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(12) **United States Patent**
Edokpayi

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(54) **ADJUSTABLE BREAKOUT DEVICE**

(71) Applicant: **Overhead Door Corporation**, Lewisville, TX (US)

(72) Inventor: **Frank Isioma Edokpayi**, Corpus Christi, TX (US)

(73) Assignee: **Overhead Door Corporation**, Lewisville, TX (US)

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Related U.S. Application Data

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E05D 15/48 (2006.01)
E05D 15/06 (2006.01)
E05D 15/58 (2006.01)

(52) **U.S. Cl.**
CPC ***E05D 15/48*** (2013.01); ***E05D 15/0604*** (2013.01); ***E05D 15/58*** (2013.01); *E05D 2015/485* (2013.01); *E05D 2015/586* (2013.01); *E05Y 2900/132* (2013.01)

(58) **Field of Classification Search**
CPC E05D 15/48; E05D 15/485; E05D 15/586; E05D 15/58; E05D 15/0604; E05Y 2900/132
See application file for complete search history.

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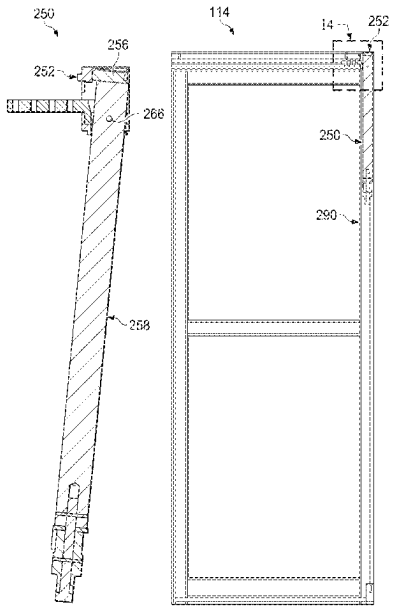
Primary Examiner — Justin B Rephann
(74) *Attorney, Agent, or Firm* — Haynes and Boone, LLP

(57) **ABSTRACT**

A sliding door system is disclosed which includes an adjustable breakout device that is configured to change the suspension angle of one or more door panels of the sliding door system. The adjustable breakout device may include a support bar configured to extend vertically along the door panel, a housing configured to be mounted on an upper portion of the support bar, a bracket configured to be mounted on the upper portion of the support bar and within a portion of the housing, a set screw configured to pass through the housing and through the upper portion of the support bar, and a pivot configured to pass through the bracket. The set screw may be adjusted to cause the support bar to rotate about the pivot and therefore change the suspension angle of the one or more door panels.

20 Claims, 17 Drawing Sheets



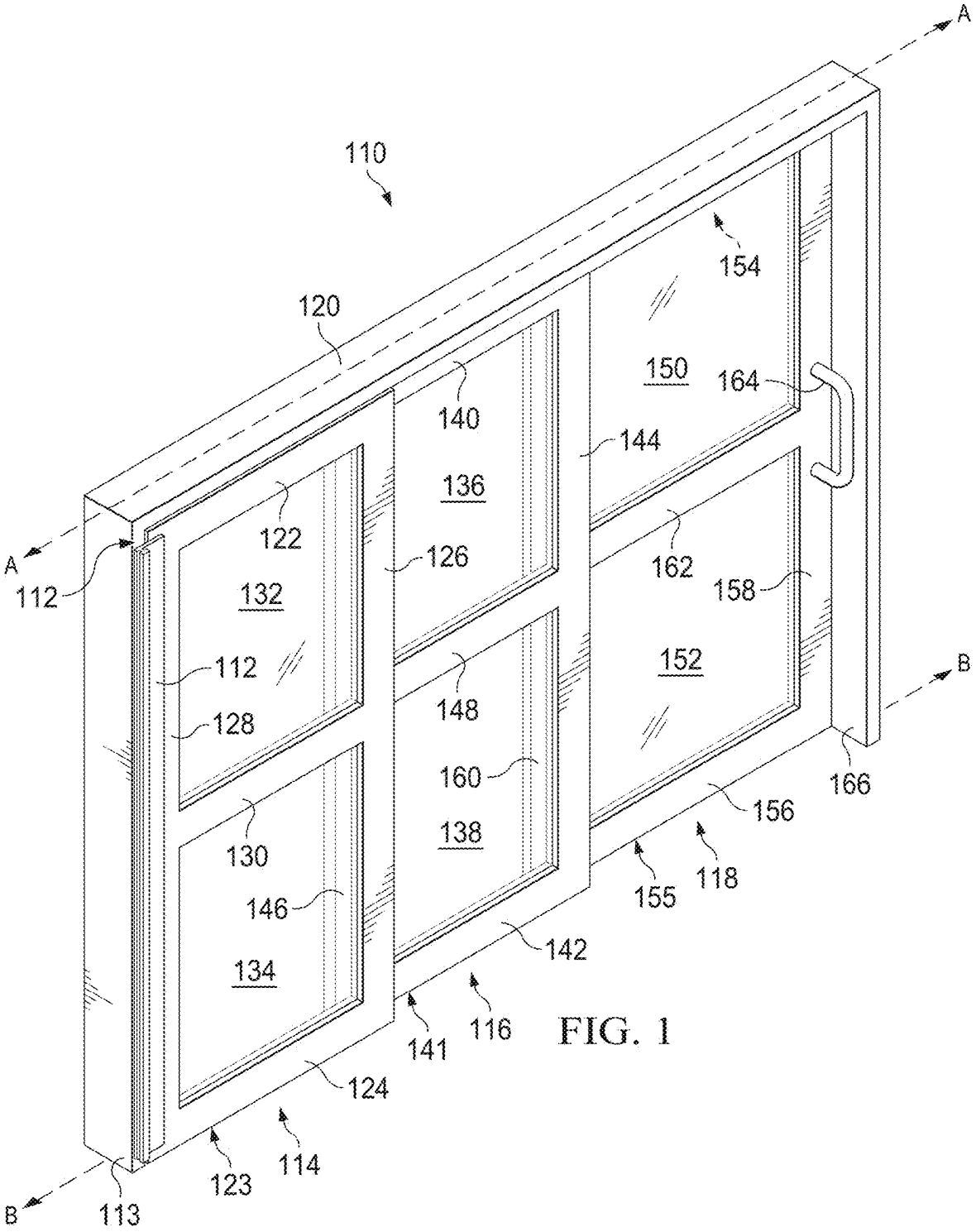

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FIG. 1

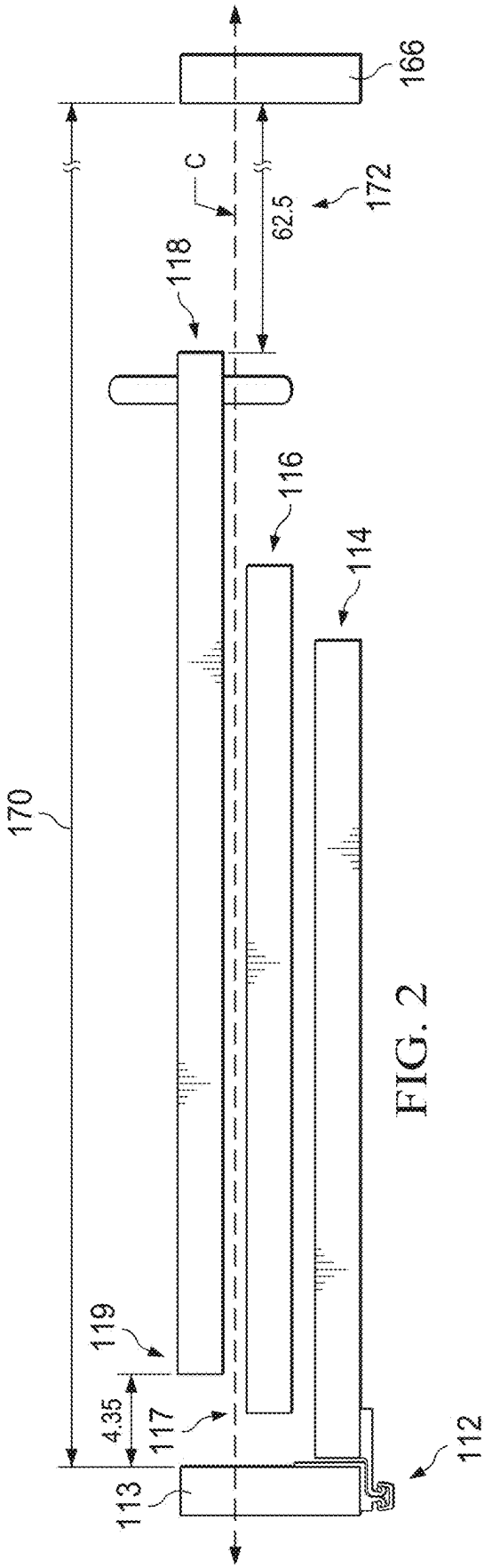

FIG. 2

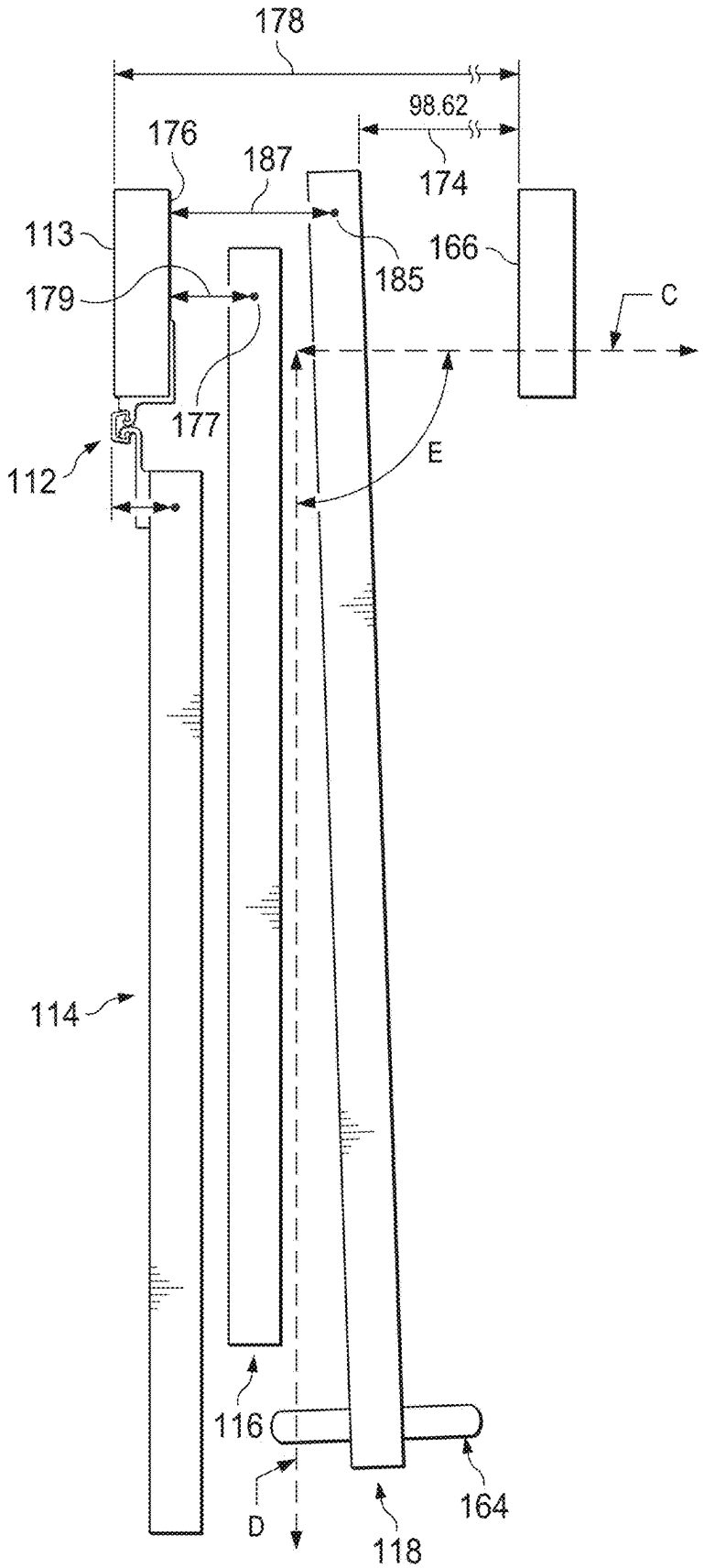

FIG. 3

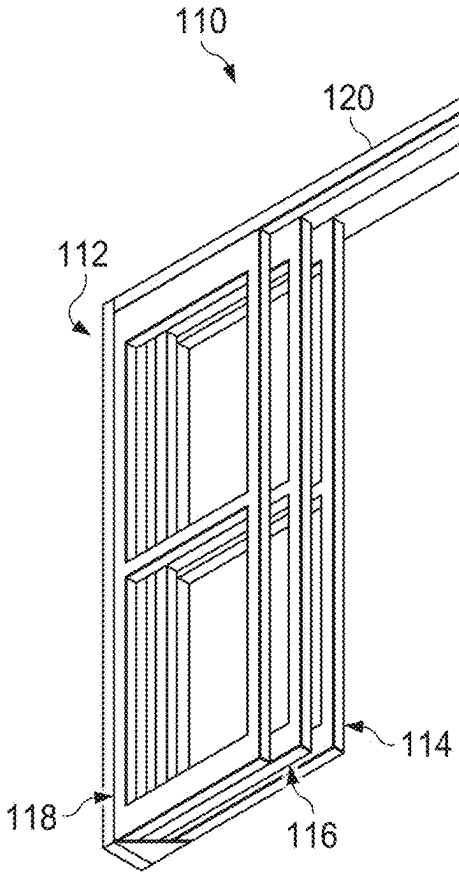

FIG. 4

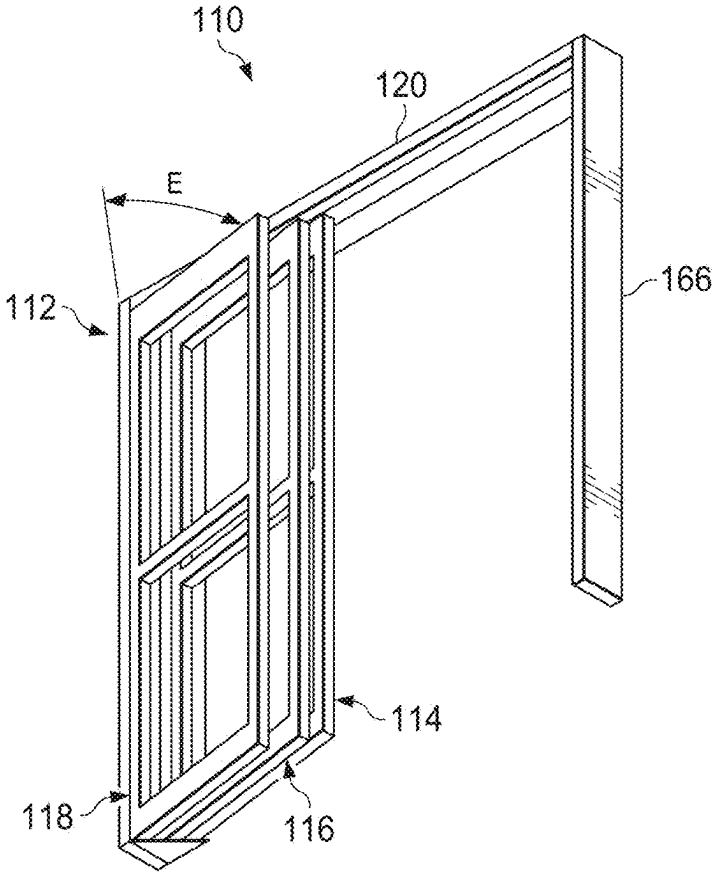

FIG. 5

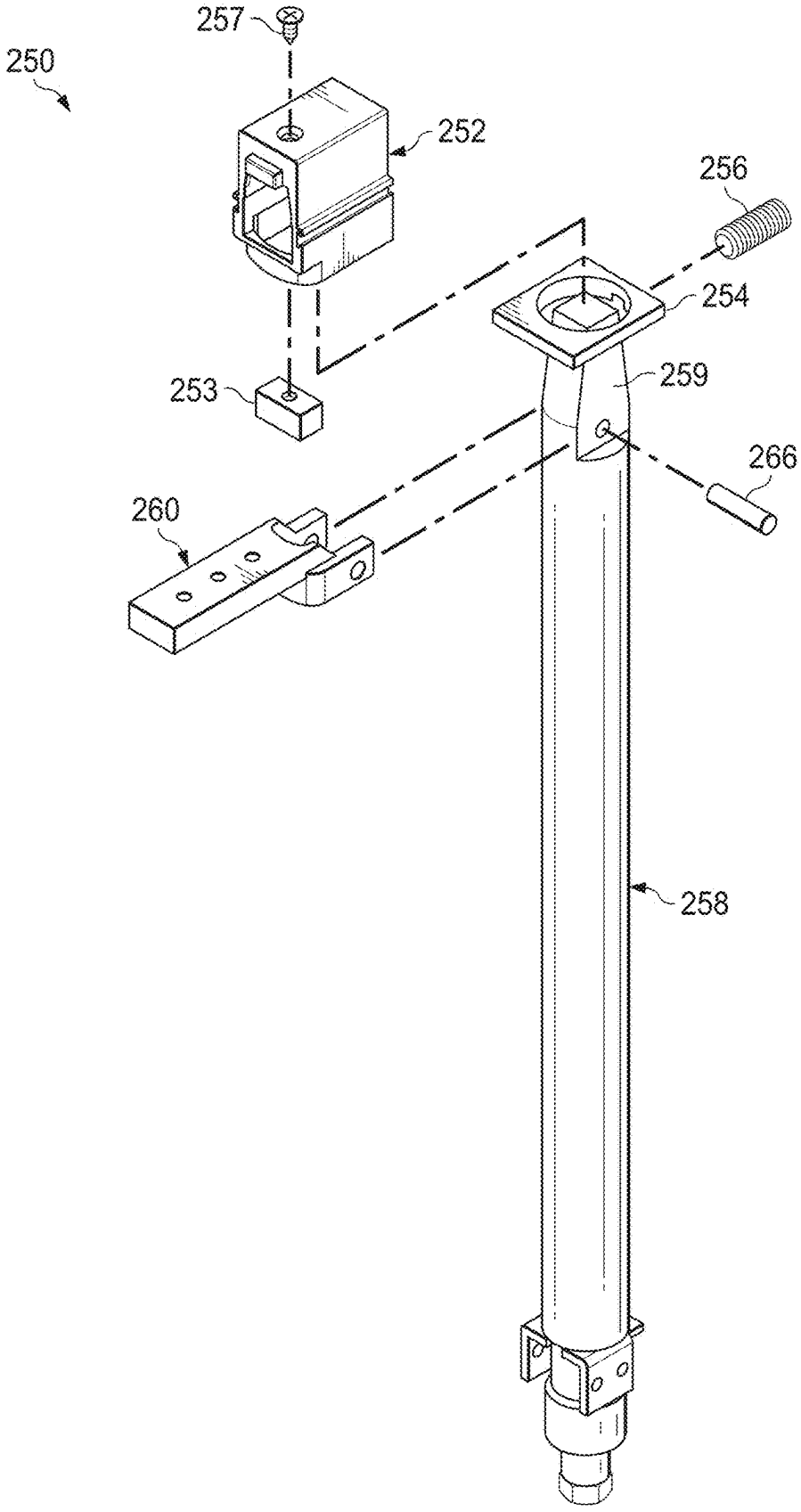

FIG. 6

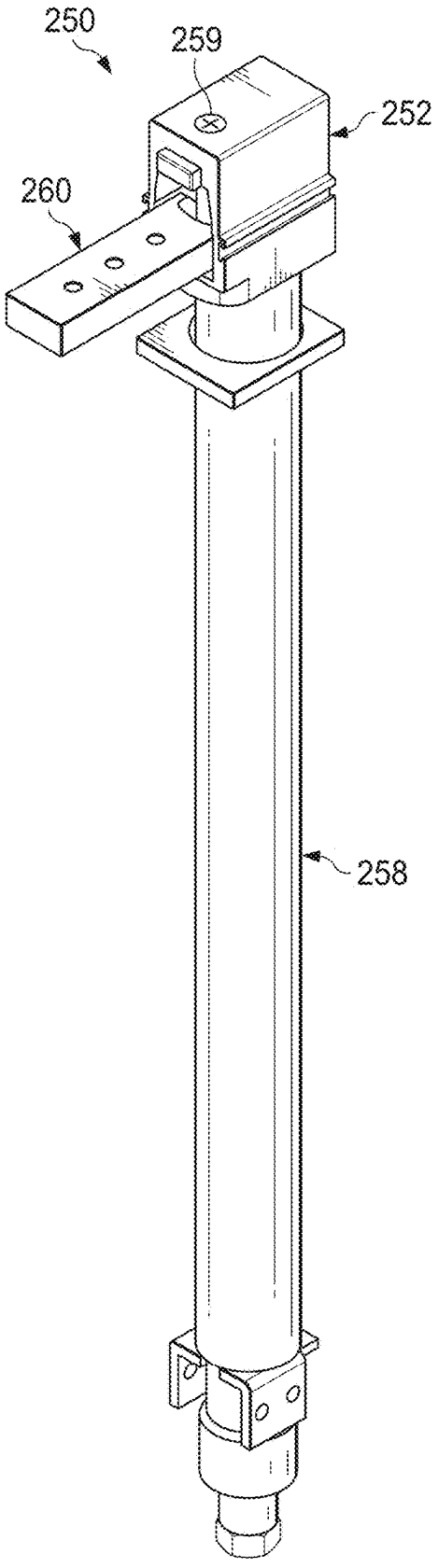

FIG. 7

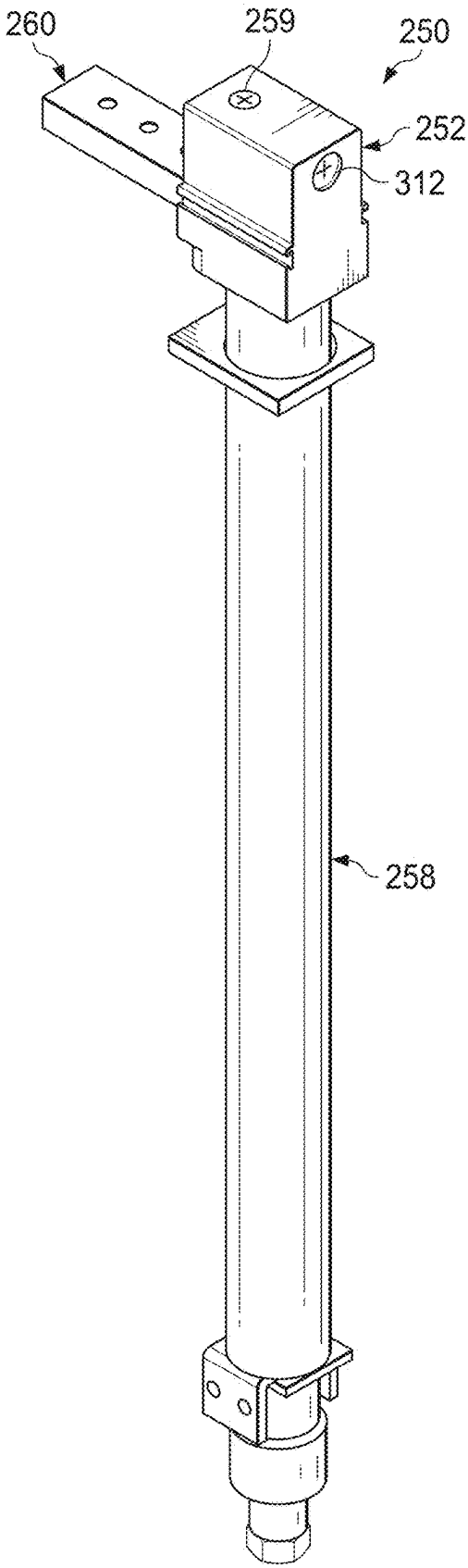

FIG. 8

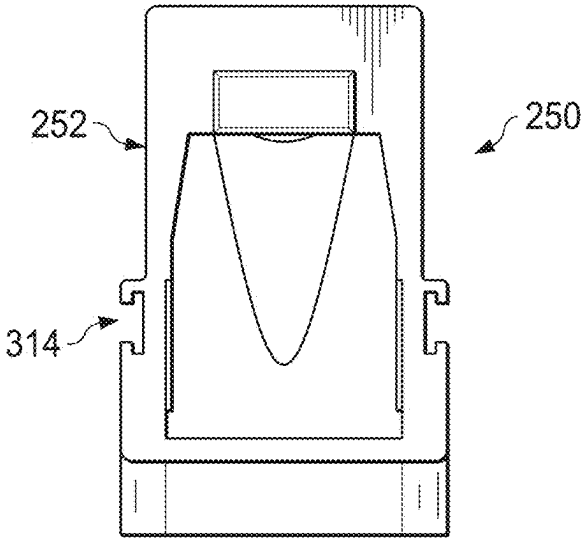

FIG. 9A

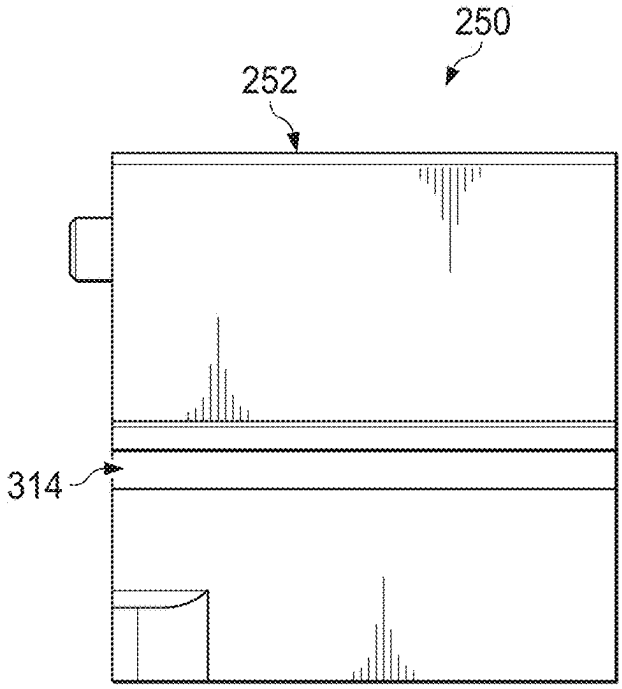

FIG. 9B

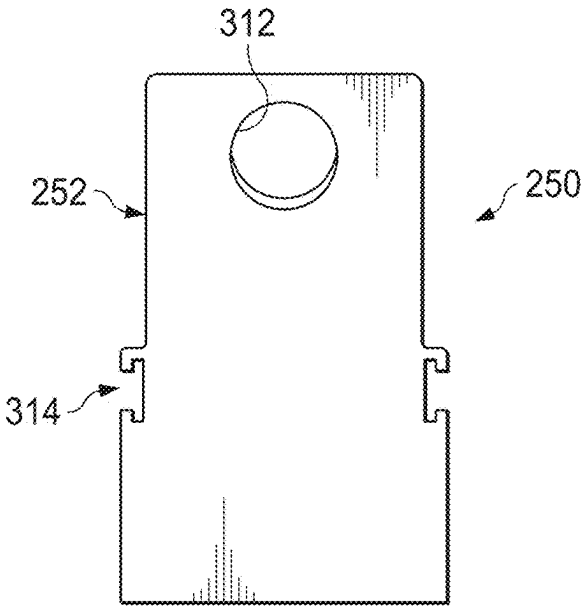

FIG. 9C

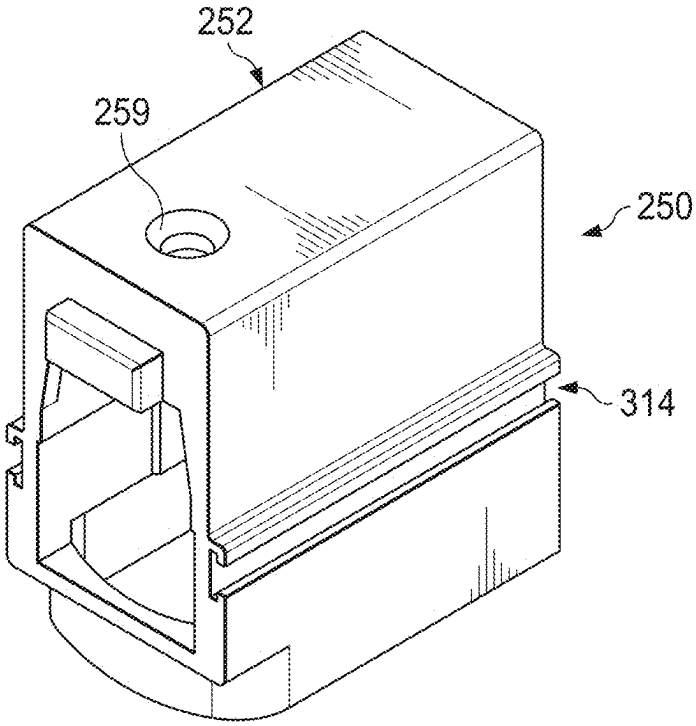

FIG. 9D

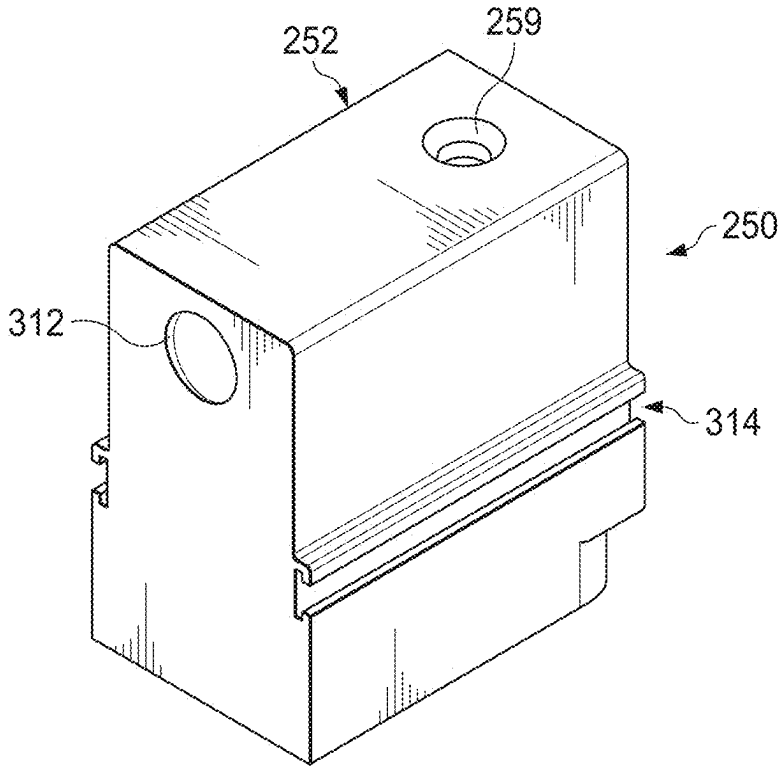

FIG. 9E

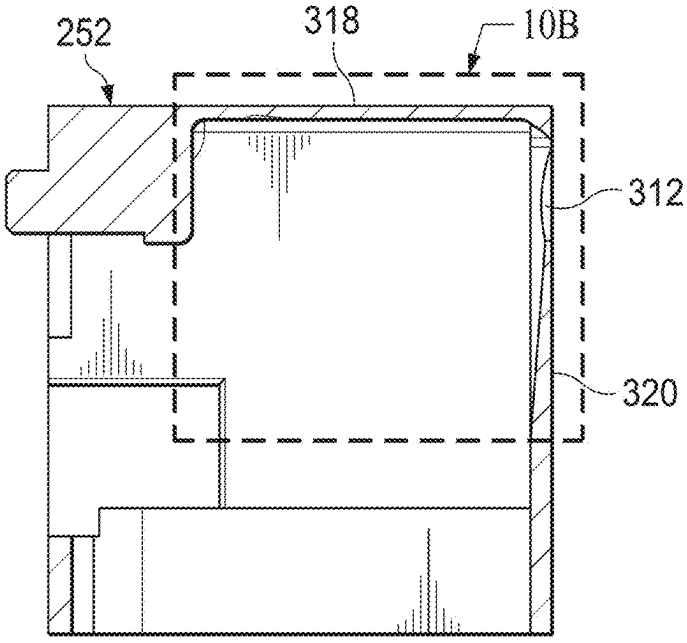

FIG. 10A

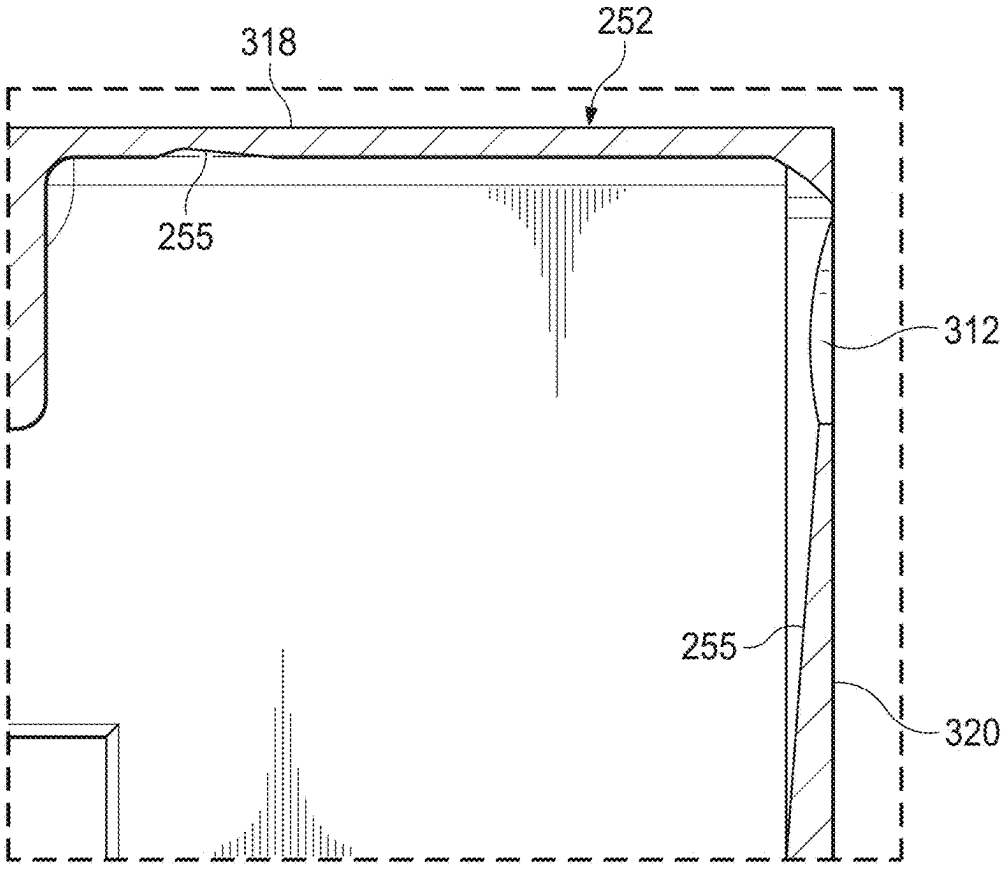

FIG. 10B

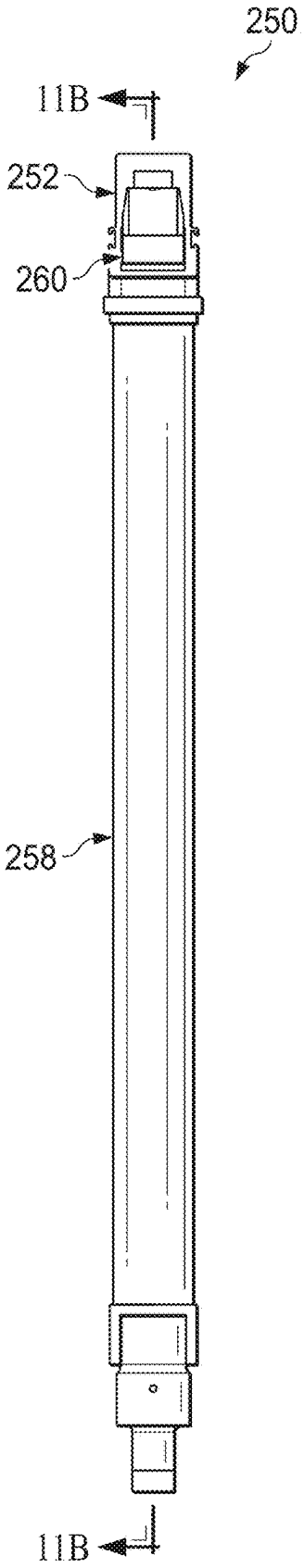

FIG. 11A

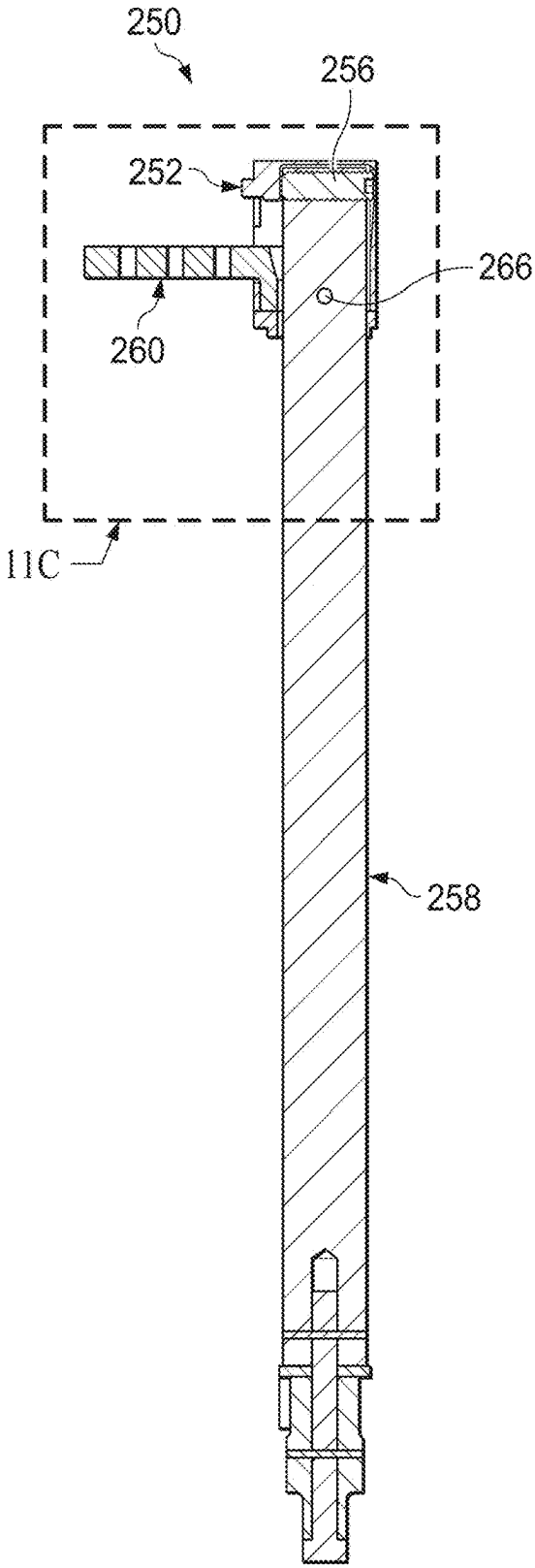

FIG. 11B

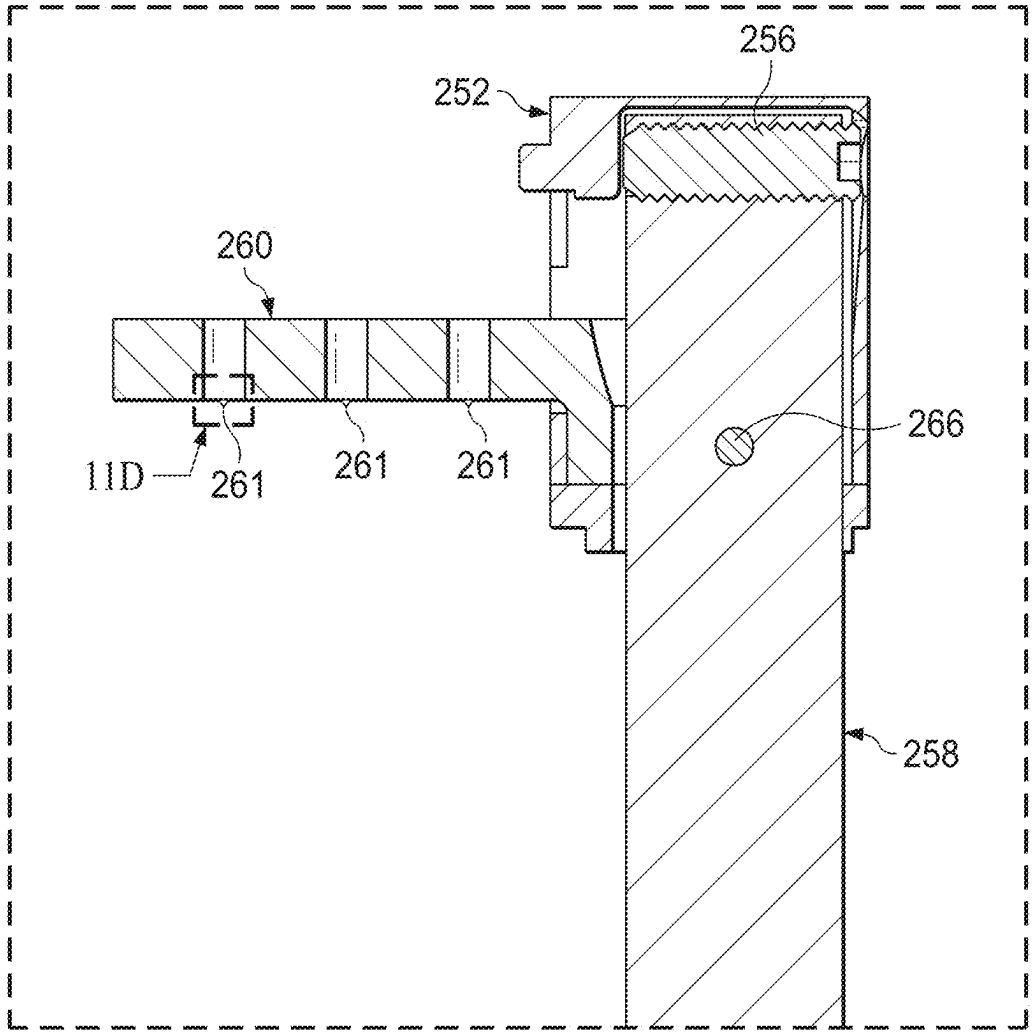

FIG. 11C

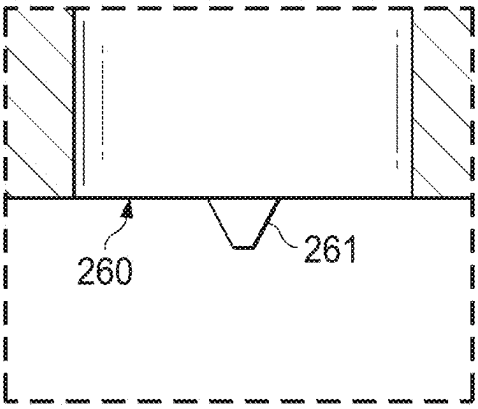

FIG. 11D

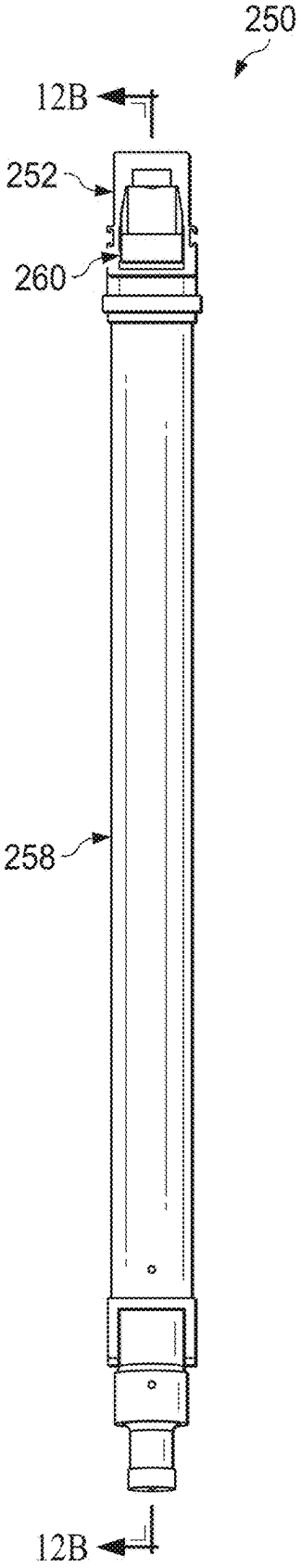

FIG. 12A

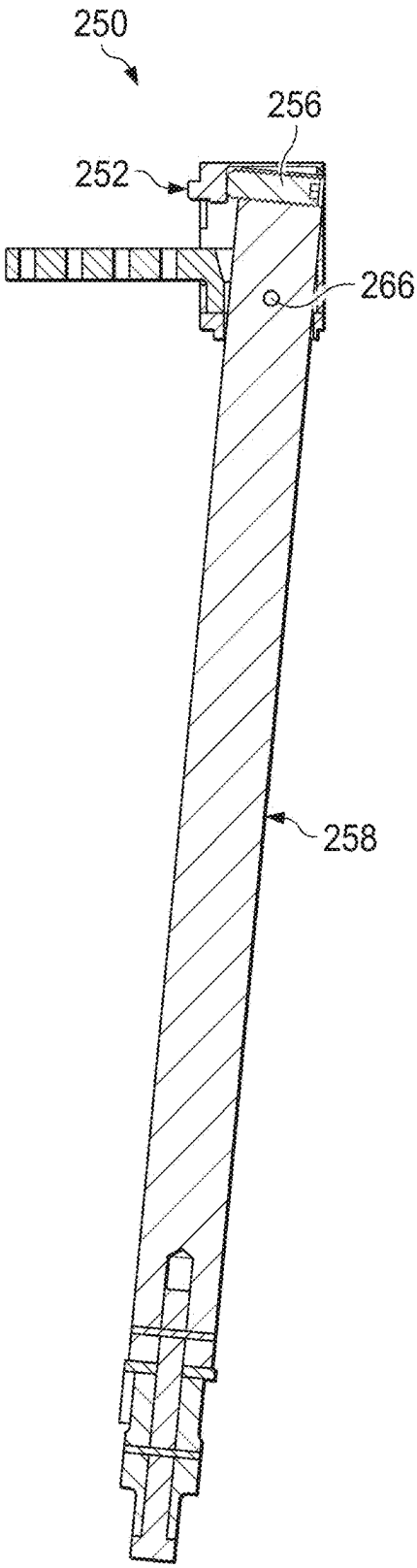

FIG. 12B

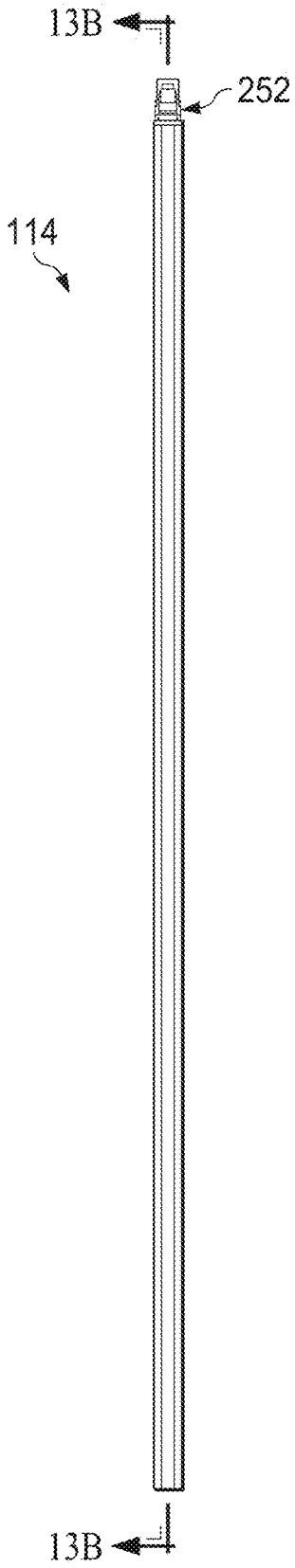

FIG. 13A

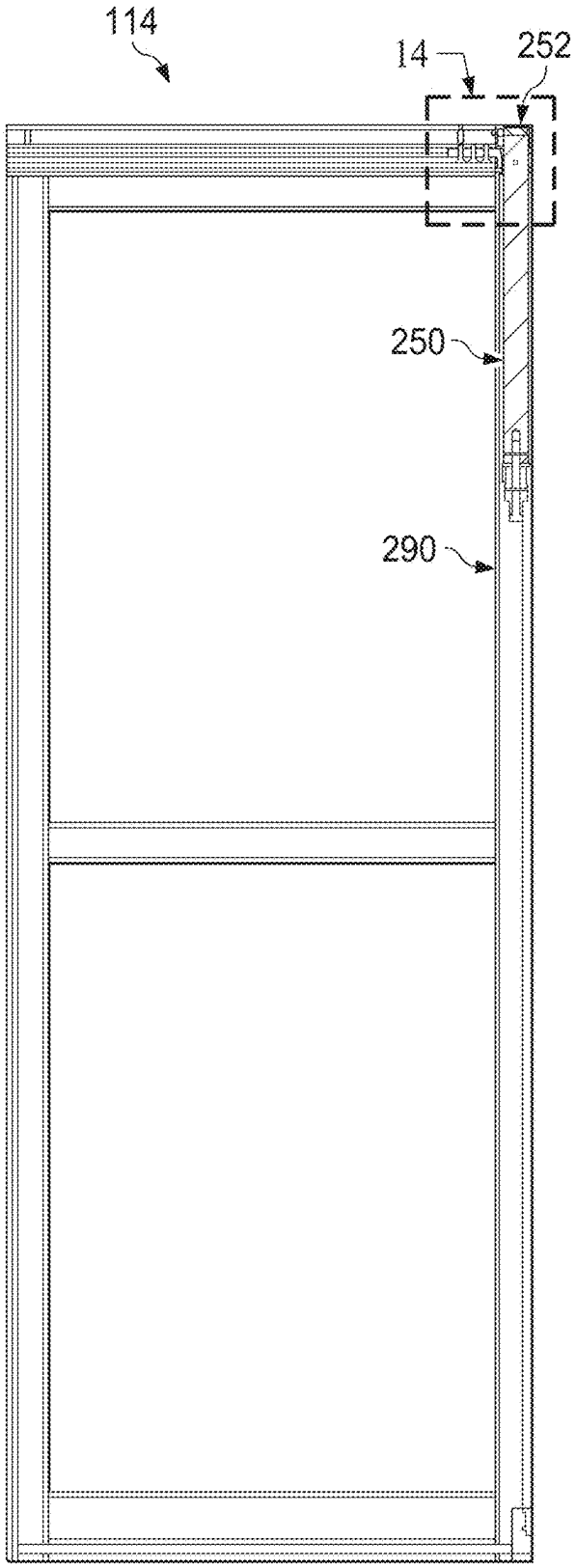

FIG. 13B

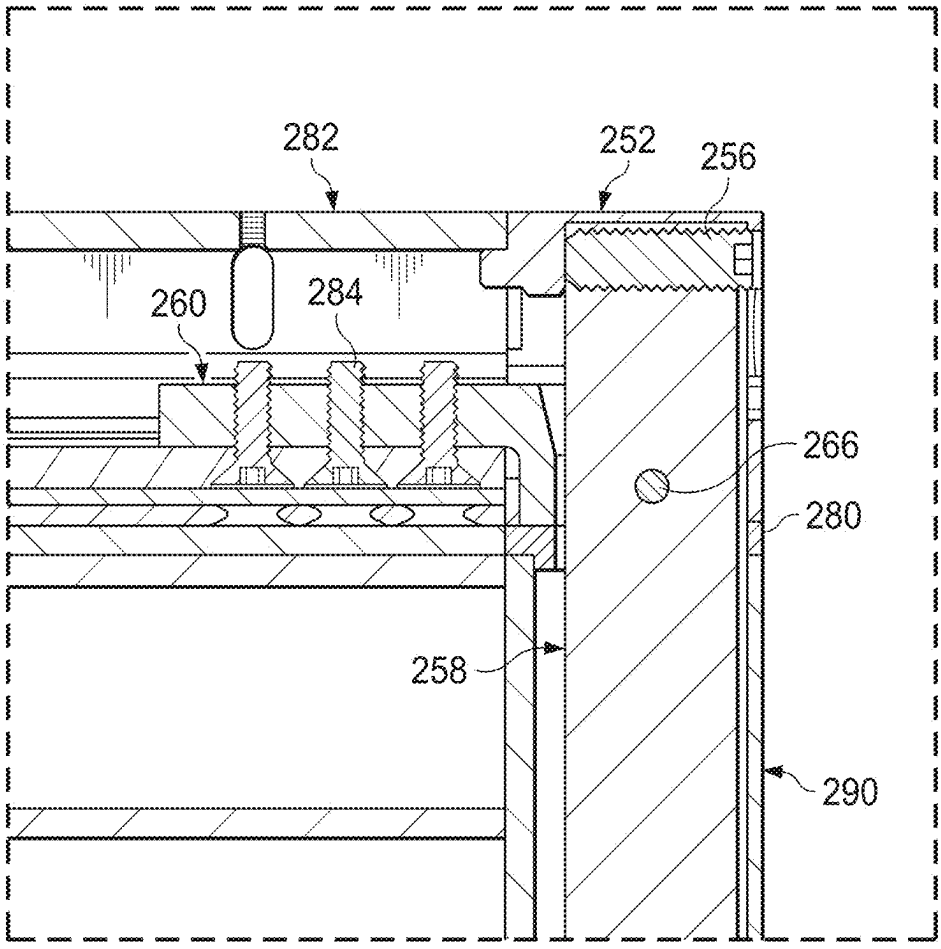

FIG. 14

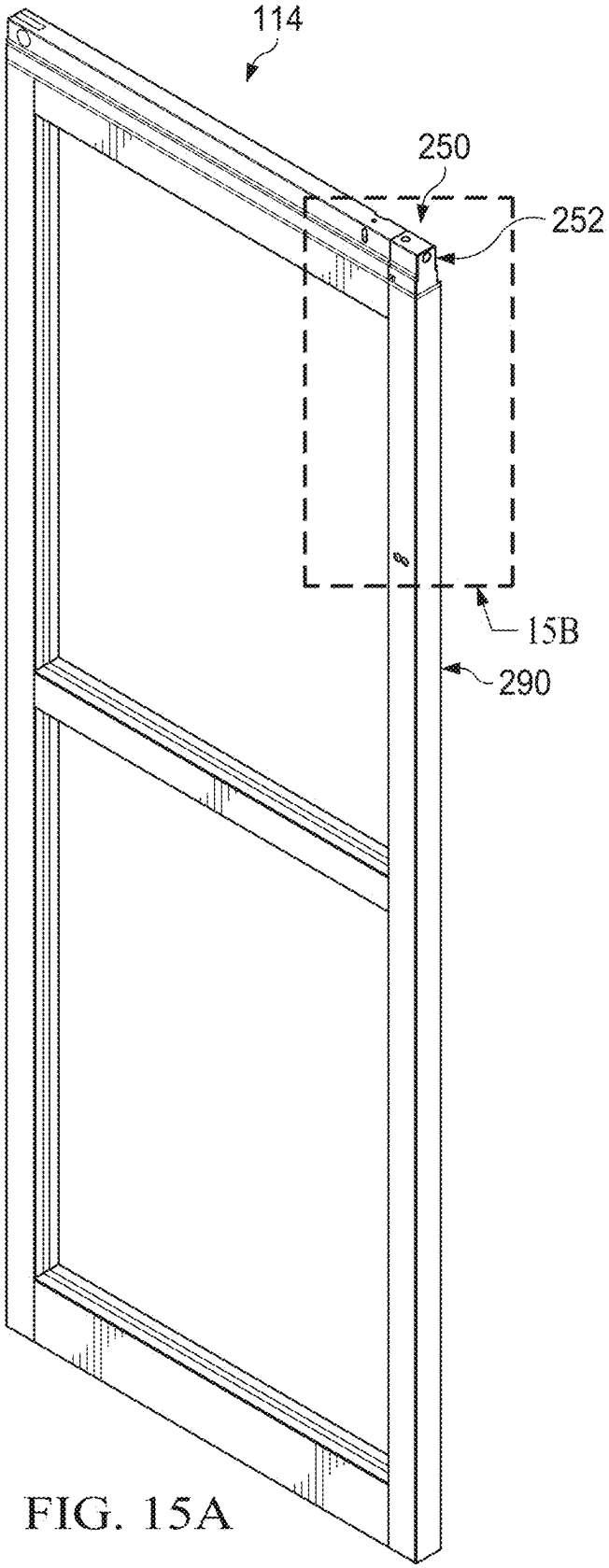

FIG. 15A

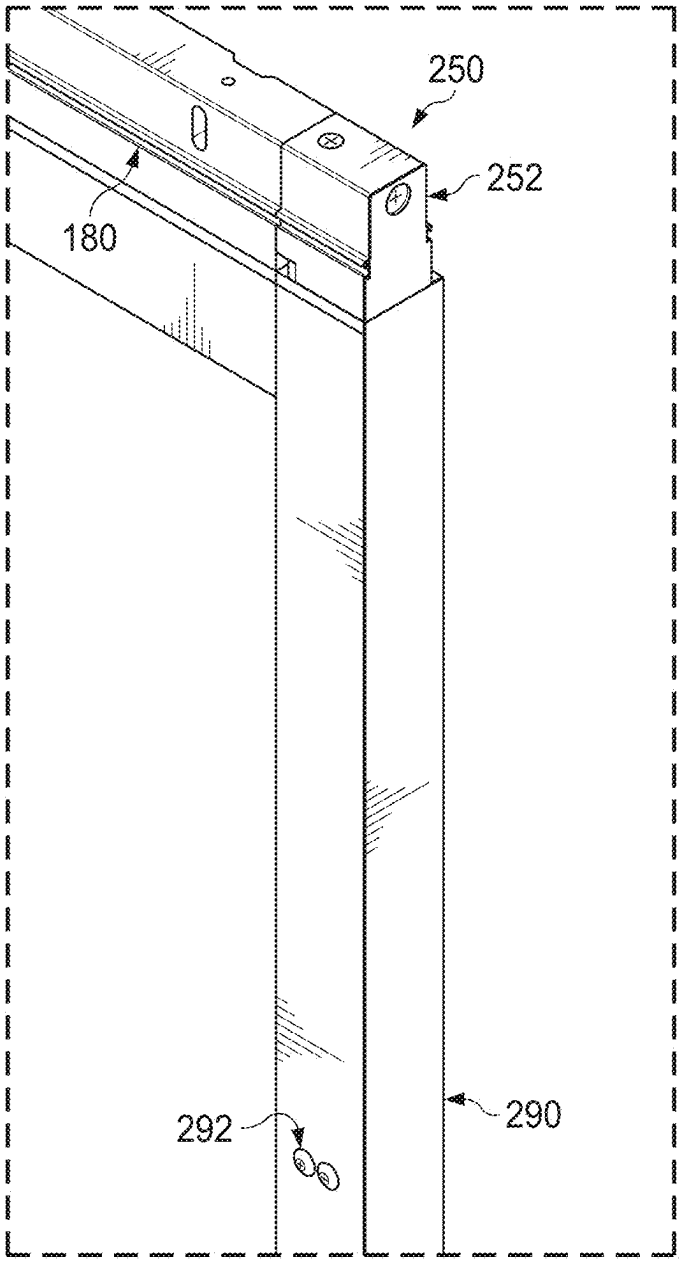

FIG. 15B

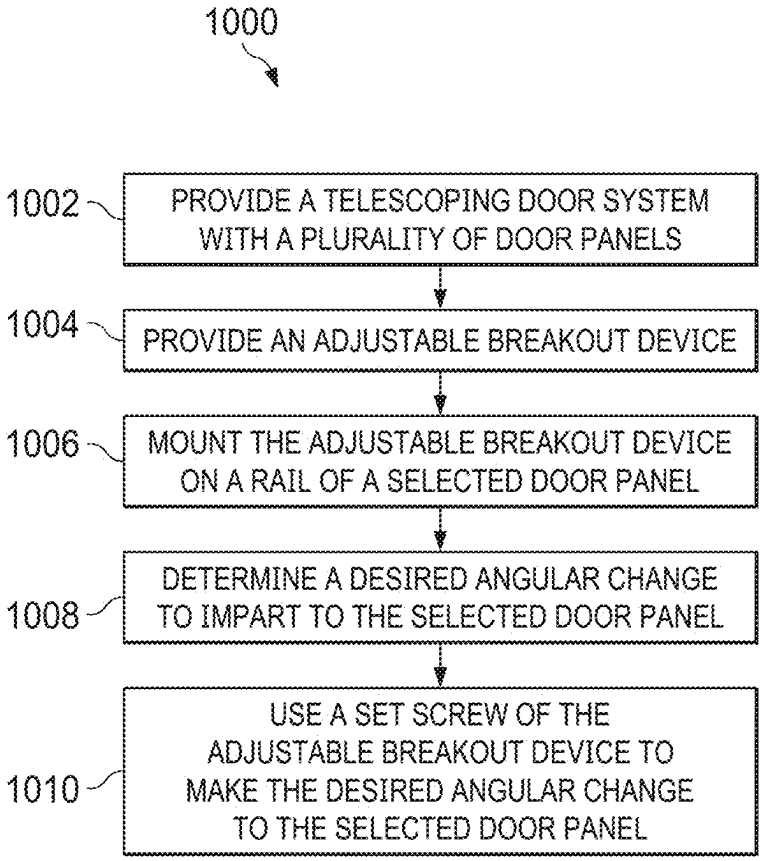
1000
1002
PROVIDE A TELESCOPING DOOR SYSTEM WITH A PLURALITY OF DOOR PANELS
1004
PROVIDE AN ADJUSTABLE BREAKOUT DEVICE
1006
MOUNT THE ADJUSTABLE BREAKOUT DEVICE ON A RAIL OF A SELECTED DOOR PANEL
1008
DETERMINE A DESIRED ANGULAR CHANGE TO IMPART TO THE SELECTED DOOR PANEL
1010
USE A SET SCREW OF THE ADJUSTABLE BREAKOUT DEVICE TO MAKE THE DESIRED ANGULAR CHANGE TO THE SELECTED DOOR PANEL

FIG. 16

ADJUSTABLE BREAKOUT DEVICE

PRIORITY

This application claims the benefit of the filing date of U.S. Provisional Application No. 63/597,234, filed Nov. 8, 2023, which is incorporated herein by reference in its entirety.

This application is related to U.S. application Ser. No. 18/680,391 filed May 31, 2024, entitled "Breakout Crawl Arrester" and U.S. application Ser. No. 18/680,939 filed May 31, 2024, entitled "Adjustable Floor Mounted Pivot Plate", which are both incorporated by reference herein in their entirety.

TECHNICAL FIELD

The present disclosure relates generally to sliding door systems, and more particularly to sliding door systems with breakout functionality. In particular, the sliding door system may include an adjustable breakout device that lends support to the panels of the door during a breakout procedure.

BACKGROUND

Sliding door systems are sometimes used as entryways and exits to intensive care units ("ICU") and critical care units in hospitals, among other places. In particular, patient rooms in these units are often equipped with large manual sliding doors. The doors are often glass (sometimes in aluminum door frames) to allow medical professionals a view of the patients that need round-the-clock monitoring. Because stretchers, wheelchairs, and other medical equipment are frequently moved in and out of the ICU, sliding doors are often employed. ICUs and other hospital facilities also have certain environmental standards that should be maintained to ensure a healthy environment for patient recovery which impact the type of doors available for use. For example, in certain ICUs, the sliding doors do not have tracks to reduce the ingress of contaminants. For example, many intensive care units have sliding doors that are supported without a bottom track that is fixed to the floor. In these types of doors, the upper track provides the primary support and guides the linear motion of the door as it slides to open and close. However, this design can involve putting a large amount of weight on only a few small components of the door, which may lead to wear and damage over time, as well as decreased functionality of the doors.

Another requirement of some sliding doors such as those used in a hospital application is the ability to "breakout." That is, these doors should have the ability to rotate off the track, so that a pushing force will cause the door to swing open. The terms "breakout," "breakaway," and "swingout" refer to the ability of the door to be opened by rotating the panels of the door off of the track, as opposed to the normal sliding motion of the panels. The breakout feature may be employed in various circumstances such as for an emergency or to accommodate larger equipment such as gurneys or patient beds, and should be able to be accomplished without requiring detailed knowledge of the workings of the door or specific steps that must be followed to allow emergency egress through a telescoping sliding door that has been broken away.

However, many existing breakout doors are problematic because they lack sufficient support for the weight required for the breakout door panels. For example, breakout doors are generally only supported by one or two support points.

The components bearing this weight may wear out over time and cause damage to the door system and floor beneath.

Another limiting aspect to many breakout capable sliding doors is that the weight distribution for the door system is set at installation. Once the door is built, the breakout system is set and consequently cannot be adjusted in the field. Many of these sliding door systems experience imbalances during breakout procedures that may cause damage to the door panels or floor over time. Therefore, needs exist for more robust telescoping doors with breakout functionality that are adjustable.

SUMMARY

One or more of the foregoing needs may be met by embodiments in accordance with the present disclosure, wherein, embodiments may include an adjustable breakout device for use with a sliding door system. The adjustable breakout device may include: a support bar configured to extend vertically with respect to a door panel of the sliding door system; a housing configured to be mounted on an upper portion of the support bar; a bracket configured to be mounted on the upper portion of the support bar and within a portion of the housing; a set screw configured to pass through the housing and through the upper portion of the support bar, such that the set screw bears against a proximal end of the housing; and a pivot configured to pass through a first protrusion of the bracket, the support bar, and a second protrusion of the bracket, respectively, wherein when the set screw is turned to put pressure on the proximal end of the housing, the support bar rotates about the pivot.

In some implementations, the support bar is configured to be mounted within a vertical rail of the door panel of the sliding door system. The support bar rotating about the pivot may impart a change in a suspension angle of the door panel. The first protrusion and the second protrusion of the bracket may form a U shape configured to extend around the support bar. The bracket further may further include a bar extending approximately horizontally with respect to the door panel, the bracket comprising a proximal end of which is connected to the U shape formed by the first and second protrusions of the bracket.

In some implementations, the bar of the bracket is configured to be mounted to a horizontal rail of the door panel. The upper portion of the support bar may include a first flat region and a second flat portion on an opposite side of the support bar as the first flat region. The first protrusion may be aligned with the first flat region and the second protrusion may be aligned with the second flat region. The housing may include a first sidewall and a second sidewall opposite the first sidewall, wherein the first sidewall is aligned with the first flat region and the second sidewall is aligned with the second flat region. The housing may include a third sidewall perpendicular to the first and second sidewalls, wherein the third sidewall comprises a first hole that is sized for the set screw to pass therethrough. The set screw may be configured to pass through the first hole of the housing and through a second hole in the upper portion of the support passing between the first and second flat regions.

A sliding door system with breakout functionality is also provided, which may include: a first door panel configured to be mounted to a top rail, the first door panel comprising a first pivot point about which the first door panel is configured to rotate in a breakout procedure; a second door panel configured to be mounted to the top rail, the second door panel configured to slide linearly with respect to the first door panel, the second door panel comprising a second

pivot point about which the second door panel is configured to rotate in a breakout procedure; an adjustable breakout system mounted on a vertical rail of the second door panel, the adjustable breakout system including: a support bar configured to extend along the vertical rail of the second door panel; a housing configured to be mounted on an upper portion of the support bar; a bracket configured to be mounted on the upper portion of the support bar and within a portion of the housing; a set screw configured to pass through the housing and through the upper portion of the support bar, such that the set screw bears against a proximal end of the housing; and a pivot configured to pass through the bracket and the support bar, wherein an angle at which the second door panel hangs with respect to the top rail is changed when the set screw is turned, which in turn causes the support bar to rotate about the pivot.

In some implementations, the bracket includes a first protrusion and a second protrusion forming a U shape that is configured to extend around the support bar. The bracket may also include a bar extending approximately horizontally, the proximal end of which is connected to the U shape formed by the first and second protrusions of the bracket. The bar of the bracket may be configured to be mounted to a horizontal rail of the second door panel. The upper portion of the support bar may include a first flat region and a second flat portion on an opposite side of the support bar as the first flat region. A first protrusion of the bracket may be aligned with the first flat region and a second protrusion of the bracket is aligned with the second flat region.

A method for adjusting a sliding door system with breakout functionality is also provided, which may include: providing a door panel of the sliding door system, the door panel suspended from a mounting rail; providing an adjustable breakout device mounted on the door panel, the adjustable breakout device comprising a support bar configured to extend vertically along the door panel, a housing configured to be mounted on an upper portion of the support bar, a bracket configured to be mounted on the upper portion of the support bar and within a portion of the housing, a set screw configured to pass through the housing and through the upper portion of the support bar, and a pivot configured to pass through the bracket and the support bar; determining a desired angular change to an angle at which the door panel is suspended from the mounting rail; and turning the set screw of the adjustable breakout device to bear against an inner wall of the housing with a steel block to change the angle at which the door panel is suspended from the mounting rail to achieve the desired angular change.

The method may also include mounting the bracket to a horizontal rail of the door panel. The method may include turning the set screw by accessing the set screw though a hole in the housing.

There has thus been outlined, rather broadly, certain embodiments of the invention in order that the detailed description thereof herein may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional embodiments of the invention that will be described below and which will form the subject matter of the claims appended hereto.

In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of embodiments in addition to those described and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein, as well as the abstract, are for the purpose of description and should not be regarded as limiting.

As such, those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

Additional features, advantages, and aspects of the disclosure may be set forth or apparent from consideration of the following detailed description, drawings, and claims. Moreover, it is to be understood that both the foregoing summary of the disclosure and the following detailed description are exemplary and intended to provide further explanation without limiting the scope of the disclosure as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the disclosure, are incorporated in and constitute a part of this specification, illustrate aspects of the disclosure and together with the detailed description serve to explain the principles of the disclosure. No attempt is made to show structural details of the disclosure in more detail than may be necessary for a fundamental understanding of the disclosure and the various ways in which it may be practiced. In the drawings:

FIG. **1** shows a perspective view of a telescoping door system according to an embodiment of the present disclosure.

FIG. **2** is an illustration of a top view of the telescoping door system shown in FIG. **1** in a standard (or non-breakout) position according to an embodiment of the present disclosure.

FIG. **3** is an illustration of a top view of the telescoping door system shown in FIG. **1** shown in a breakout position according to an embodiment of the present disclosure.

FIG. **4** is a perspective view of a door frame for a door system where the doors are in a non-broken out position according to an embodiment of the present disclosure.

FIG. **5** is a perspective view of a door frame for a door system where the doors are in a broken out position according to an embodiment of the present disclosure.

FIG. **6** is an exploded view of an adjustable breakout device according to an embodiment of the present disclosure.

FIG. **7** is a front perspective view of an adjustable breakout device according to an embodiment of the present disclosure.

FIG. **8** is a rear perspective view of an adjustable breakout device according to an embodiment of the present disclosure.

FIG. **9**A is a front perspective view of a housing of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **9**B is a cross-sectional view of a housing of the adjustable breakout device along line F according to an embodiment of the present disclosure.

FIG. **9**C is a rear perspective view of a housing of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **9**D is a perspective view of a housing of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **9**E is a perspective view of a housing of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **10**A is a cross-sectional view of the housing of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **10**B is a magnified cross-sectional view of area G in FIG. **10**A of the housing of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **11**A is a perspective view of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **11**B is a cross-sectional view of the adjustable breakout device along line H according to an embodiment of the present disclosure.

FIG. **11**C is a magnified cross-sectional view of area J in FIG. **11**B of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **11**D is a magnified cross-sectional view of area K in FIG. **11**C of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **12**A is a perspective view of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **12**B is a cross-sectional view of the adjustable breakout device along line L according to an embodiment of the present disclosure.

FIG. **13**A is a side perspective view of a door panel of the door assembly according to an embodiment of the present disclosure.

FIG. **13**B is a cross-sectional view of a door panel of the door assembly along line M according to an embodiment of the present disclosure.

FIG. **14** is a magnified cross-sectional view of area N in FIG. **13**B of the adjustable breakout device according to an embodiment of the present disclosure.

FIG. **15**A is a perspective view of a door panel of the door assembly according to an embodiment of the present disclosure.

FIG. **15**B is a magnified view of area O in FIG. **15**A of a door panel of the door assembly according to an embodiment of the present disclosure.

FIG. **16** is a flowchart illustrating a method for using a telescoping door system with an adjustable breakout device according to embodiments of the present disclosure.

DETAILED DESCRIPTION

The aspects of the disclosure and the various features and advantageous details thereof are explained more fully with reference to the non-limiting aspects and examples that are described and/or illustrated in the accompanying drawings and detailed in the following description. It should be noted that the features illustrated in the drawings are not necessarily drawn to scale, and features of one aspect may be employed with other aspects as the skilled artisan would recognize, even if not explicitly stated herein. Descriptions of well-known components and processing techniques may be omitted so as to not unnecessarily obscure the aspects of the disclosure. The examples used herein are intended merely to facilitate an understanding of ways in which the disclosure may be practiced and to further enable those of skill in the art to practice the aspects of the disclosure. Accordingly, the examples and aspects herein should not be construed as limiting the scope of the disclosure, which is defined solely by the appended claims and applicable law. Moreover, it is noted that like reference numerals represent similar parts throughout the several views of the drawings.

FIG. **1** is a perspective view of a sliding door system (such as a telescoping door system) **110** which may include door panels **114**, **116**, **118** (which may also be referred to as doors). In particular, the telescoping door system **110** may include a sidelite panel **114**, a slow slide panel **116**, and a fast slide panel **118**. The panels or door panels **116**, **118** are slidable and all panels **114**, **116**, and **118** are able to pivot (i.e., suitable for breakout). When the panels **116** and **118** are slid to the closed position, this may be referred to as the slide closed position as shown in FIG. **1**. The sidelite panel **114** is coupled to the trailing door jamb **113** for pivotal movement, however, the sidelite panel **114** does not move linearly. The slide panels **116**, **118** are also known as the Swing Slide or "SX," panels or doors and the sidelite panel **114** is known as the Swing Only or "SO" panel or door.

The teachings of the present disclosure are not limited to any type of telescoping door system, but are applicable to any type of sliding door system in general This may include the three-panel telescoping door system shown in the figures, and may be also employed with a dual-panel slide/swing door system. In this case, the telescoping door system **110** would include a single sliding door panel (such as **116**) as well as a nonsliding door panel (such as **114**). In other implementations, two, three, or more than three door panels may be included in the telescoping door system **110**.

In some implementations, the door panels **114**, **116**, **118** are arranged to extend in approximately the same direction such that the door panels **114**, **116**, **118** may be configured to fully or partially close a doorway. In particular, the sidelite panel **114** may be configured to stay relatively motionless during opening or closing of the door system **110**, whereas slide panels **116**, **118** are configured to move relative to the first door panel **114**. The slow slide panel **116** is immediately coupled to the sidelite panel **114**, and the fast slide panel **118** is immediately coupled to and leads the slow slide panel **116**. The slide panels **116**, **118** and the sidelite panel **114** may be supported by a header **120**. The header **120** may include a track that guides the linear motion of the slide panels **116**, **118** of the telescoping door system **110** (i.e., along path A as shown in FIG. **1**). According to certain embodiments, the header **120** may be aluminum or nylon covered aluminum. The slide panels **116**, **118** move linearly with respect to the sidelite panel **114** in a telescoping manner with the fast slide panel **118** leading and controlling the linear movement of the slow slide panel **116**. This linear movement may also be referred to as sliding movement. The bottom of the slow slide panel **116** may also be guided by a track that is generally located on the underside of the sidelite panel **114** (i.e., running along path B as shown in FIG. **1**). The bottom of the fast slide panel **118** is guided by a track formed in a bottom rail **142** of the slow slide panel **116**.

With reference to FIGS. **1**-**5**, the telescoping door system **110** may also include a breakout hinge **112** that allows the panels **114**, **116**, **118** of the door system **110** to be broken out. When broken out, the panels **114**, **116**, **118** are able to rotate about the breakout hinge **112** along path E (shown in FIGS. **3** and **5**). Breaking out the panels **114**, **116**, **118** may create a large opening through which oversized equipment, furniture, and the like may fit through. While a specific type of hinge **112** (swing clear continuous geared hinge) is shown in FIG. **2** and FIG. **3**, any typical hinge **112** (piano, pin, or any other suitable hinge) may be used as appreciated by one of ordinary skill in the art after reviewing this disclosure.

FIG. **2** is a schematic of a top, plan view of the telescoping door system **110** illustrating the distances of the various panels **114**, **116**, **118** with respect to the door jambs **113**, **166** to illustrate the fully open position (sometimes referred to as the slide open position) of the telescoping door system **110**. The area between the lead jamb **166** and the trailing jamb **113** is referred to as the clear opening **170**. According to one embodiment, the distance of the clear opening **170** may be 100-120 inches, for example 108 inches. Each of the door panels **114**, **116**, **118** is disposed in the clear opening **170**, and a portion of the clear opening **170** defines the slide opening **172** and the breakout opening **174** (also referred to as a pivot opening or a swing opening) (see FIG. **3**). The slide opening **172** is present and at its greatest length when the slide panels **116**, **118** are fully slid open linearly. That is, the slow slide panel **116** and the fast slide panel **118** are each positioned linearly closest to the trailing jamb **113**. The panels **114**, **116**, **118** of the telescoping door system **110** may be configured to slide along line C as shown in FIG. **2**.

FIG. **3** illustrates a schematic of a top, plan view of the telescoping door system **110** which has been broken out. In particular, the panels **114**, **116**, **118** have been pivoted such from their original arrangement along line C to a breakout line D (where angle E is the angle between lines C and D). This breakout position forms breakout opening **174**. The pivot motion of the sidelite panel **114** is facilitated by the hinge **112**. The breakout opening **174** illustrated in FIG. **3** is created when each of the slide panels **116**, **118** are positioned closest to the trailing jamb **113** and each of the slide panels **116**, **118** and the sidelite panel **114** are pivoted such the panels **114**, **116**, **118** are rotated approximately 90 degrees toward the sidelite side of the clear opening **170**. In other implementations, the panels **114**, **116**, **118** may be rotated less than 90 degrees in a breakout position.

In this breakout position, the panels **114**, **116**, **118** cannot be linearly moved with respect to each other to close the slide opening **172**. The breakout opening **174** is significantly larger than the slide opening **172**. In a hospital, the slide opening **172** is used for ingress and egress of typical foot traffic, but if a bed or other large equipment needs to be moved through the door system **110**, the panels **114**, **116**, **118** may be pivoted to create the larger breakout opening **174**.

In some implementations, tracks **123**, **141**, **155** may be disposed in the underside of each of the door panels **114**, **116**, **118**, respectively. These tracks may be used to constrain and guide the motion of door panels **116**, **118** with respect to the other slide panels **114**, **116**, **118**. A pivot assembly may also be included that is disposed within these tracks **123**, **141**, **155**. This pivot assembly is discussed in further detail in the copending application entitled "Adjustable Breakout Device" which is incorporated by reference herein in its entirety.

The sidelite panel **114** may include a top rail **122**, a bottom rail **124**, a lead rail **126**, a trailing rail **128**, and a mid-rail **130**. An upper pane of glass **132** is framed by a portion of the lead rail **126**, the trailing rail **128**, the top rail **122**, and the mid-rail **130**. A lower pane of glass **134** is framed by portions of the lead rail **126**, the trailing rail **128**, the bottom rail **124**, and the mid-rail **130**. The slow slide panel **116** similarly includes upper and lower glass panes **136**, **138** framed by a top rail **140**, a bottom rail **142**, a lead rail **144**, a trailing rail **146**, and a mid-rail **148**. The fast slide panel **118** also includes upper glass pane **150** and lower glass pane **152** framed by an upper rail **154**, a bottom rail **156**, a lead rail **158**, a trailing rail **160**, and a mid-rail **162**. The rails may be made of any suitable material such as steel, other metals, PVC, wood, composites, or the like. However, in certain embodiments a lightweight material, such as aluminum may be used for the various rails of the door system **110**. According to an alternate embodiment, each panel may have no glass panes, one glass pane, two glass panes, or more than two glass panes.

A user may move the telescoping door system **110** from a fully open position to a fully closed position by manually applying a force to a handle **164** disposed on the lead rail **158** of the fast slide panel **118** to displace the fast slide panel **118** toward a lead jamb **166**. The fast slide panel **118** is linearly displaced a certain distance, and it catches the slow slide panel **116** and displaces it toward the lead jamb **166** until the fast slide panel **118** reaches the lead jamb **166**. The fast slide panel **118** may be positively latched to maintain the door system **110** in the fully closed position. To move the telescoping door system **110** from the fully closed position to the fully open position, the reverse occurs when the user applies the force to the fast slide panel **118** to linearly displace it toward the trailing jamb **113** (also referred to herein as a pivot jamb), and after the fast slide panel **118** is linearly displaced a certain distance, it catches the trailing end **117** (see FIG. **2**) of the slow slide panel **116** and displaces it toward the trailing jamb **113**. Alternatively, the linear motion of the slide panels **116**, **118** may be driven by an operator for automatic sliding movement of the panels **116**, **118**.

In pivoting the panels **114**, **116**, **118** to form the breakout opening **174**, each panel **114**, **116**, **118** may pivot on its own pivot axis **171**, **177**, **185**, respectively. Each pivot axis **171**, **177**, **185** location and door system **110** dimensions are selected to allow the other adjacent panels to pivot approximately 90 degrees without the panels **114**, **116**, **118** interfering with each other.

It should be understood that the slide open limit of the slow slide panel **116** is associated with its pivot axis **177**. So, when the slow slide panel **116** is slid open such that its trailing end **117** is positioned closest to the trailing jamb **113**, (as shown in FIG. **2**) the slow slide panel **116** is in position to allow it to pivot to its breakout position without interfering with the pivot motion of the sidelite panel **114**. The same is true for the fast slide panel **118**.

As shown in FIG. **3**, the pivot axis **177** of the slow slide panel **116** is disposed a distance **179** from the face **176** of the trailing jamb **113** and the pivot motion of the slow slide panel **116** does not interfere with the pivot motion of the sidelite panel **114**. Similarly, the pivot axis **177** of the slow slide panel **116** is disposed a closer distance **179** to the face **176** of the trailing jamb **113** than the distance **187** of the pivot axis **185** and the pivot motion of the fast slide panel **118** and does not interfere with the pivot motion of the slow slide panel **116**.

FIGS. **4** and **5** show a perspective view shown from the bottom from an angle of the door system **110**. FIG. **4** shows the door system **110** is a non-broken out or pivot closed position and FIG. **5** shows the door system **110** in a partially broken out or pivot closed position. The door system **110** includes the sidelite panel **114**, the slow slide panel **116**, and the fast slide panel **118**. The header **120** and lead jamb **166** are also shown.

The telescoping door system **110** may also be one half of a dual telescoping door system **110** where a second multi-panel telescoping door is disposed opposite the telescoping door system **110** such that a fully closed position has the two telescoping door systems **110** meeting each other in a center of the door frame or opening.

In some implementations, the telescoping door system **110** may include a floor mounted track passing along path B that may help to guide the linear or sliding motion of the

slide panels **116**, **118**. In other implementations, the telescoping door system may not include a floor mounted track. For example, in certain healthcare facilities such as an intensive care unit in a hospital, it may be undesirable to have a floor track.

In various implementations, the telescoping door system **110** may include one or more features that improve its functionality over existing designs, and in particular, allow the weight distribution of the door to be adjusted, ultimately improving the function of the door. These features include an adjustable breakout device **250** discussed in reference to FIGS. **6-16**. These features may also be included in a telescoping door system **110** that is configured for use in various applications. For example, in one implementation, a telescoping door system **110** may be used in a trackless configuration in a hospital that includes an adjustable breakout device **250**. In another embodiment, a telescoping door system **110** with an adjustable breakout device **250** may be used in a tracked configuration. The adjustable breakout device **250** may be used with the breakout crawl arrester and adjustable floor mounted pivot plate discussed in copending applications "Breakout Crawl Arrester" and "Adjustable Floor Mounted Pivot Plate" which are incorporated by reference herein in their entirety.

The adjustable breakout device **250** overcomes challenges faced by non-adjustable sliding doors. In particular, in existing sliding door systems, once the door is built, the breakout system is set and consequently cannot be adjusted in the field. Many of these sliding door systems experience imbalances during breakout procedures that may cause damage to the door panels or floor over time. Some sliding door systems have a series of angled machined cuts, one of which is built into the door panel and the angle of the machine cut selected is determined by the width of the door panel. The wider the door panel, the steeper the angle. The angle of the cut may determine the strength of the breakout system, and accordingly, these machined cuts are only suitable to be used for a narrow range of door weights. This means that if a door weight goes outside of that range, the proper functionality of the door is impaired. In the field, this means that some lighter doors are over-powered by the system causing them to lift-up during breakout and the system is underpowered for some heavier doors, causing them to drop and hit the ground at the non-pivot end when the door is broken out. This is a challenge many manufacturers in the door industry faces. In contrast, on-field adjustability of the adjustable breakout device **250** ensures it can cater for a wide range of door weights and can be set to the required strength by the installer. The function of the adjustable breakout device is simple and easily accessible as shown in FIGS. **16-22**B.

FIG. **6** shows an exploded view of the adjustable breakout device **250** which is suitable for use with the telescoping door system **110**. In some implementations, the breakout device **250** includes a housing **252**, an inner block **253**, a vertical extrusion cover **254**, a set screw **256**, a top bolt **257**, a support bar **258**, a U bracket **260**, and a dowel pin **266**. In one implementation, the support bar **258** has a generally round surface and is formed from steel with a length of about 20 inches long and a diameter of 1⅜ inches. The sides of the support bar **258** may be ground flat symmetrically from the top to a depth of about 3⅜ inches to form flat regions **259**. The width across these flat regions **259** may be about 13/16 inches. At the bottom of these flat regions, a U bracket **260** may be attached to the round bar **258** via a high strength dowel pin **266** that passes through both legs of the U bracket **260** and the middle of the flat regions **259** of the support bar **258** such that the support bar **258** can swing around the dowel pin **266** with a swept angle of about 24 degrees. At the top of the support bar **258**, a threaded through hole may be formed to accommodate a set screw **256**, which in one example is a ½"-13 set screw with an axis 9/32 inch from the top, parallel to the flat regions **259** and horizontally equidistant from them. In some implementations a top bolt **257** may be configured to pass through a hole **259** in the housing **252**. The top bolt may be held in place by a inner block **253** with a threaded hole. In some implementations, the inner block is formed from metal, such as steel. FIGS. **7** and **8** show various perspective views of the adjustable breakout device **250**.

FIGS. **9**A-**9**E shows various perspective views of the housing **252**. In some implementations, the housing **252** encloses the U bracket **262**, the areas where the support bar **258** attaches to the U bracket **260**, the area at the top of the U bracket **260** with the flat area **259**, and the set screw at the top of the support bar **258**. The housing **252** may be formed from a metal, such as cast aluminum. The housing **252** may include a top hole **259** as well as a hole **312** passing through a bottom section through which the set screw **256** at the top of the support bar **258** can be accessed and turned using a tool such as an ¼ inch Allen wrench. This hole **312** may have a ½ inch diameter. Further perspective and cross-section views of the housing **252** are shown in FIGS. **21** and **22**. In the embodiment show in FIGS. **10**A and **10**B (which is a magnified view G of FIG. **10**A), recessed areas **255** are disposed in the top and rear walls **318**, **320** of the housing **252** which may accommodate rotation of the set screw **256** (shown in FIGS. **11**B and **11**C). The housing **252** may also include protrusions **314** which may be sized and configured to receive an engaging rail **180** of the door panel **114** (as shown in FIGS. **15**A and **15**B).

Adjustment of the breakout device **250** is shown in FIGS. **11**A-**11**D and **12**A-**12**B. FIG. **11**B is a cross-sectional view of the breakout device shown in FIG. **11**A along line H showing the set screw **256** is profile. FIG. **11**C shows a magnified portion J of the adjustable breakout device **250** with the set screw **256** that has not been tightened. In comparison, FIG. **12**B shows a cross-sectional view along line L of the breakout device **250** in FIG. **12**A where the set screw **256** has been tightened. When the set screw **256** is tightened, it applies pressure to the interior of the housing **252**, causing the support bar **258** to pivot around the dowel pin **266**. This may in turn result in changing the angle of the support bar **258** and consequently be used to increase the strength or capacity of the panels of the telescoping door. FIG. **11**D shows a magnified portion K of a small protrusion **261** that may extend out from the bottom side of the U bracket **260** that dig into the frame of the door panel to prevent slipping. Protrusions **261** may be disposed across the bottom side of the U bracket **260**.

FIG. **13**B is a cross-section view of a door panel **114** shown in FIG. **13**A along line M showing the placement of the adjustable breakout device **250**. In some embodiments, the adjustable breakout device **250** is positioned in a top portion of the door panel, such when pressure is applied by adjusting the set screw **256**, the position of the door panel **114** may be adjusted.

Aspects of the adjustable breakout device **250** are shown in more detail in FIG. **14** which is a magnified portion N of FIG. **13**B. The adjustable breakout device **250** may be integrated with the rest of the door panel **114** by the rest of the length of the support bar **258** going into the pivot vertical rail **290** of the door and may be screwed to it. Further, the support bar **258** may be attached to the rail **290** via a U

bracket **262** that rotates around the axis of the bar, allowing for the door panel to rotate around the support bar **258**. The U bracket **262** may protrude out from the housing **252** and may be sized to fit into a hollow of the wheel carriage extrusion or engaging rail **180** (also shown in FIG. **15**B) and may be screwed to it using three socket cap screws **284**, which in one embodiment are 5/16"-18 flat head socket cap screws. This placement may pull the housing **252** firmly against the heel of the wheel carriage extrusion **282**. In some embodiments, the housing **252** has the same general external cross-sectional profile as the wheel carriage extrusion **282**. FIG. **31** also shows a vertical extrusion cover **280**. The position of the adjustable breakout device **250** within the door panel **114** is further shown in FIGS. **33**, which is an enlarged view of a portion of FIG. **32**, and in particular, enlarging the portion encircled by circle B in FIG. **32**.

In some embodiments, the adjustable breakout device **250** is attached to a door panel via three socket cap screws **284** (which may be 5/16"-18 flat head socket cap screws) which attach the U bracket **260** to the engaging rail **180** and two socket cap screws **292** (shown in FIG. **22**B, which may be ¼"-20 button head socket cap screws) that attach the support bar **258** to the vertical pivot rail **290**.

FIG. **16** shows a flowchart illustrating a method **1000** for using a telescoping door system with an adjustable breakout device according to embodiments of the present disclosure. The adjustable breakout device may be the adjustable breakout device **250** described in FIGS. **1**-**15**.

The method **1000** may include block **1602** to provide a telescoping door system with a plurality of door panels such as telescoping door system **110** with panels **114**, **116**, **118** as discussed in reference to FIGS. **1**-**15**. In some implementations, this telescoping door system may be configured to breakout such that the door panels may be pivoted from the normal sliding configuration to a breakout configuration. This may provide additional clearance in the doorway of the telescoping door system.

The method **1000** may also include block **1004** to provide an adjustable breakout device. This adjustable breakout device may be the adjustable breakout device **250** discussed in reference to FIGS. **6**-**15**B. The adjustable breakout device may include a housing, a support bar, a U bracket, and a set screw as discussed previously. In some implementations, the adjustable breakout device is built into a door panel of the telescoping door system during manufacturing and adjusted to the desired angle or strength during installation of the door panel.

The method **1000** may also include block **1006** to mount the adjustable breakout device a rail of a selected door panel of the plurality of door panels. In some implementations, the adjustable breakout device is configured to be mounted to a vertical rail of the selected door panel in the configuration shown in FIGS. **13**A-**15**B.

The method **1000** may also include block **1008** to determine a desired angular change to impart to the selected door panel. For example, the selected door panel may imbalanced and may require an adjustment the angle at which it hangs to for optimal use with the rest of the telescoping door system.

The method **1000** may also include block **1010** to use a set screw of the adjustable breakout device to make the desired angular change to the selected door panel of the telescoping door system. In some implementations, when the set screw is tightened, it applies pressure to the interior of the housing of the adjustable breakout system which in turn may cause and angular change in the support bar. This motion may impart a similar angular change to the selected door panel, adjusting it by an angular change. This step may be used once or more (i.e, iteratively) to impart the desired angular changed to the selected door panel. In some implementations, the method **1000** may be used to adjust multiple panels of a telescoping door system, for example to adjust each panel to functional optimally with the others.

While the disclosure has been described in terms of exemplary aspects, those skilled in the art will recognize that the disclosure can be practiced with modifications in the spirit and scope of the appended claims. These examples given above are merely illustrative and are not meant to be an exhaustive list of all possible designs, aspects, applications or modifications of the disclosure.

I claim:

1. An adjustable breakout device for use with a sliding door system, the adjustable breakout device comprising:

a support bar configured to extend vertically with respect to a door panel of the sliding door system;

a housing configured to be mounted on an upper portion of the support bar;

a bracket configured to be mounted on the upper portion of the support bar and within a portion of the housing;

a set screw configured to pass through the housing and through the upper portion of the support bar, such that the set screw bears against a proximal end of the housing; and

a pivot configured to pass through the bracket and the support bar, wherein when the set screw is turned to put pressure on the proximal end of the housing, the support bar rotates about the pivot.

2. The adjustable breakout device of claim **1**, wherein the support bar is configured to be mounted within a vertical rail of the door panel of the sliding door system.

3. The adjustable breakout device of claim **2**, wherein the support bar rotating about the pivot imparts a change in a suspension angle of the door panel.

4. The adjustable breakout device of claim **1**, wherein the pivot is configured to pass through a first protrusion of the bracket, and a second protrusion of the bracket, respectively.

5. The adjustable breakout device of claim **4**, wherein the first protrusion and the second protrusion of the bracket form a U shape configured to extend around the support bar.

6. The adjustable breakout device of claim **5**, wherein the bracket further comprises a bar extending approximately horizontally with respect to the door panel, the bracket comprising a proximal end of which is connected to the U shape formed by the first and second protrusions of the bracket.

7. The adjustable breakout device of claim **6**, wherein the bar of the bracket is configured to be mounted to a horizontal rail of the door panel.

8. The adjustable breakout device of claim **4**, wherein the upper portion of the support bar comprises a first flat region and a second flat region on an opposite side of the support bar as the first flat region.

9. The adjustable breakout device of claim **8**, wherein the first protrusion is aligned with the first flat region and the second protrusion is aligned with the second flat region.

10. The adjustable breakout device of claim **8**, wherein the housing comprises a first sidewall and a second sidewall opposite the first sidewall, wherein the first sidewall is aligned with the first flat region and the second sidewall is aligned with the second flat region.

11. The adjustable breakout device of claim **10**, wherein the housing comprises a third sidewall perpendicular to the

first and second sidewalls, wherein the third sidewall comprises a first hole that is sized for the set screw to pass therethrough.

12. The adjustable breakout device of claim **11**, wherein the set screw is configured to pass through the first hole of the housing and through a second hole in the upper portion of the support bar passing between the first and second flat regions.

13. A sliding door system with breakout functionality, comprising:

a first door panel configured to be mounted to a top rail, the first door panel comprising a first pivot point about which the first door panel is configured to rotate in a breakout procedure;

a second door panel configured to be mounted to the top rail, the second door panel configured to slide linearly with respect to the first door panel, the second door panel comprising a second pivot point about which the second door panel is configured to rotate in a breakout procedure;

an adjustable breakout system mounted on a vertical rail of the second door panel, the adjustable breakout system comprising:

a support bar configured to extend along the vertical rail of the second door panel;

a housing configured to be mounted on an upper portion of the support bar;

a bracket configured to be mounted on the upper portion of the support bar and within a portion of the housing;

a set screw configured to pass through the housing and through the upper portion of the support bar, such that the set screw bears against a proximal end of the housing; and

a pivot configured to pass through the bracket and the support bar, wherein when the set screw is turned to put pressure on the proximal end of the housing, the support bar rotates about the pivot.

14. The sliding door system of claim **13**, wherein the bracket comprises a first protrusion and a second protrusion forming a U shape that is configured to extend around the support bar.

15. The sliding door system of claim **14**, wherein the bracket further comprises a bar extending approximately horizontally, the proximal end of which is connected to the U shape formed by the first and second protrusions of the bracket.

16. The sliding door system of claim **15**, wherein the bar of the bracket is configured to be mounted to a horizontal rail of the second door panel.

17. The sliding door system of claim **13**, wherein the upper portion of the support bar comprises a first flat region and a second flat region on an opposite side of the support bar as the first flat region.

18. The sliding door system of claim **17**, wherein a first protrusion of the bracket is aligned with the first flat region and a second protrusion of the bracket is aligned with the second flat region.

19. The sliding door system of claim **13**, wherein an angle at which the second door panel hangs with respect to the top rail is changed when the set screw is turned, which in turn causes the support bar to rotate about the pivot.

20. A method for adjusting a sliding door system with breakout functionality, comprising:

providing a door panel of the sliding door system, the door panel suspended from a mounting rail;

providing an adjustable breakout device mounted on the door panel, the adjustable breakout device comprising a support bar configured to extend vertically along the door panel, a housing configured to be mounted on an upper portion of the support bar, a bracket configured to be mounted on the upper portion of the support bar and within a portion of the housing, a set screw configured to pass through the housing and through the upper portion of the support bar, and a pivot configured to pass through the bracket and the support bar;

determining a desired angular change to an angle at which the door panel is suspended from the mounting rail; and

turning the set screw of the adjustable breakout device to bear against an inner wall of the housing with a steel block to change the angle at which the door panel is suspended from the mounting rail to achieve the desired angular change.

* * * * *