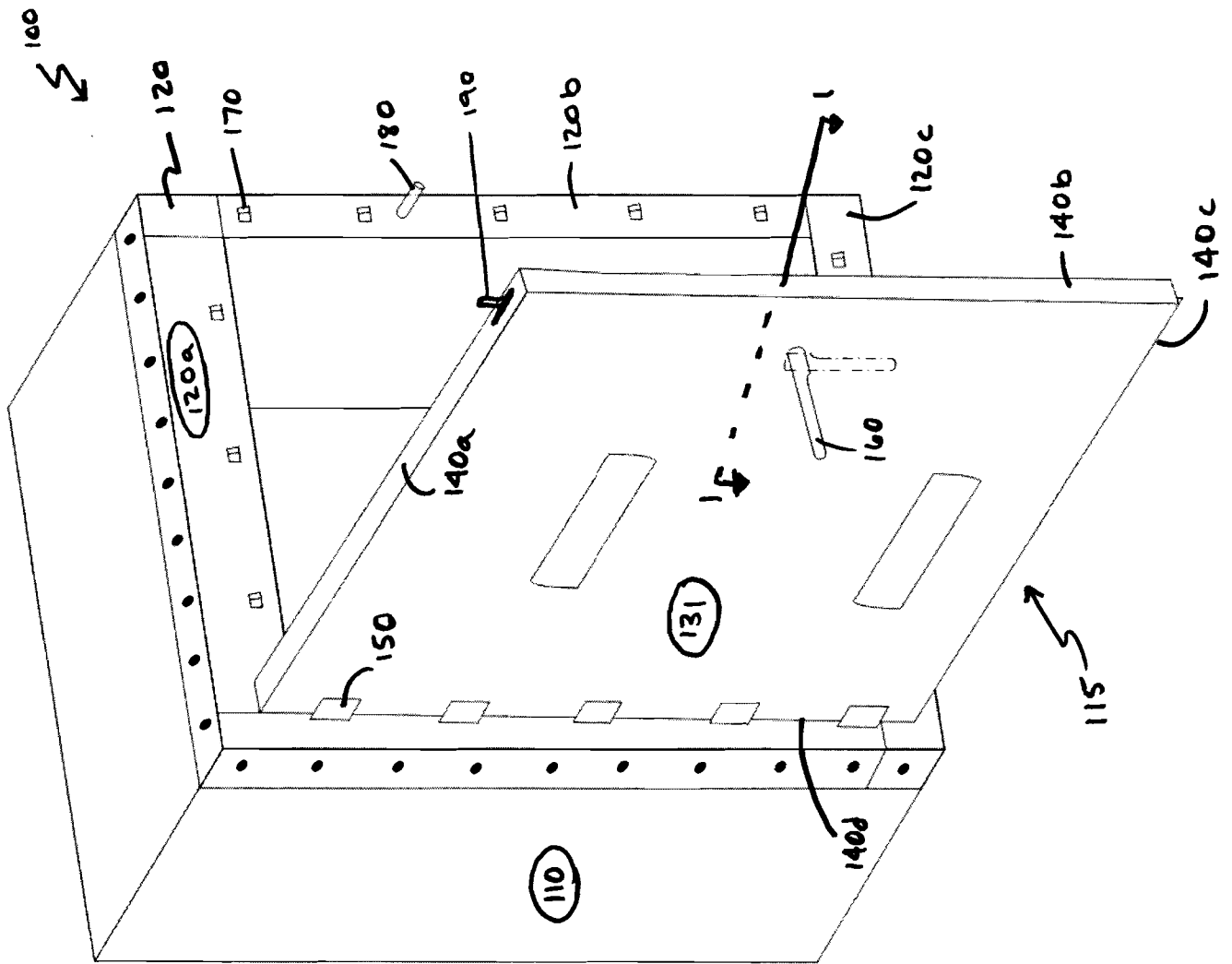


Fig. 1

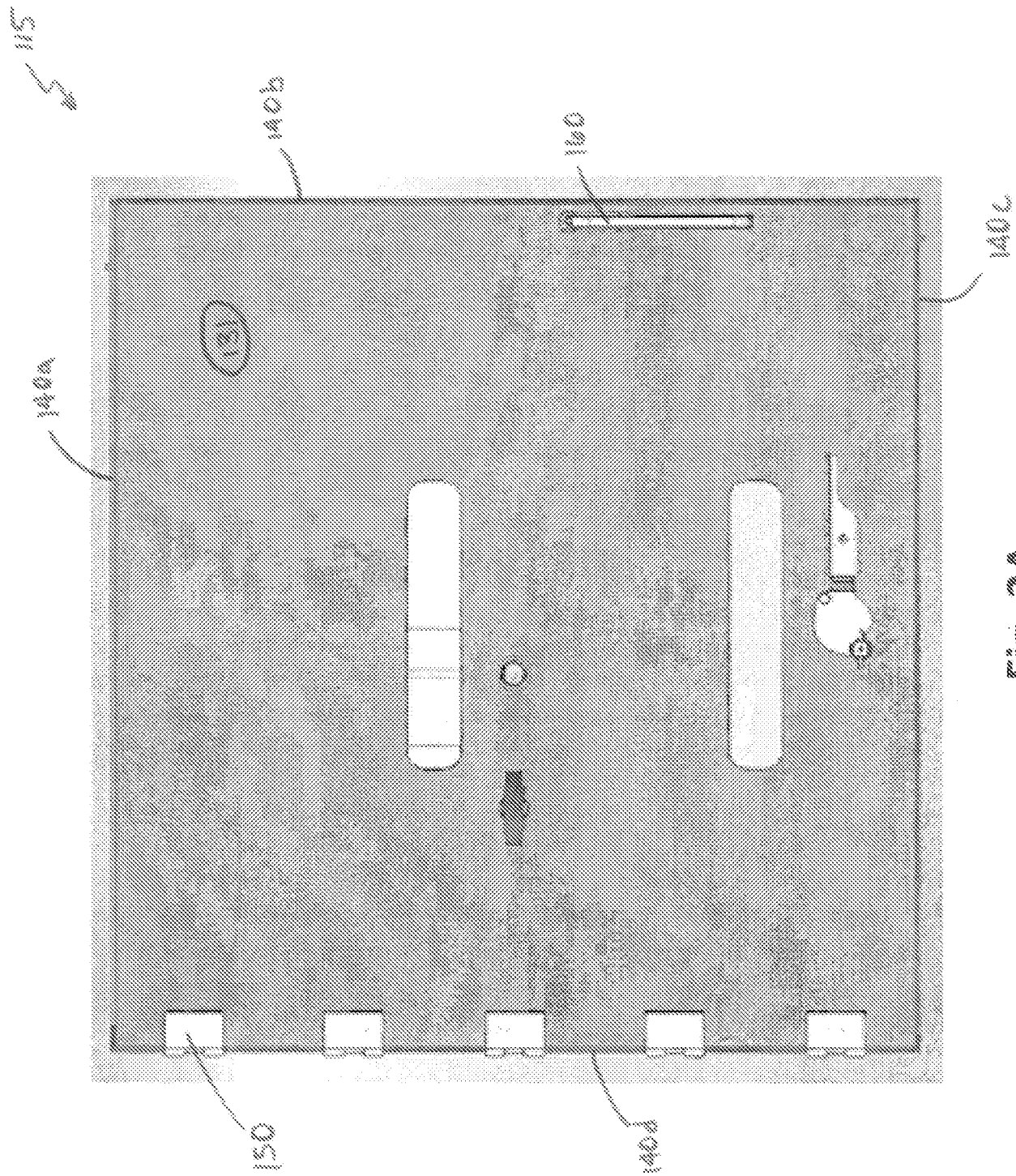
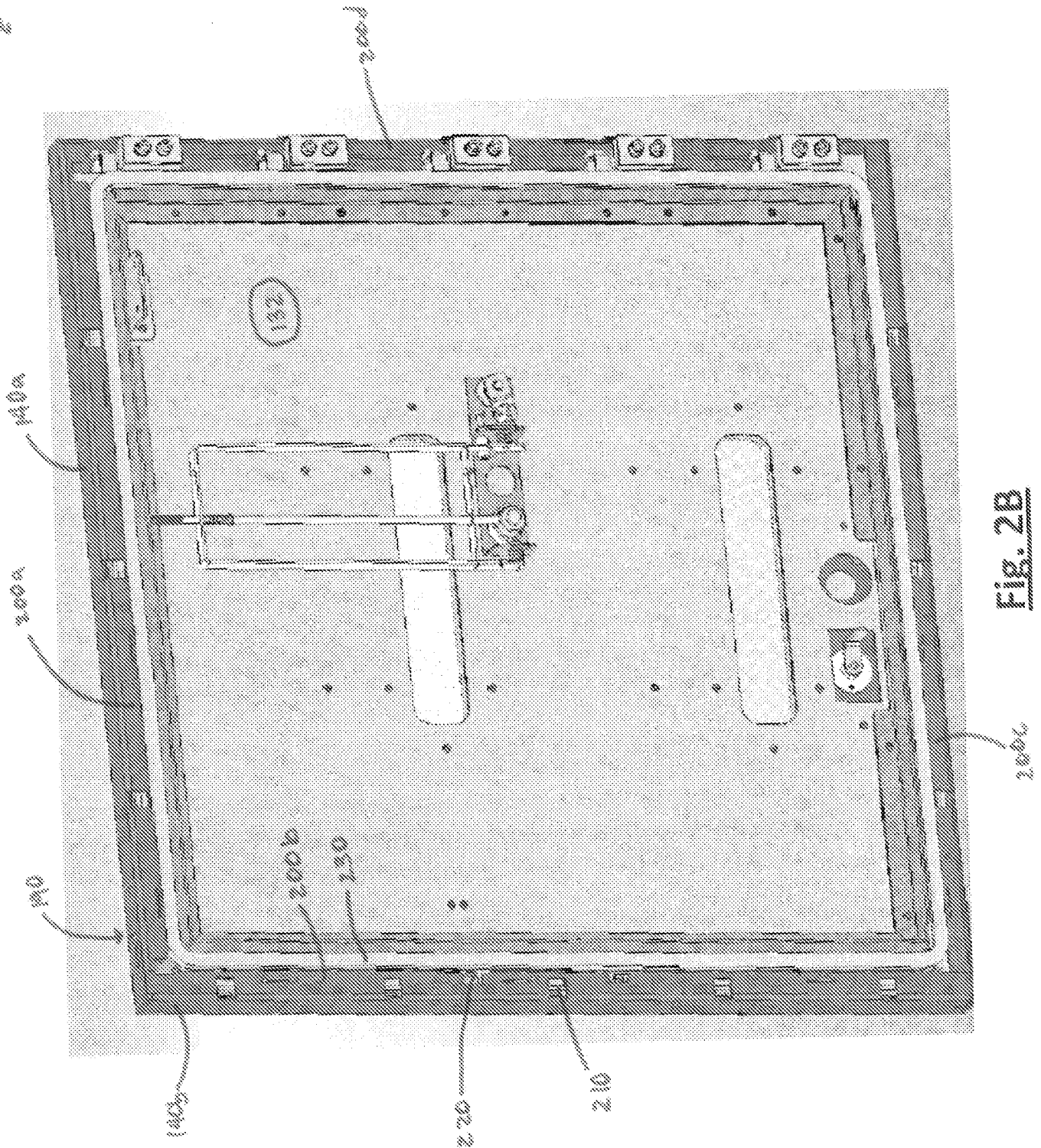


FIG. 2A



23

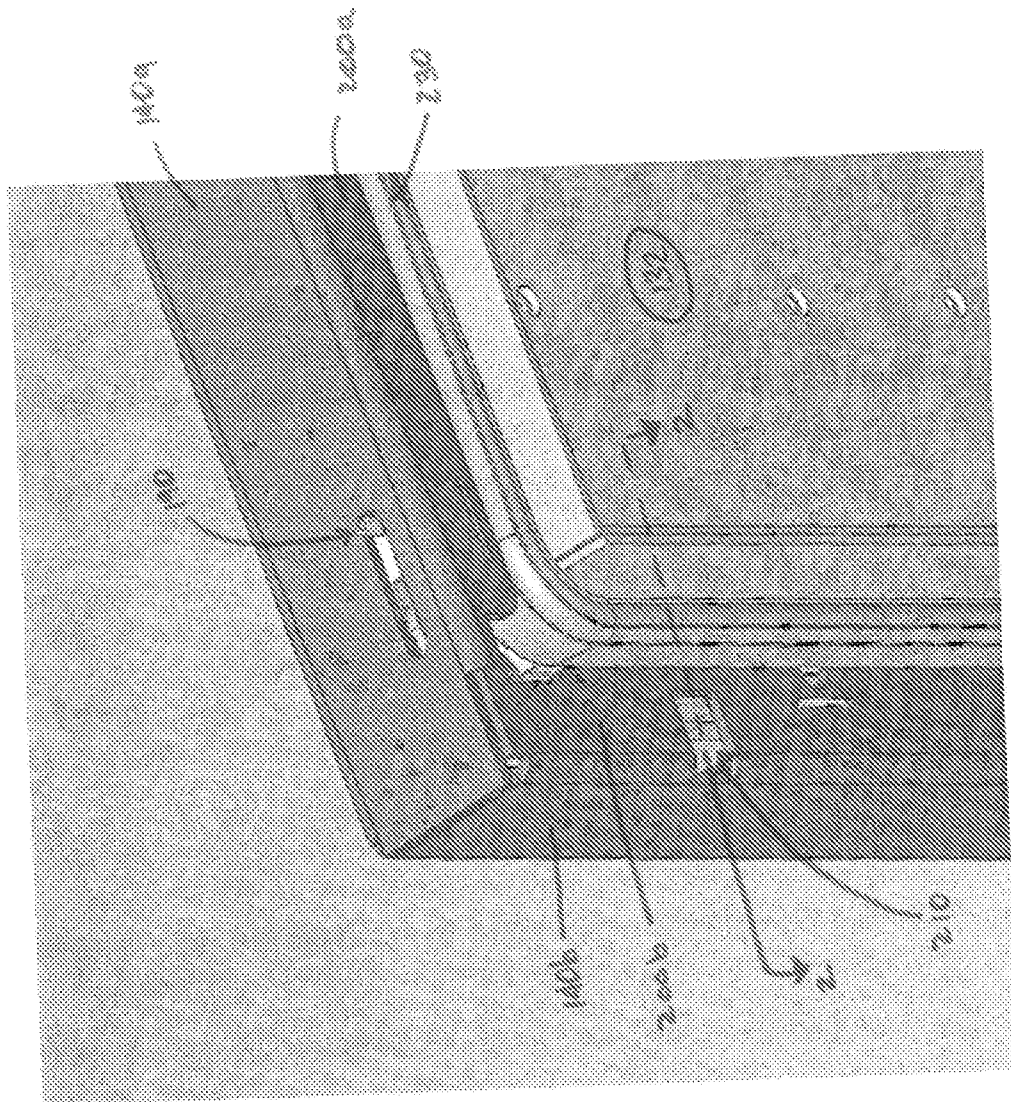


Fig. 2C

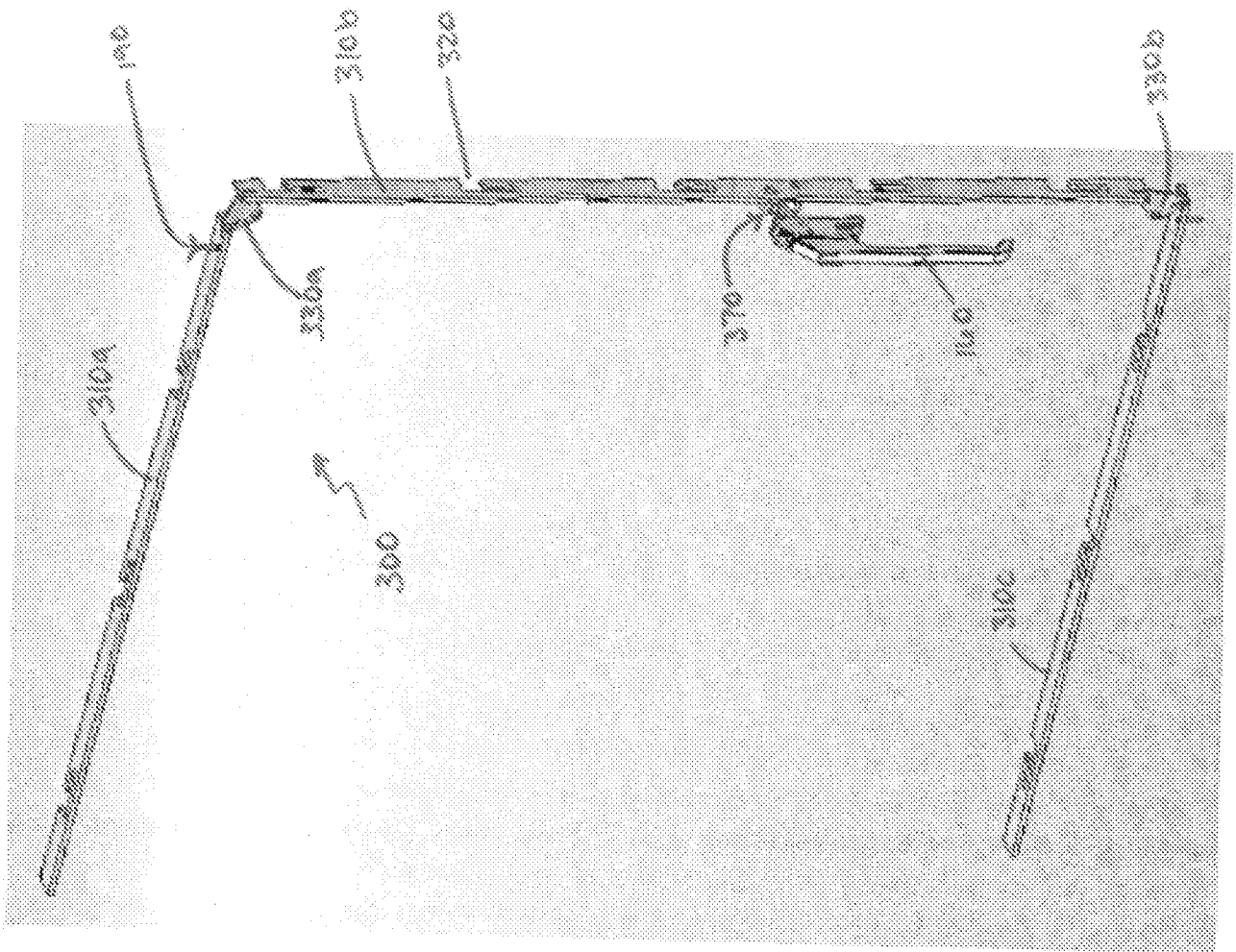


Fig. 3A

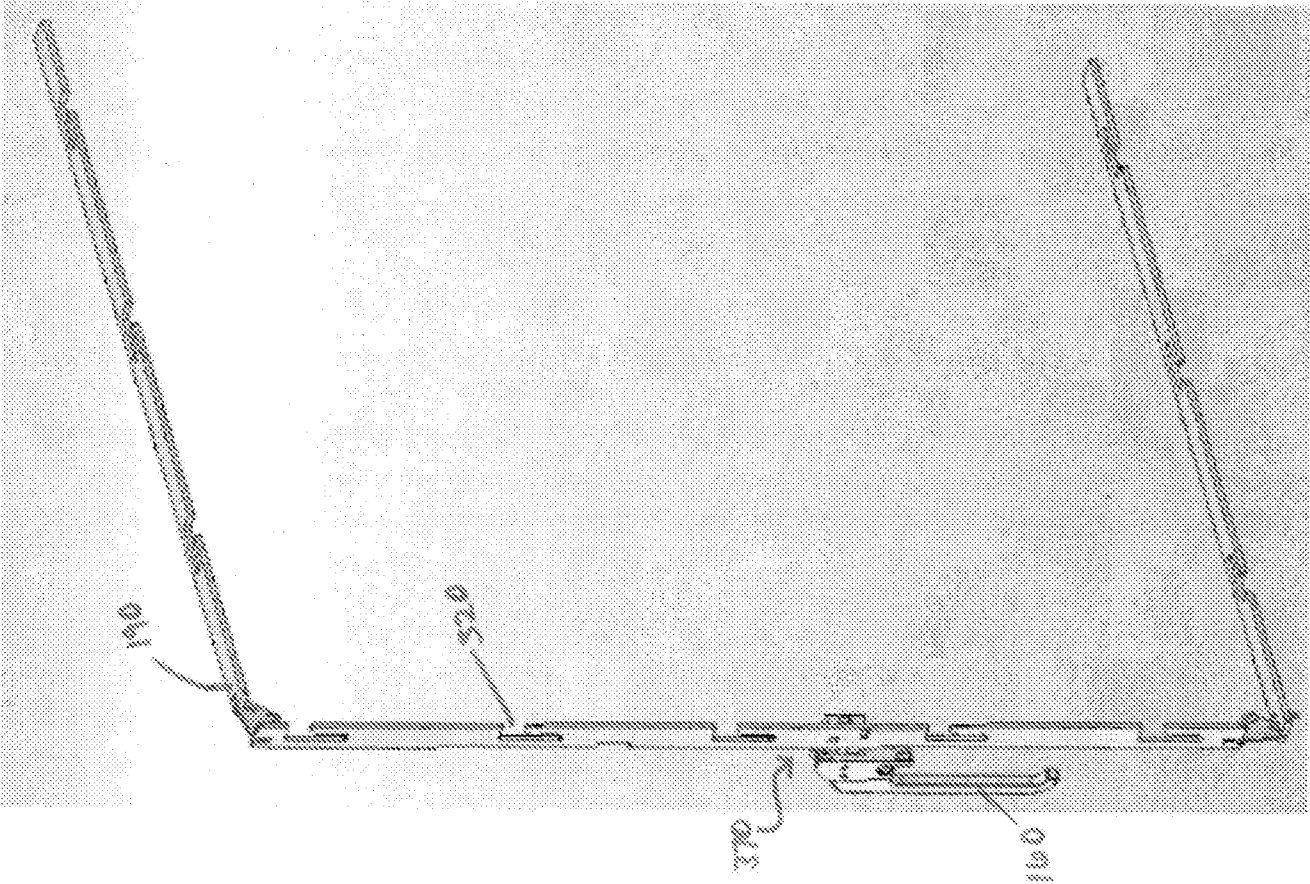


Fig. 3B

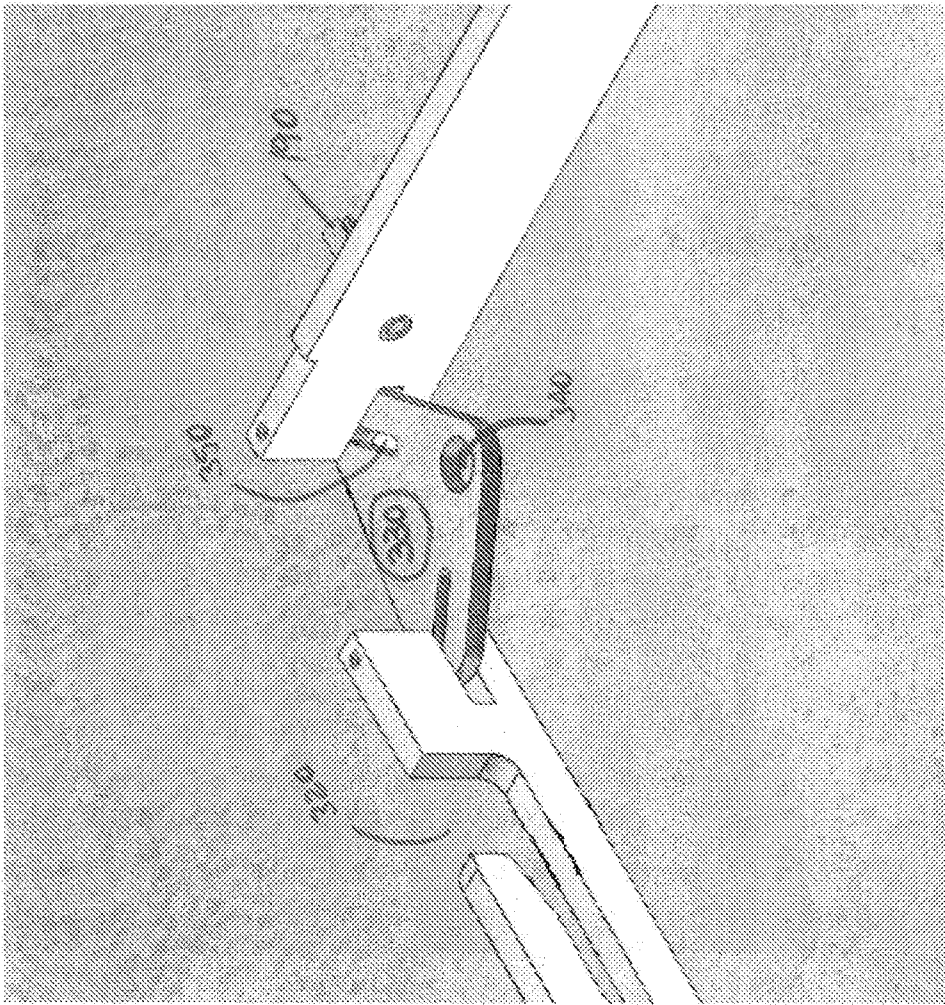


Fig. 3C

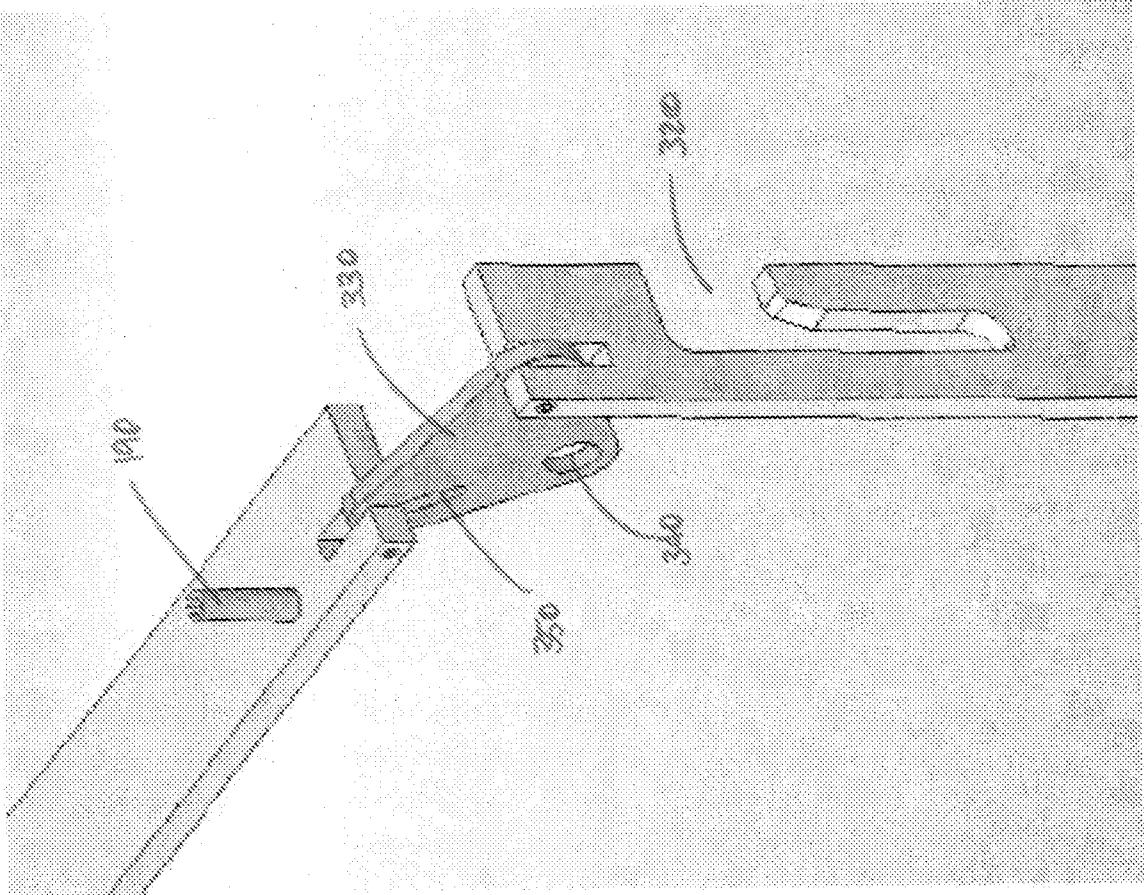


Fig. 3D

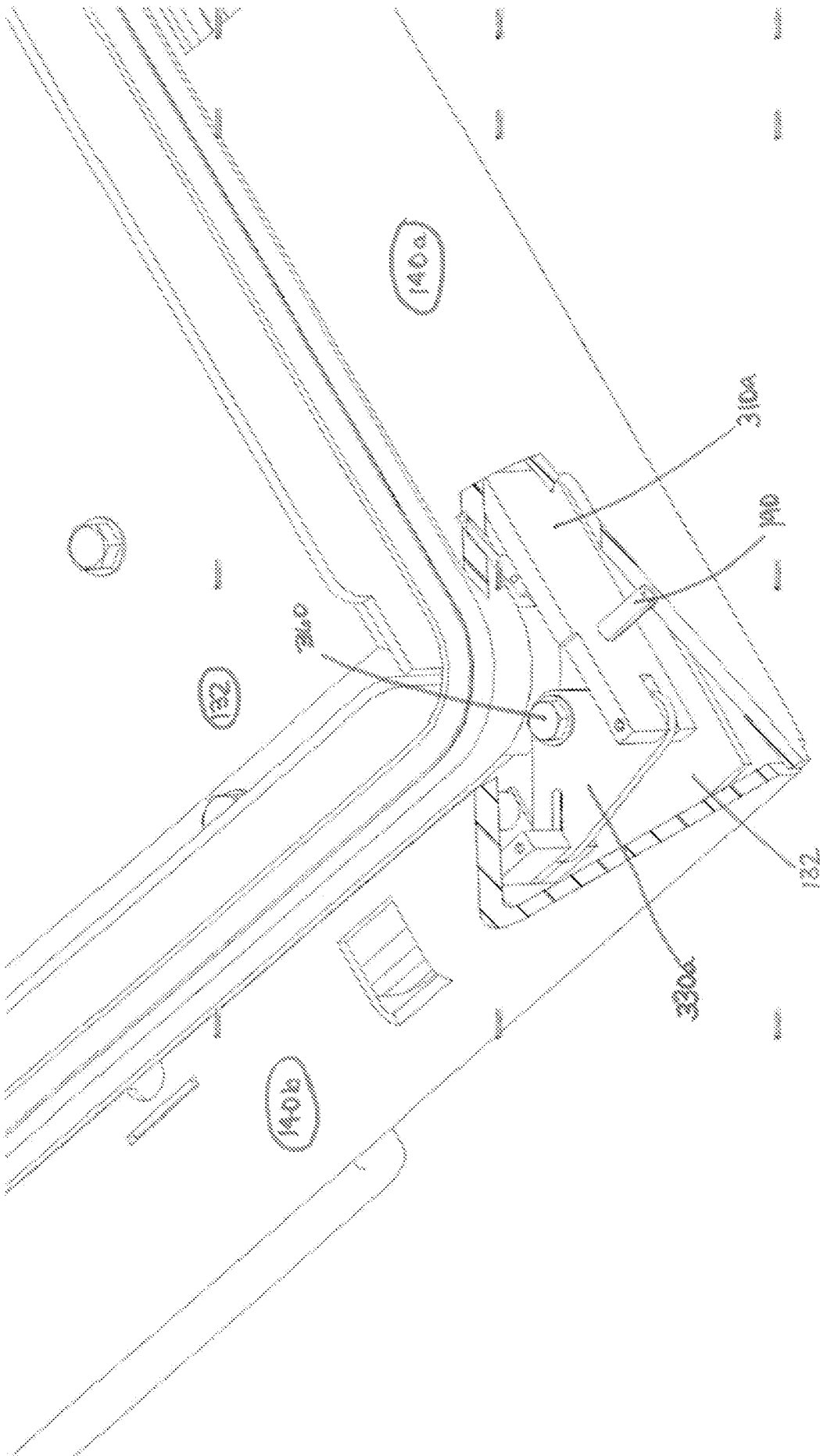
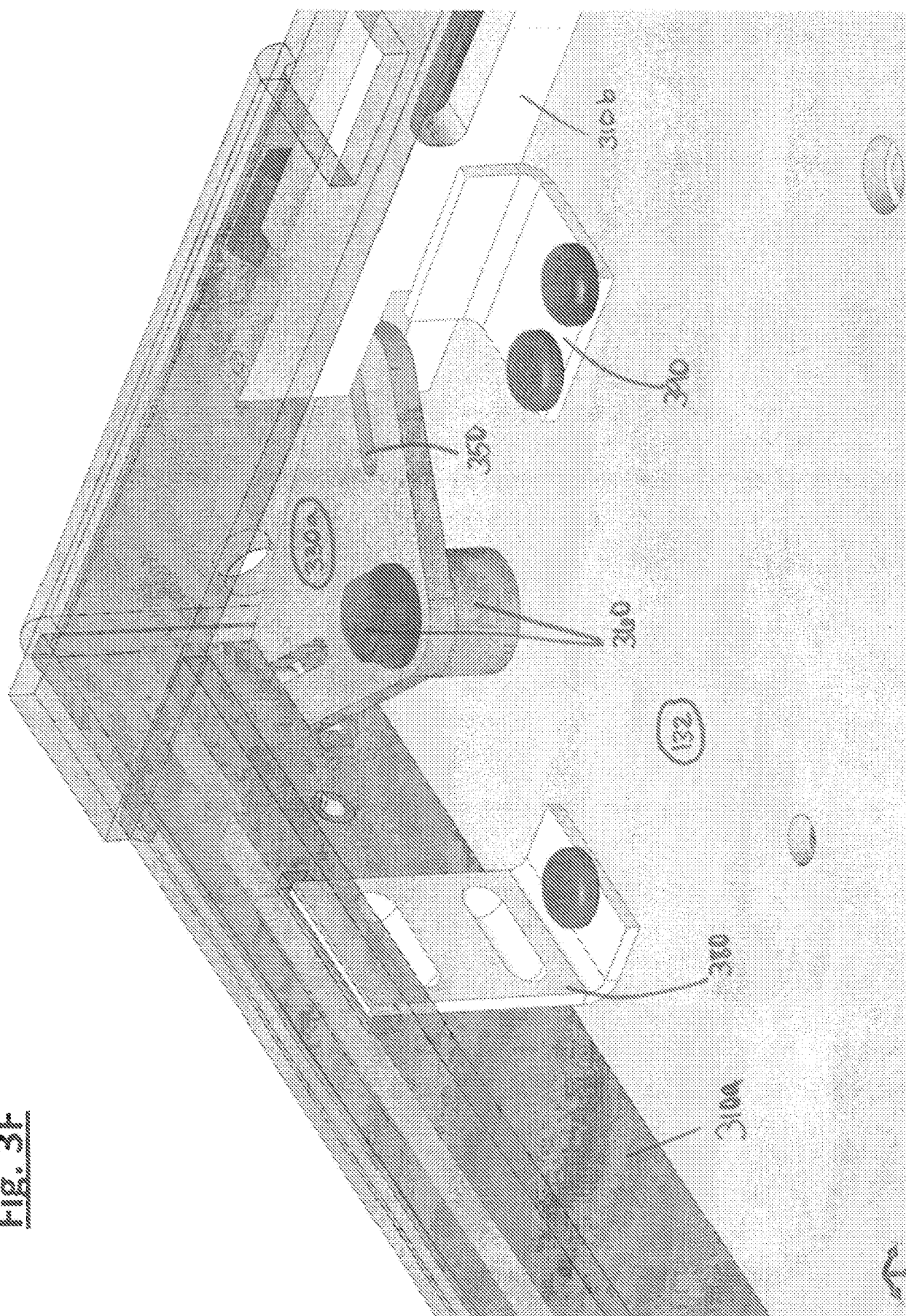
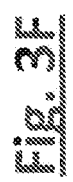


FIG. 3E



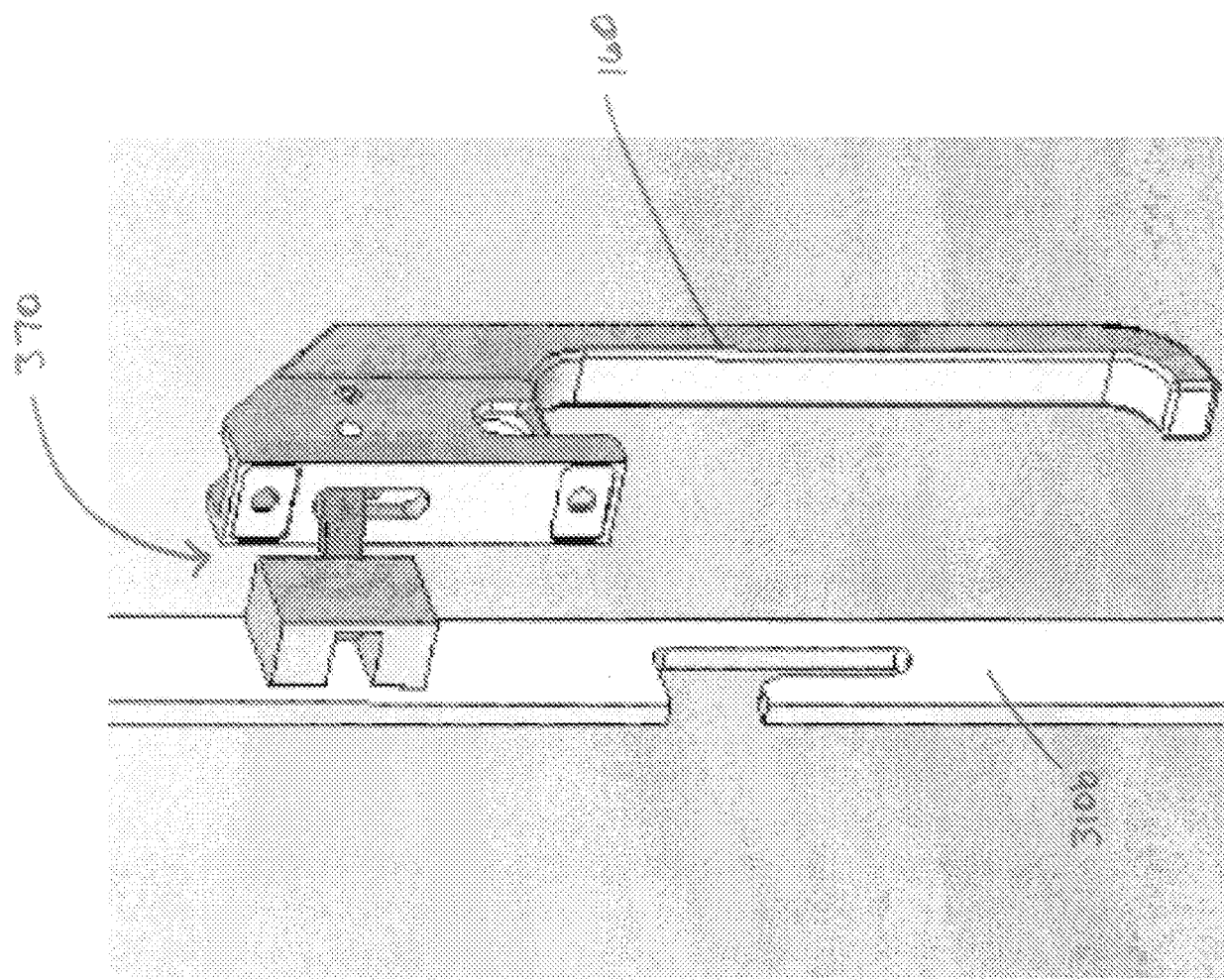
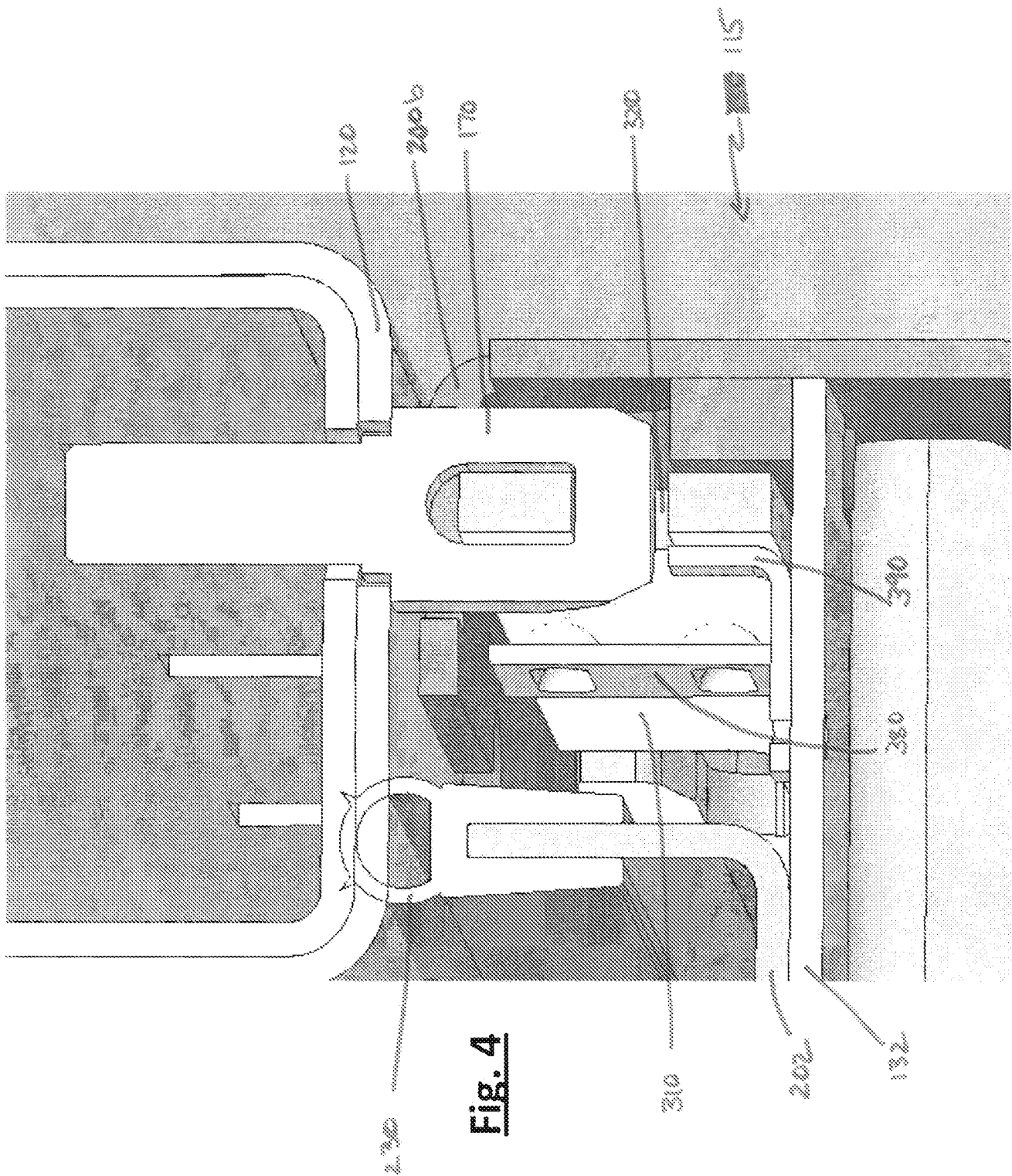
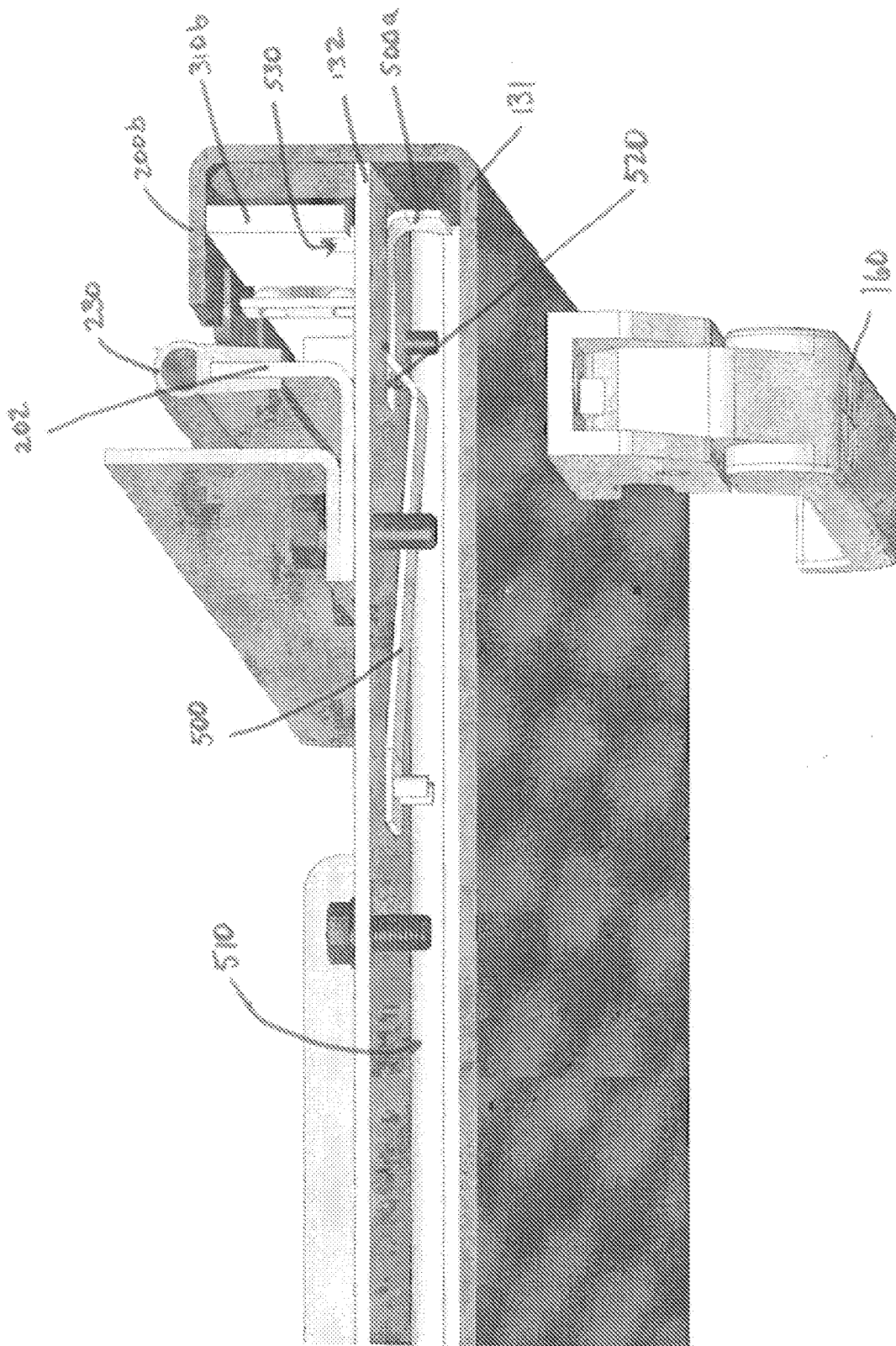


Fig. 3G





54

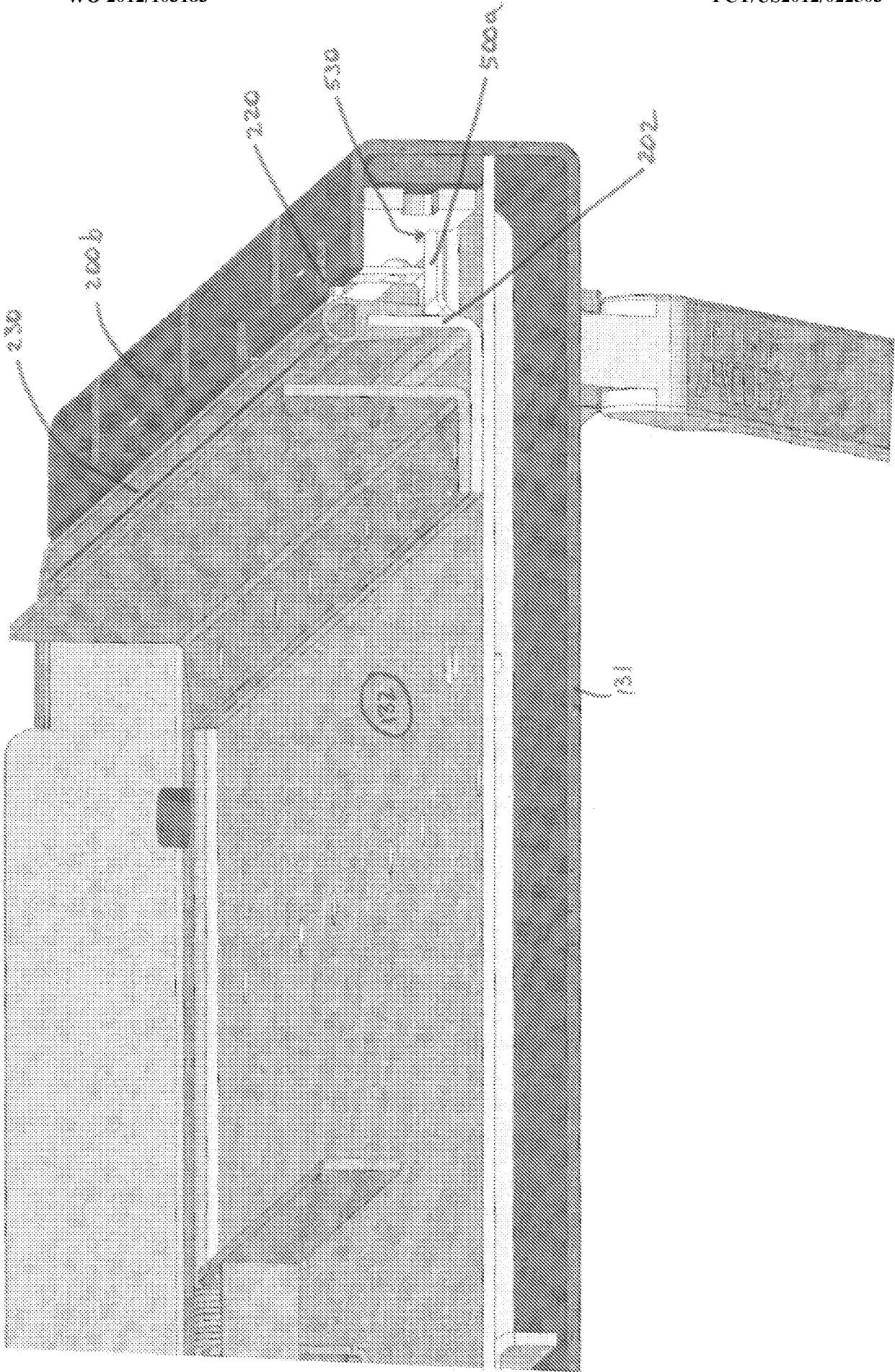


Fig. 5B

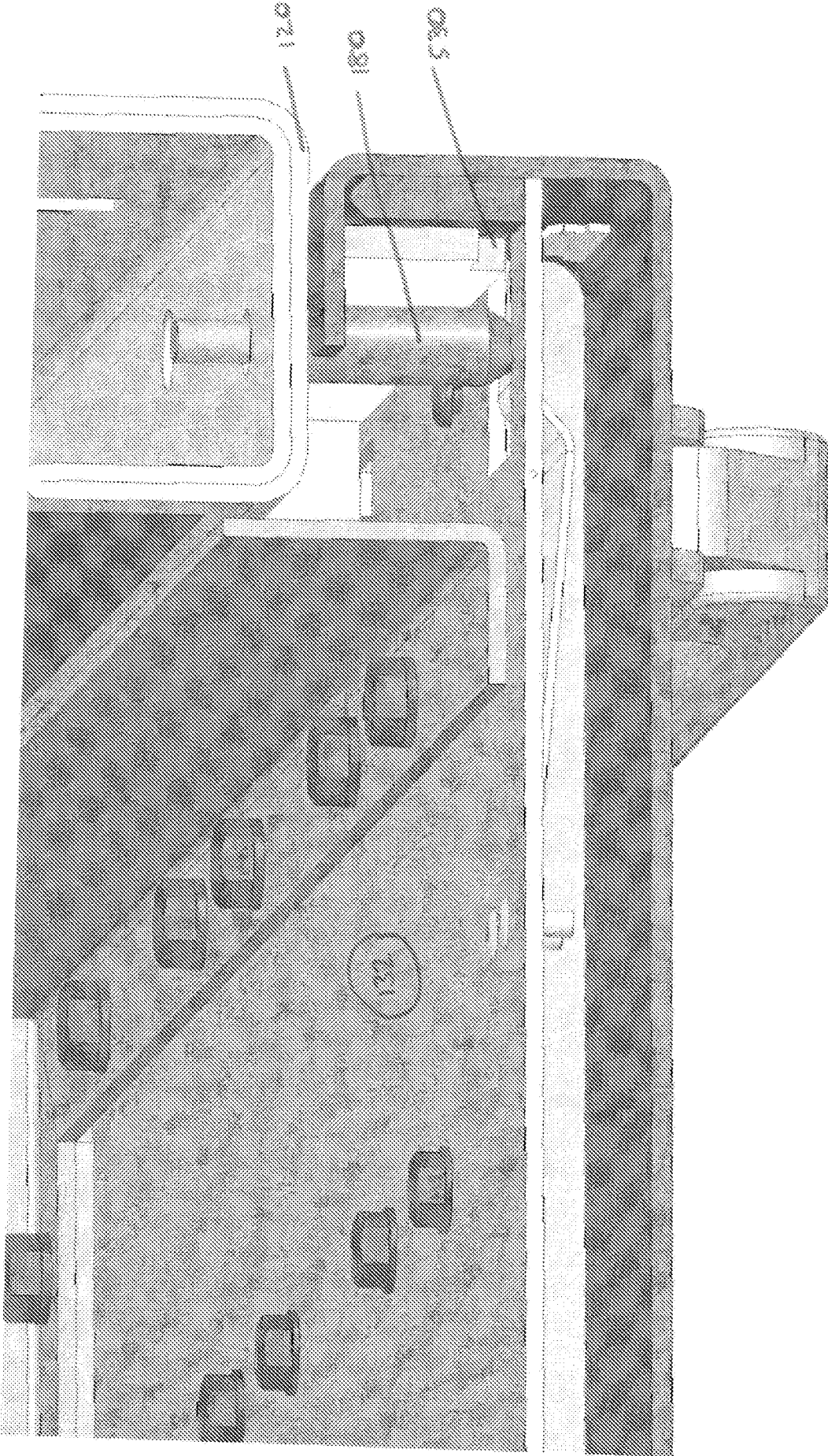


Fig. 5C

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/022503

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02B1/28 H02B1/38
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H02B E05C

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004/101364 A2 (ROAHAN RAMESH [IN]) 25 November 2004 (2004-11-25) figures	1,5
A	FR 2 934 871 A1 (SOCOMEC SA [FR]) 12 February 2010 (2010-02-12) figures	1,5
A	DE 199 39 614 C1 (DRIESCHER ELTECH WERK [DE]) 27 September 2001 (2001-09-27) figures	1,5

☐

Further documents are listed in the continuation of Box C.

☒

See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

6 June 2012

Date of mailing of the international search report

13/06/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Castanheira Nunes, F

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/022503

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2004101364 A2	25-11-2004	AU 2003272085 A1 WO 2004101364 A2	03-12-2004 25-11-2004
FR 2934871 A1	12-02-2010	NONE	
DE 19939614 C1	27-09-2001	NONE	