US009270856B2

(12) **United States Patent**
Niimura

(10) **Patent No.: US 9,270,856 B2**
(45) **Date of Patent: Feb. 23, 2016**

(54) **IMAGE READING APPARATUS AND IMAGE FORMING APPARATUS INCLUDING THE SAME**

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(73) Assignee: **CANON KABUSHIKI KAISHA**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 176 days.

(21) Appl. No.: **13/600,520**

(22) Filed: **Aug. 31, 2012**

(65) **Prior Publication Data**

US 2013/0057929 A1 Mar. 7, 2013

(30) **Foreign Application Priority Data**

Sep. 2, 2011 (JP) 2011-191221
Aug. 10, 2012 (JP) 2012-178122

(51) **Int. Cl.**
H04N 1/10 (2006.01)

(52) **U.S. Cl.**
CPC ***H04N 1/1017*** (2013.01); ***H04N 1/103*** (2013.01); ***H04N 1/1065*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

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Primary Examiner — Marivelisse Santiago Cordero
Assistant Examiner — Keara Harris
(74) *Attorney, Agent, or Firm* — Fitzpatrick, Cella, Harper & Scinto

(57) **ABSTRACT**

Provided is an image reading apparatus, including: a placing member on which an original is to be placed; a reading section arranged so as to be opposed to the original across the placing member and reading an image of the original placed on the placing member; a casing which supports an outer peripheral edge portion of the placing member; and a support member supporting a portion other than the outer peripheral edge portion of the placing member, the support member including an abutment portion abutting against the casing, the support member being capable of supporting the placing member under a state in which the abutment portion abuts against the casing.

20 Claims, 37 Drawing Sheets

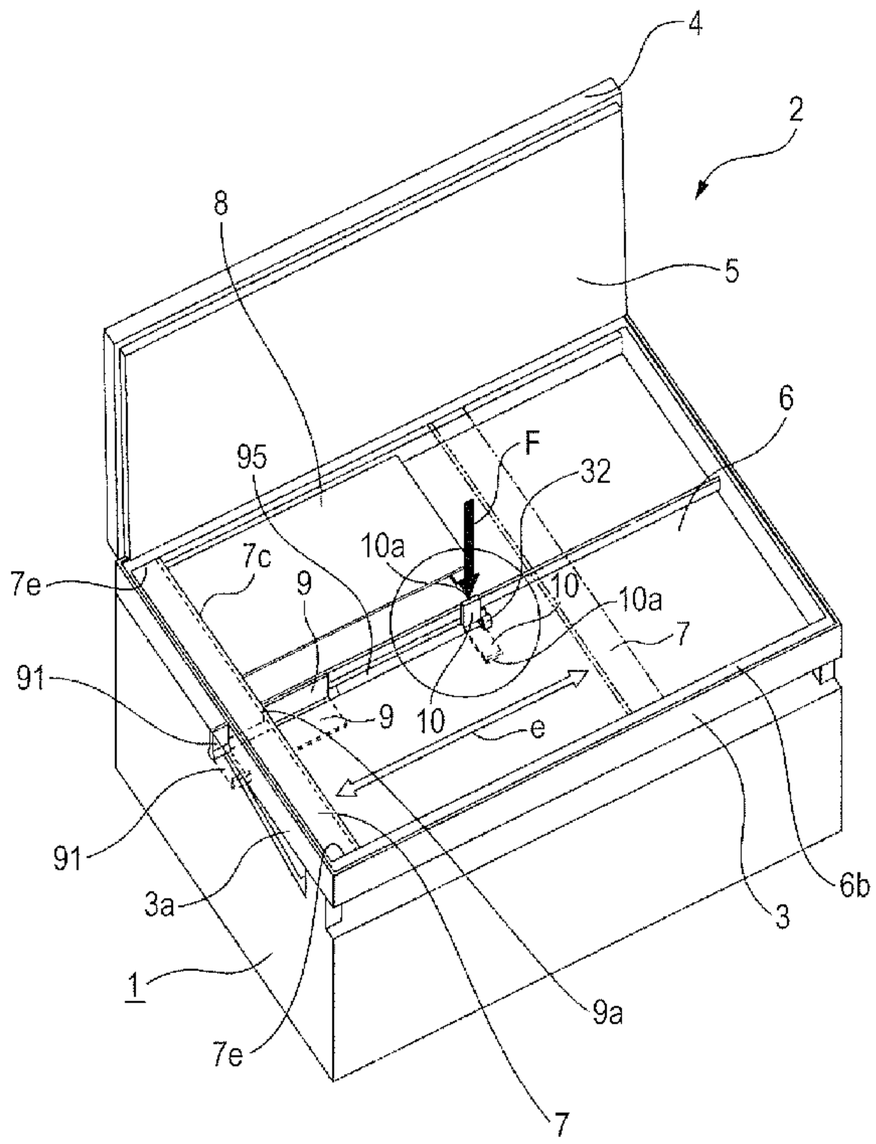


FIG. 1

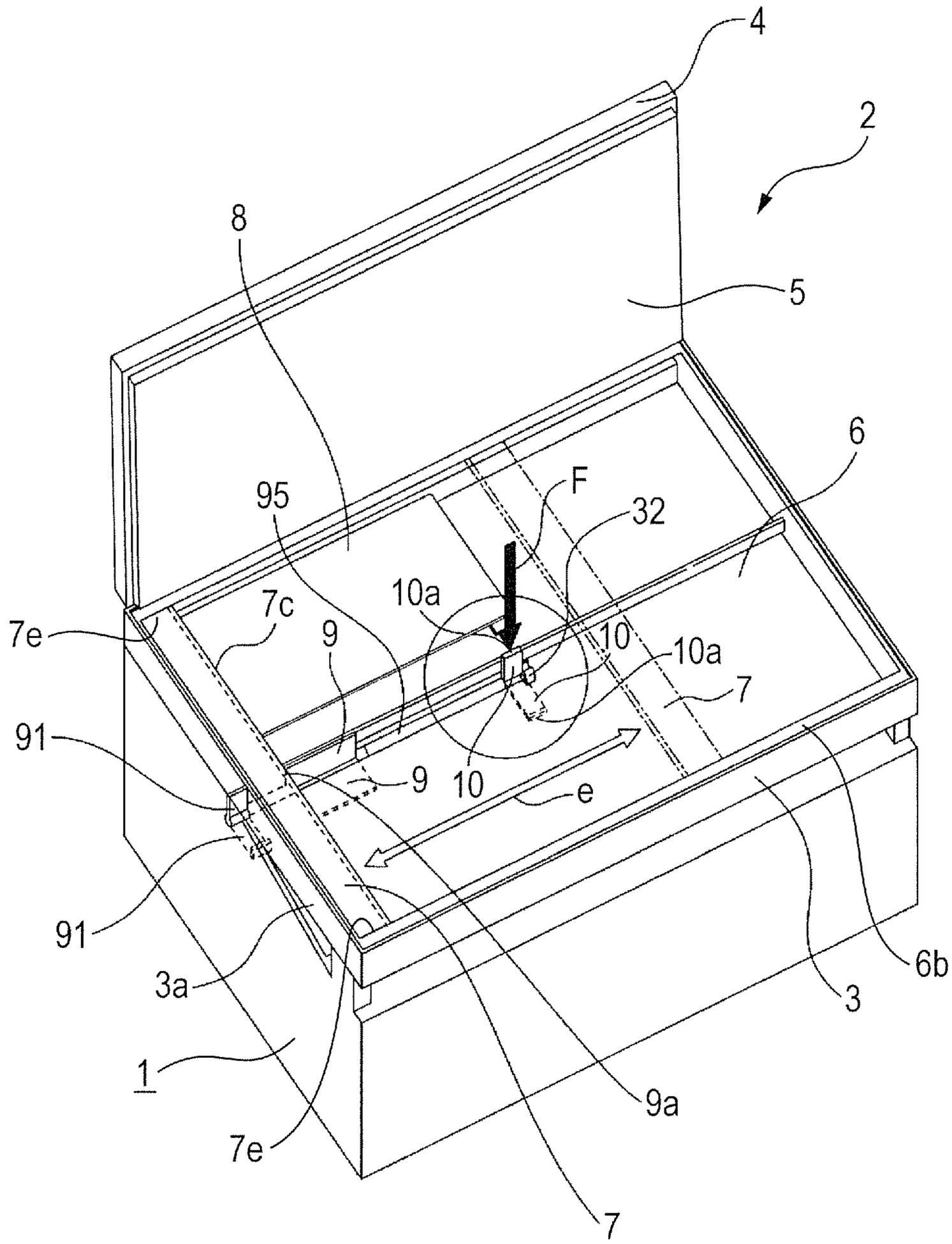
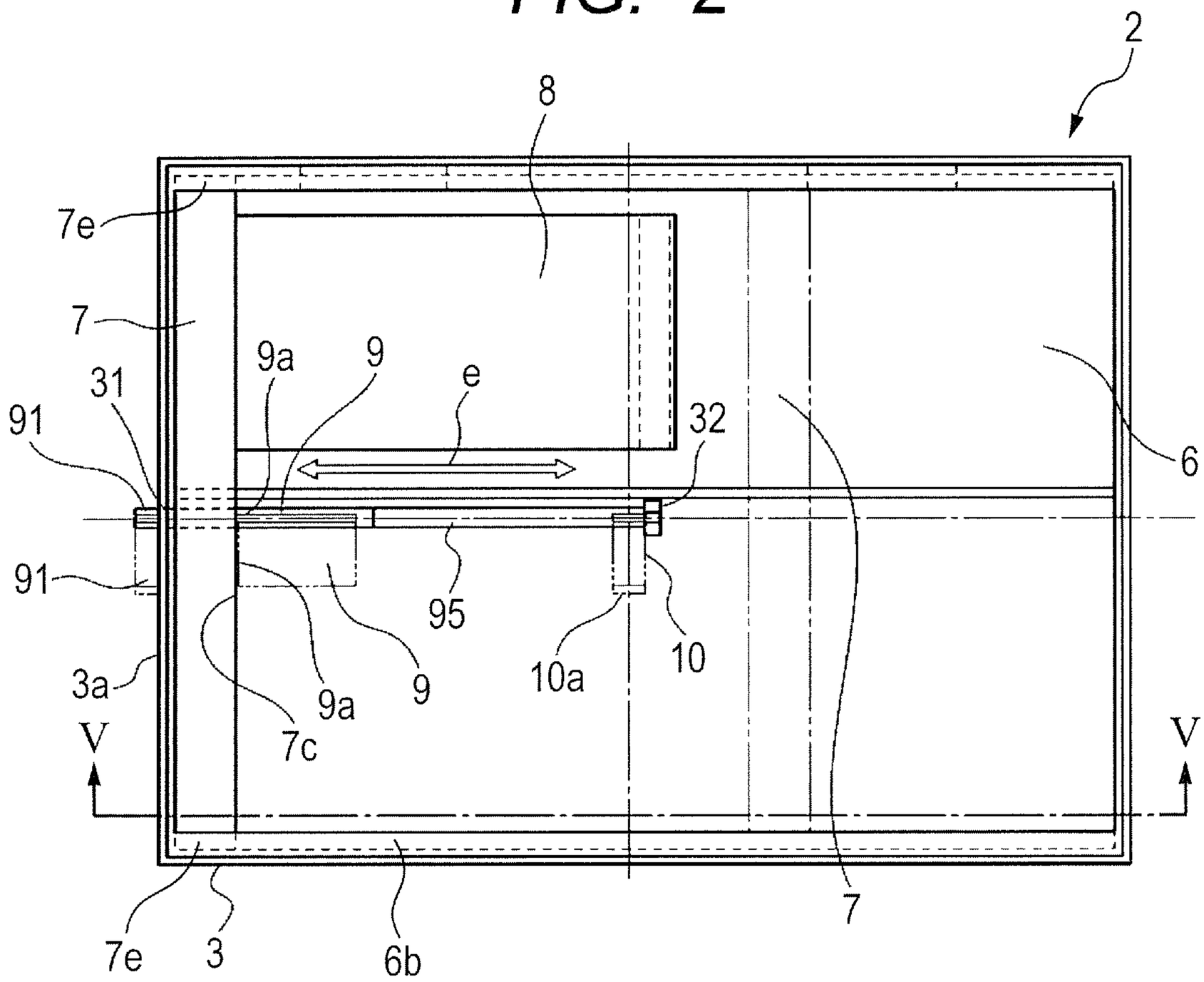


FIG. 2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9a
9
e
31
91
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9a
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7c
V
V
7e
3
6b
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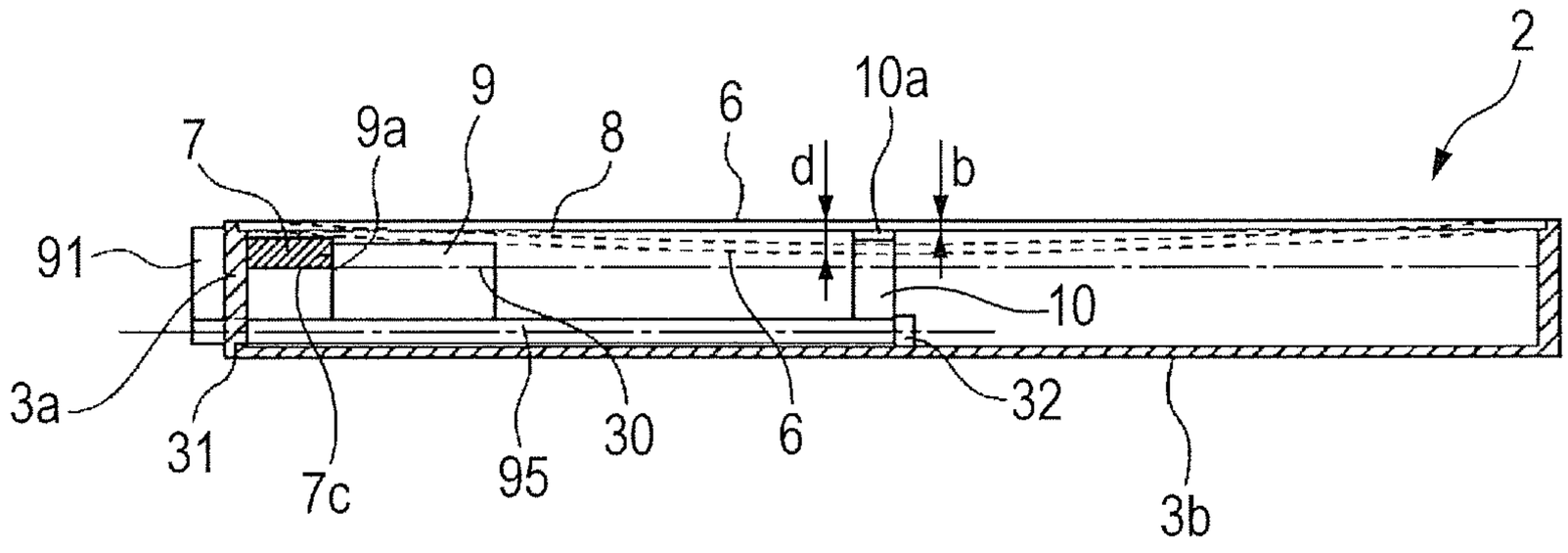
FIG. 3


2
7
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3a
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7c
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32
3b

FIG. 4

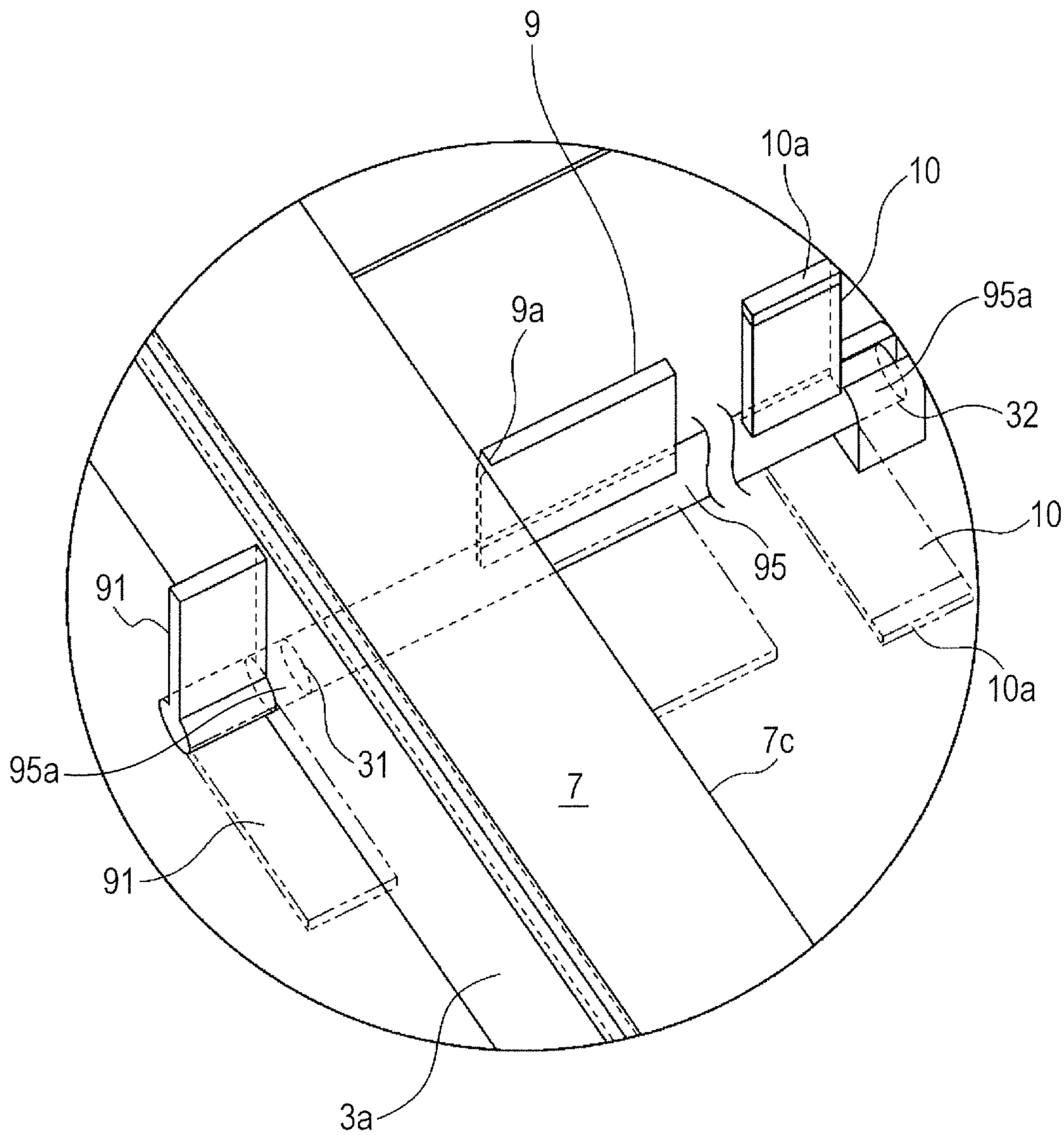
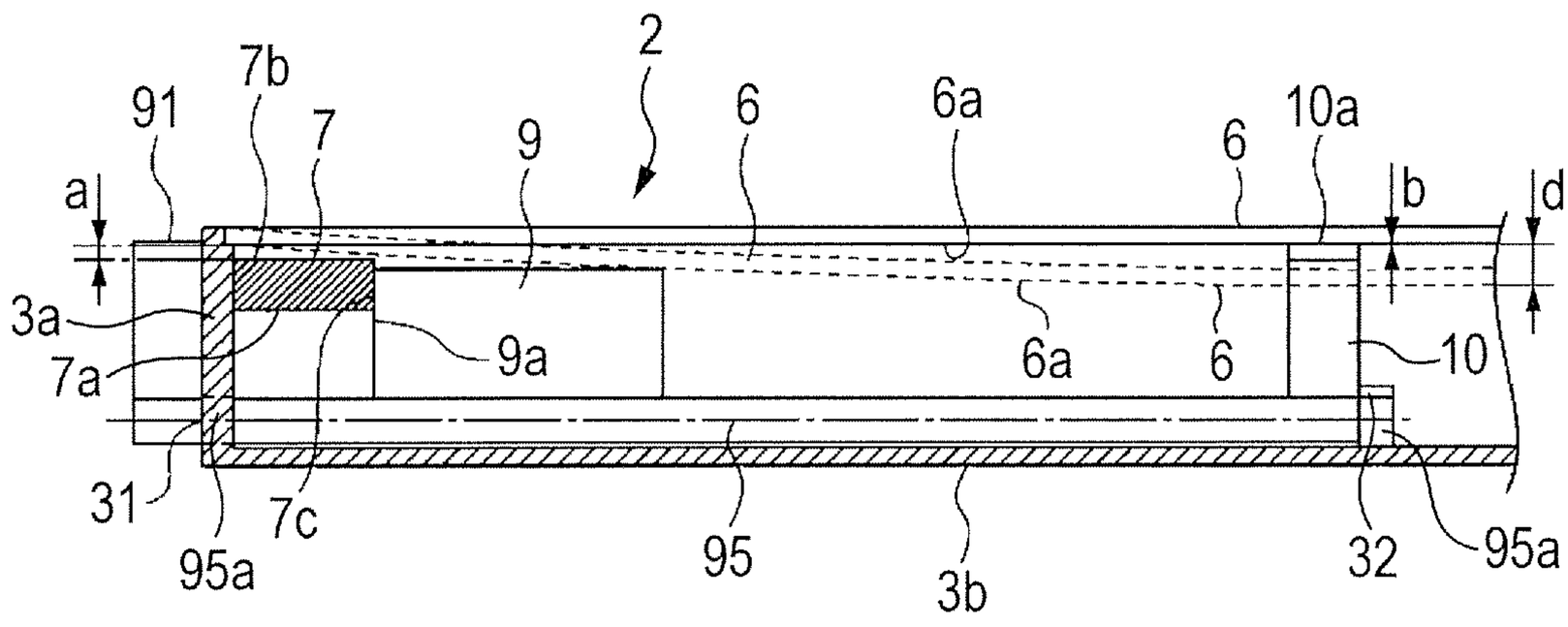


FIG. 5A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7b
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7c
95
3b
32
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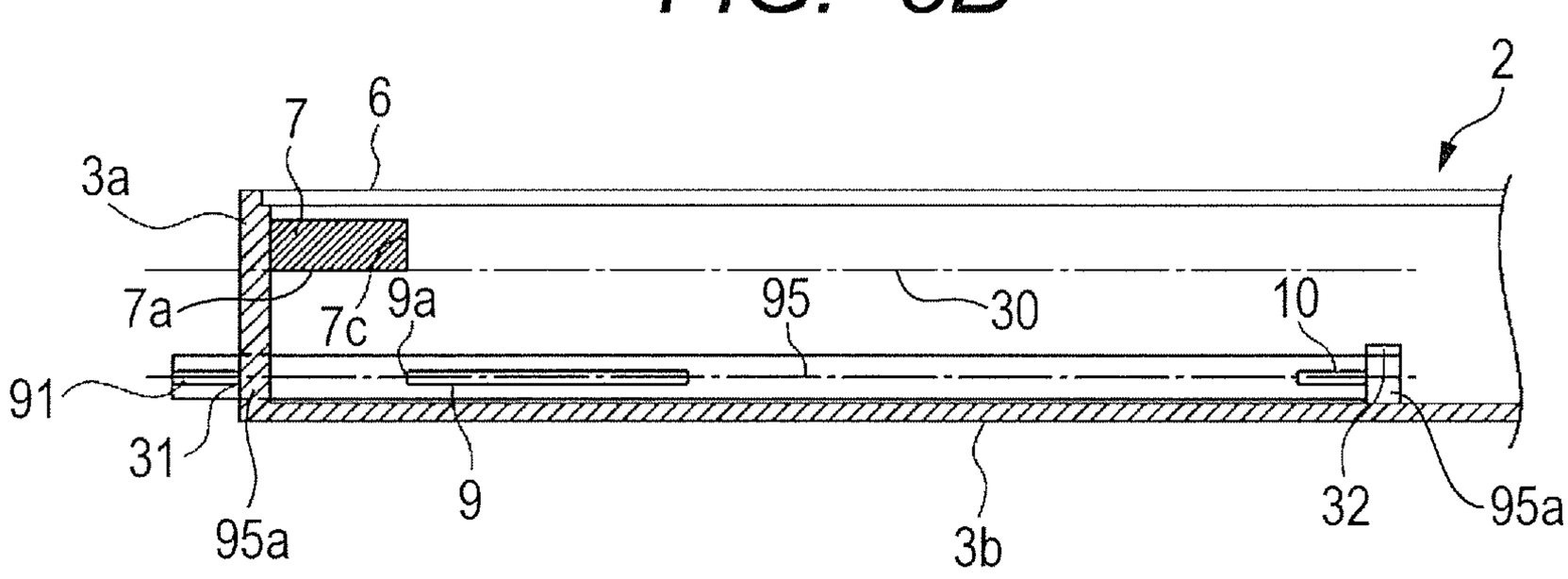
95a

FIG. 5B


2
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95a
95a

FIG. 6

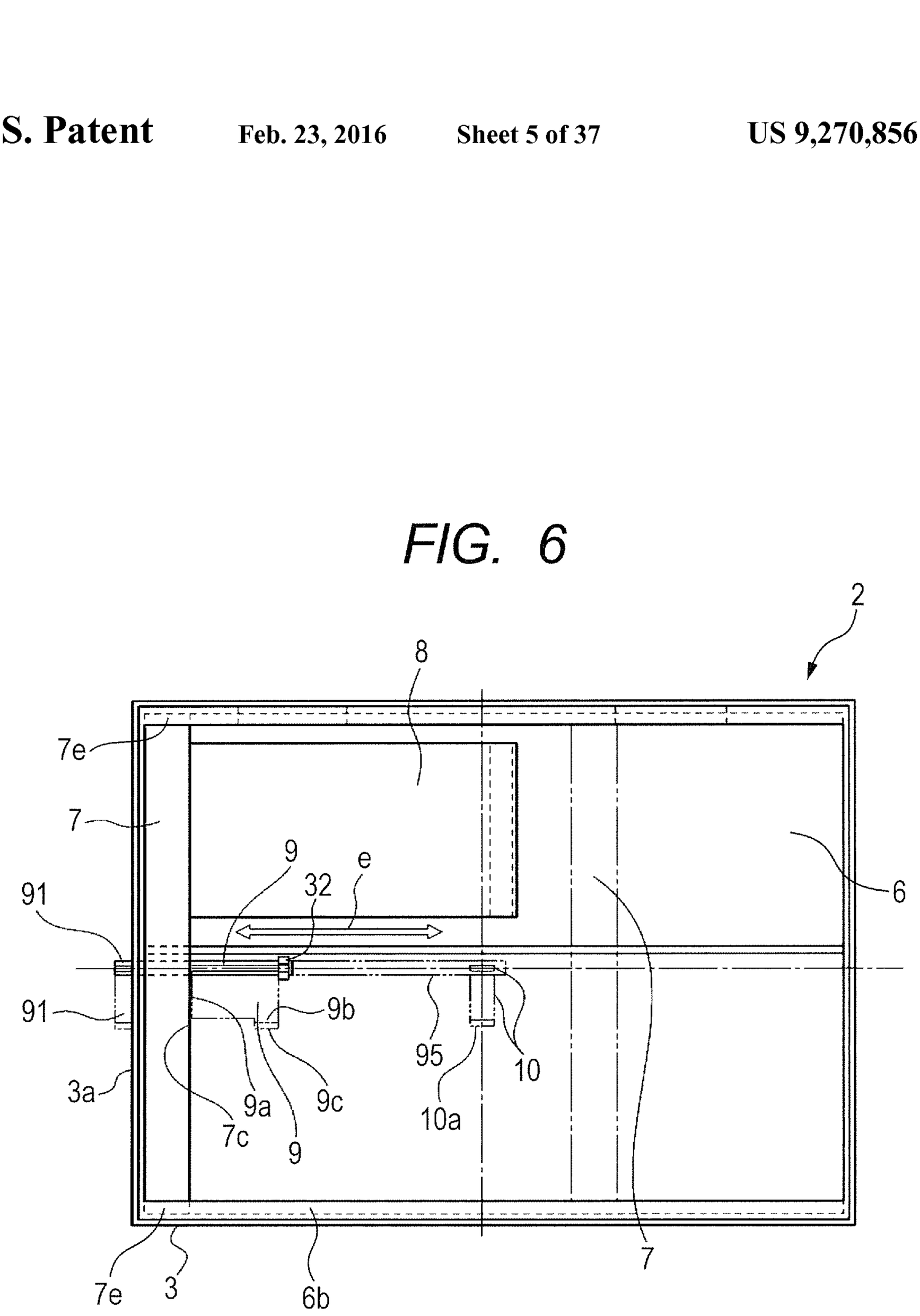


FIG. 7

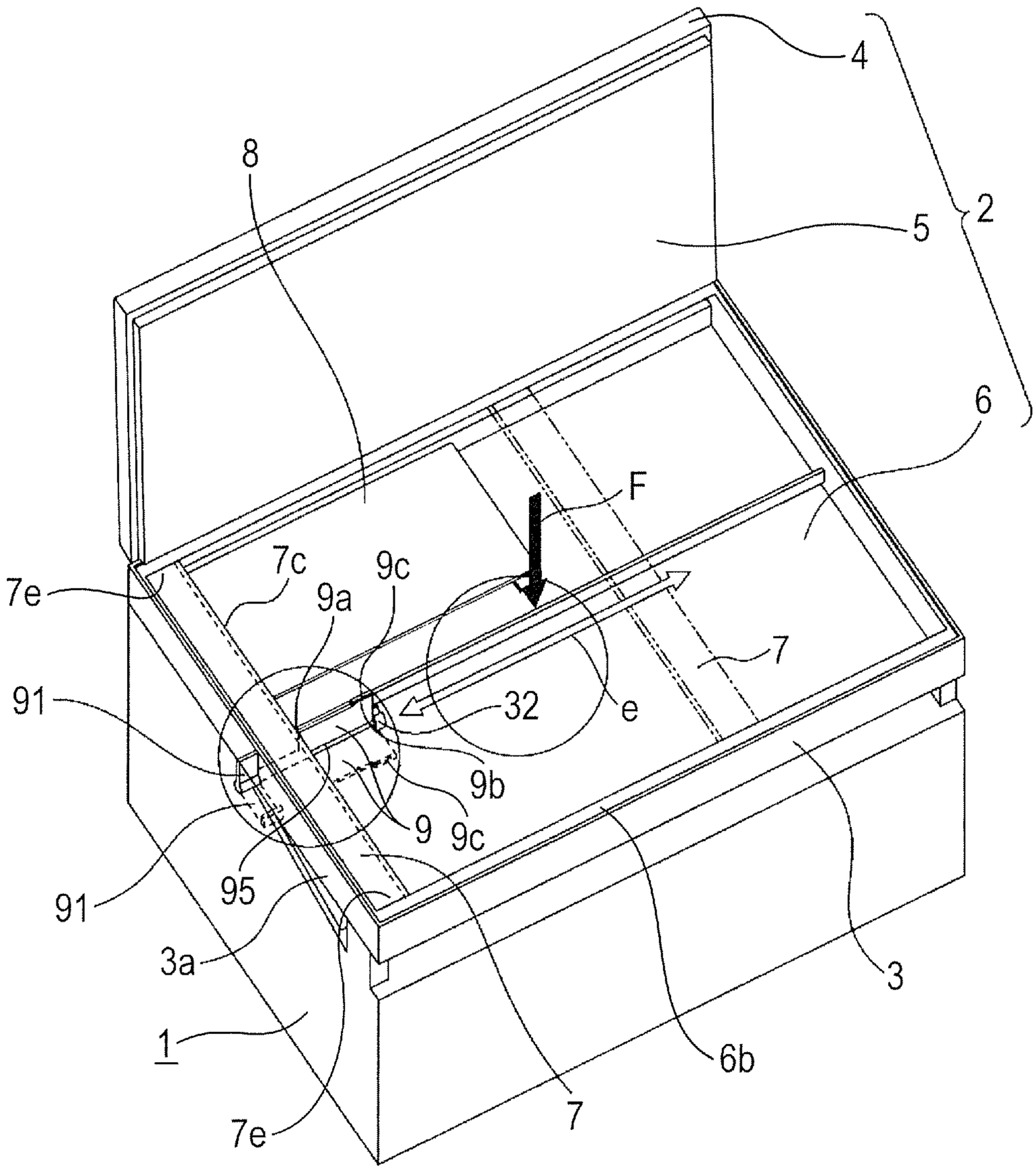
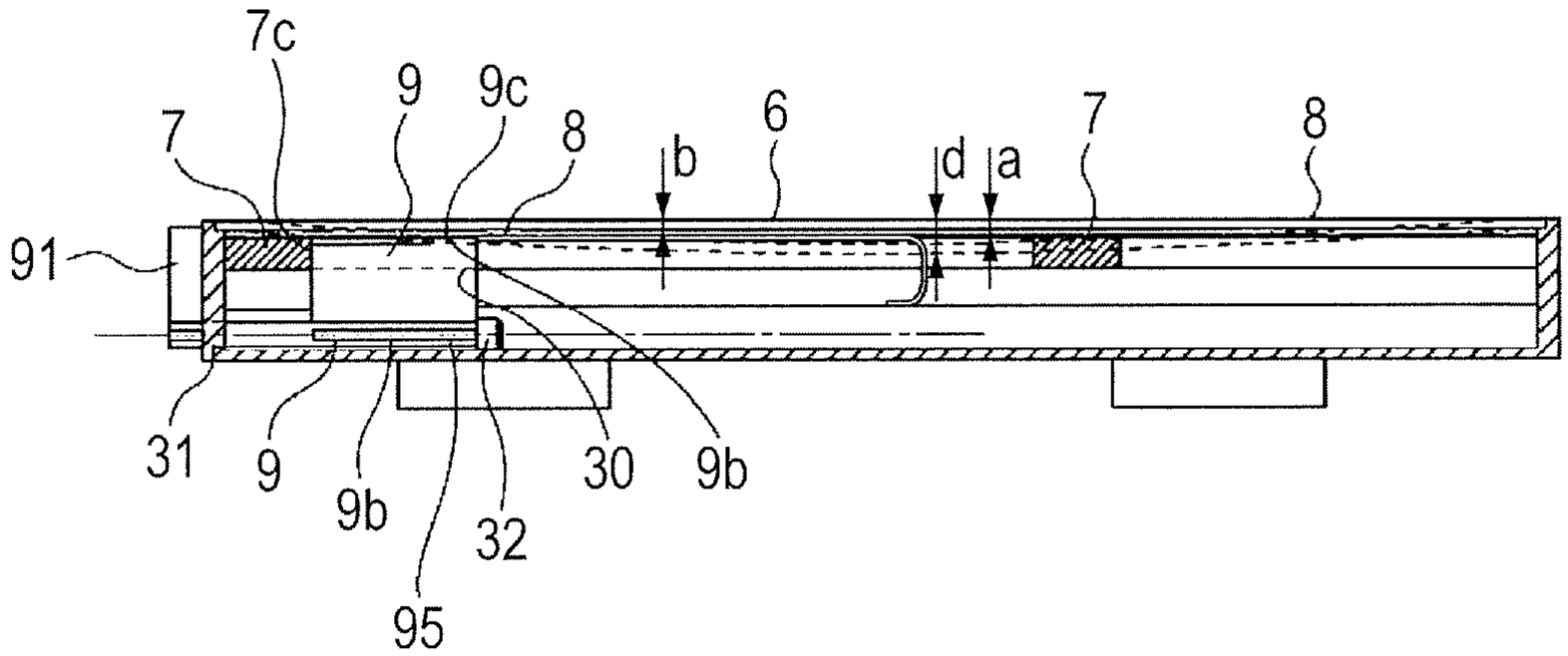


FIG. 8


7c
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9c
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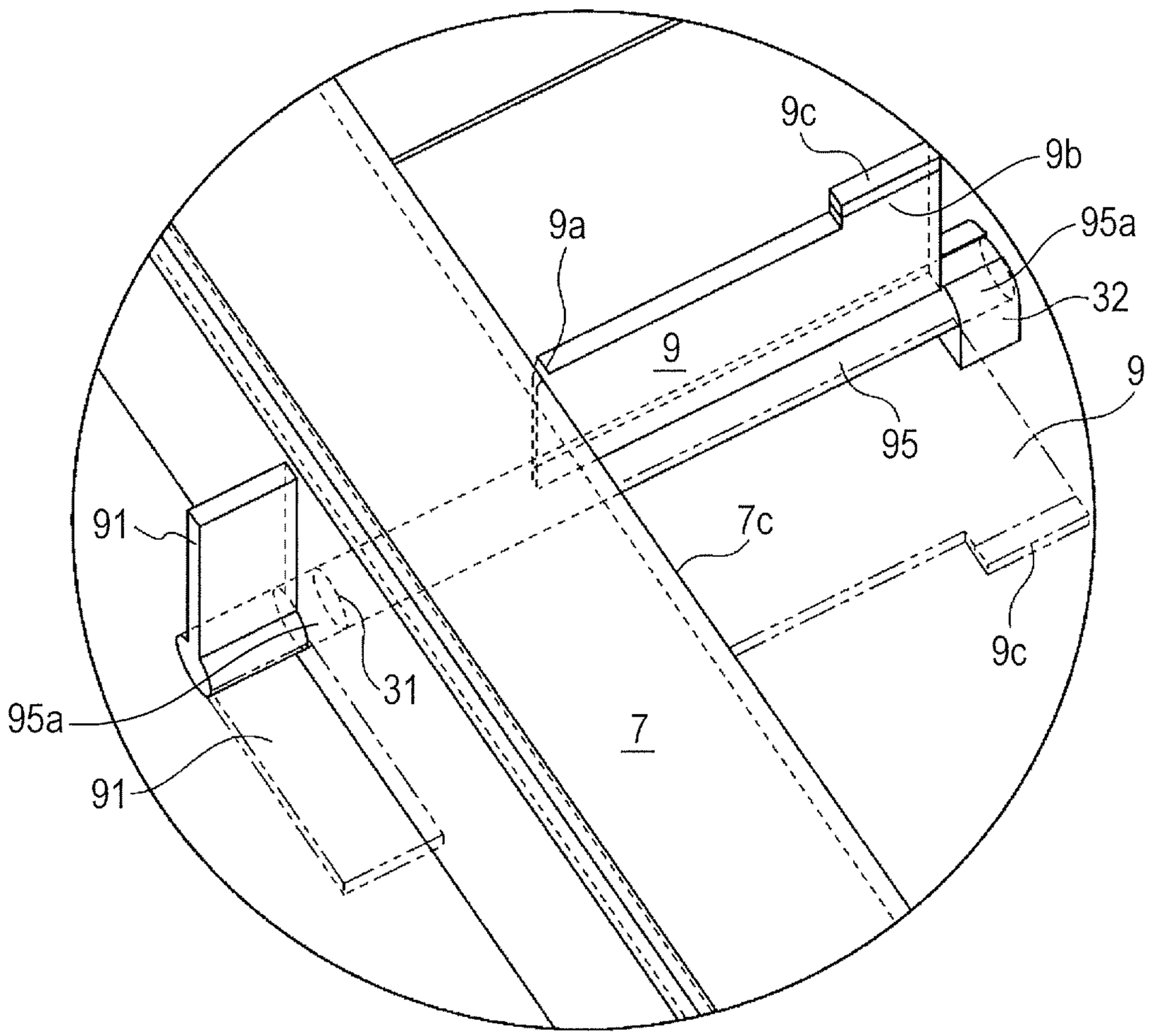
FIG. 9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95a
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9c
31
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FIG. 10

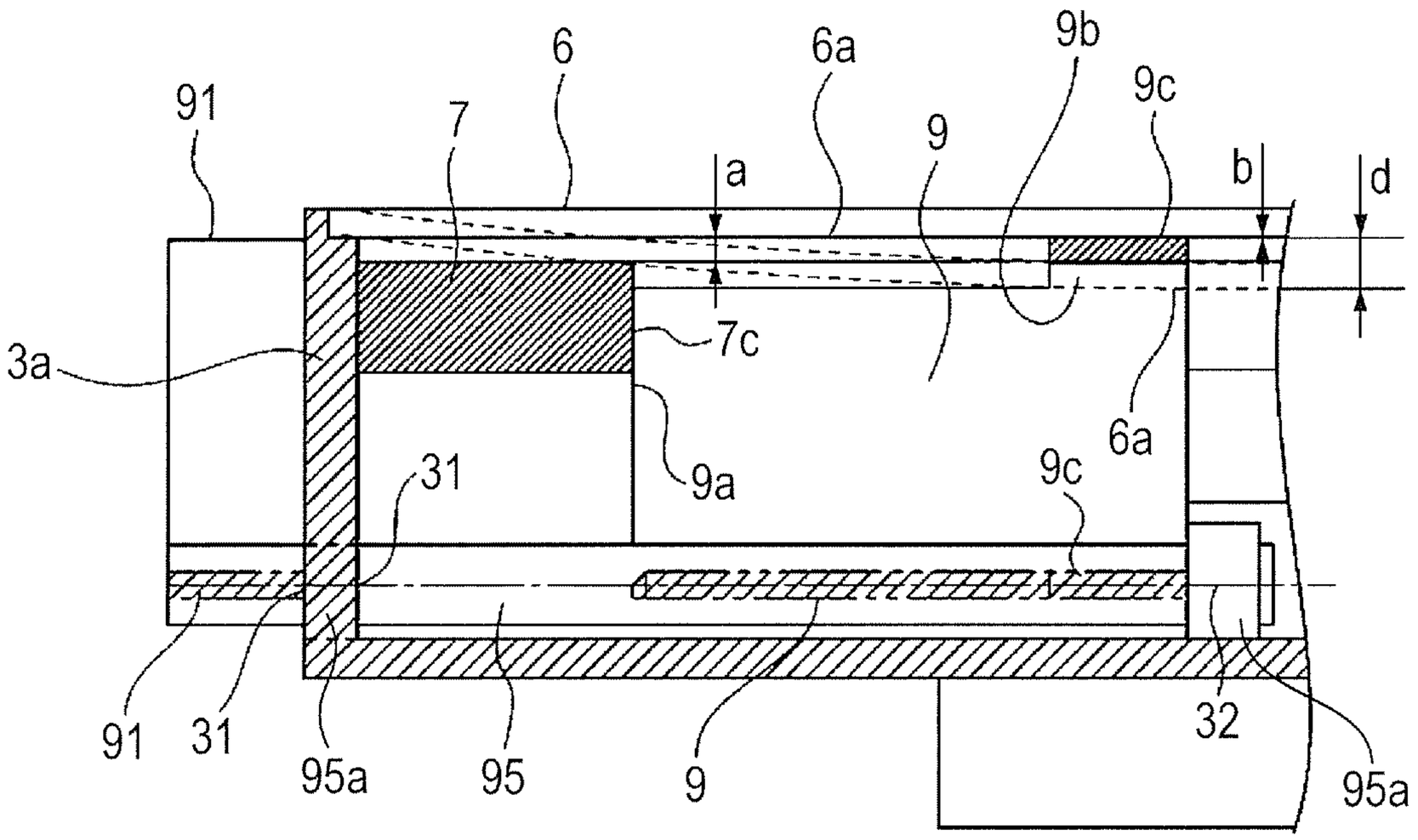


FIG. 11

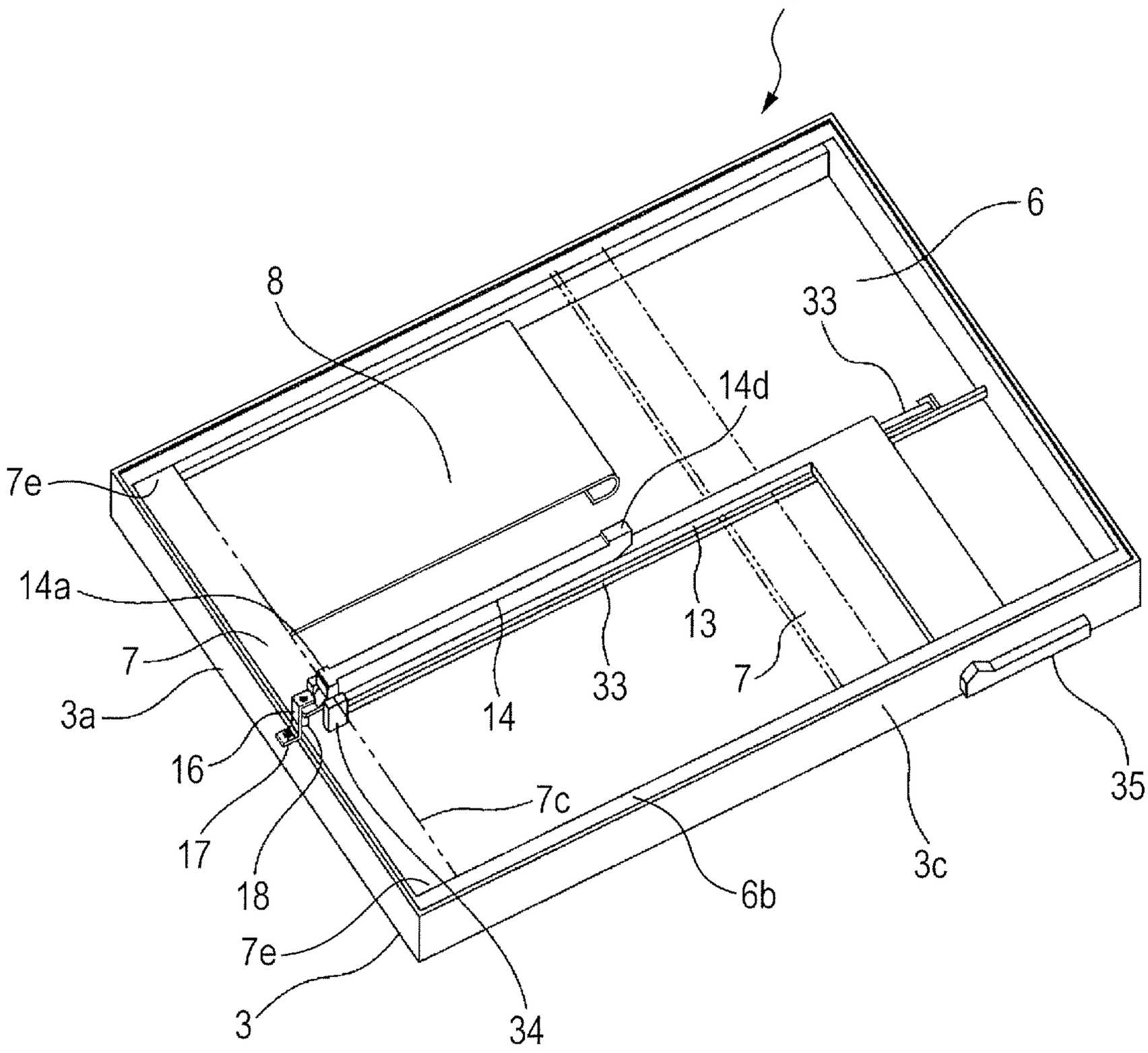
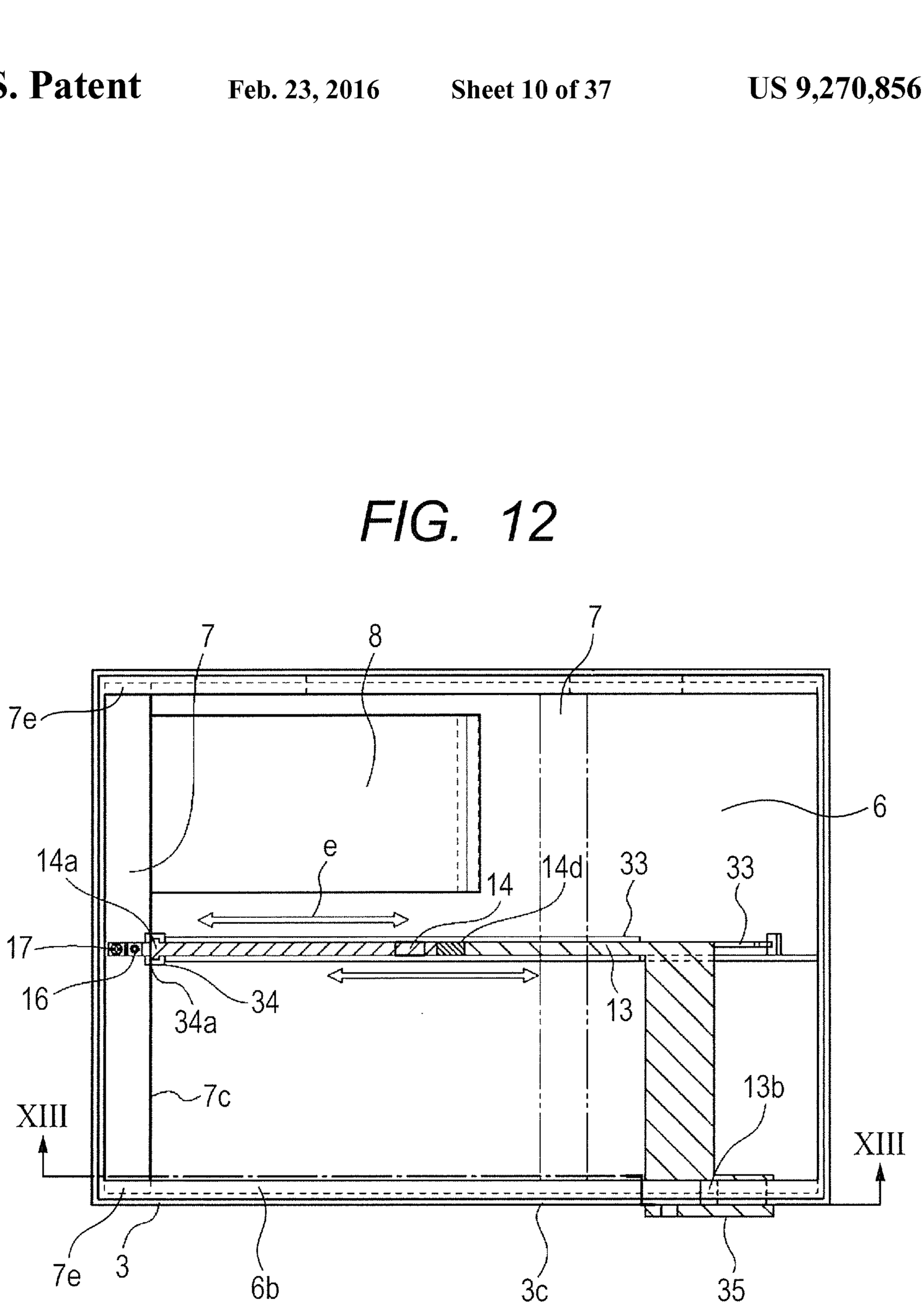


FIG. 12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34a
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XIII
XIII
7e
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6b
3c
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FIG. 13A

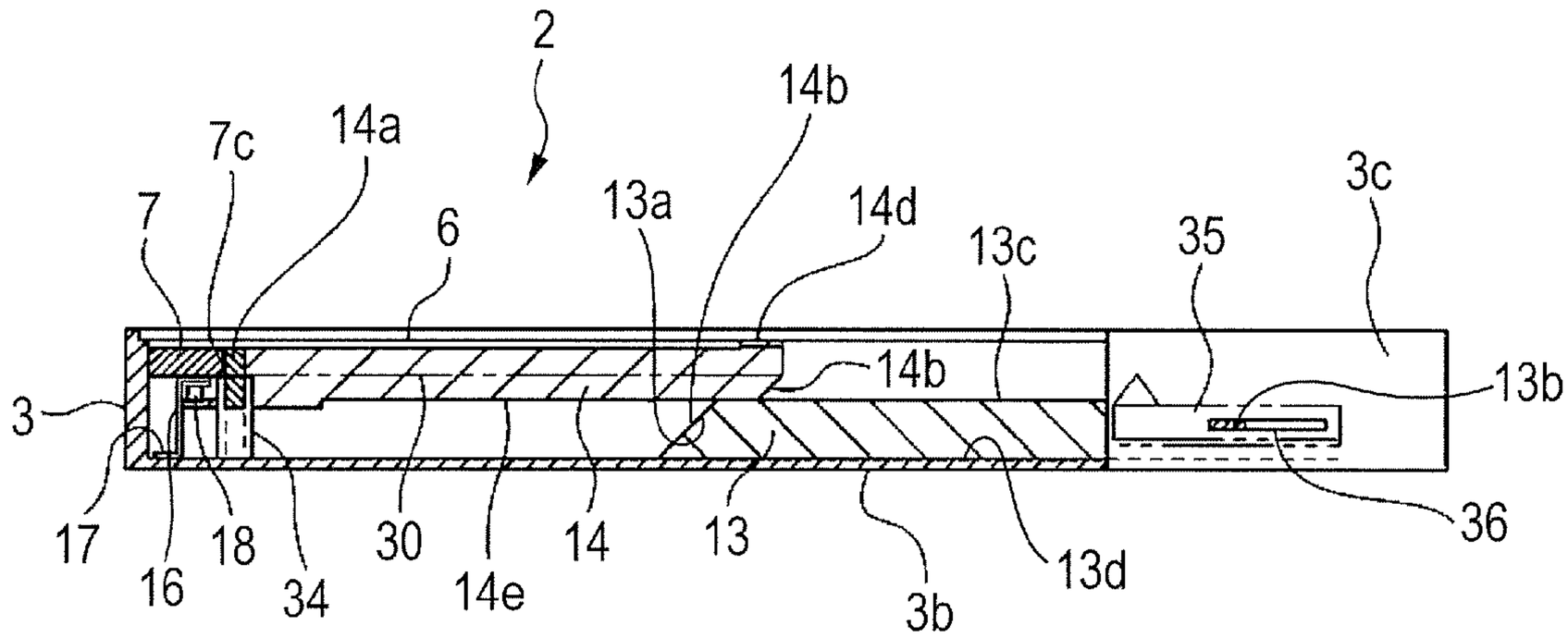


FIG. 13B

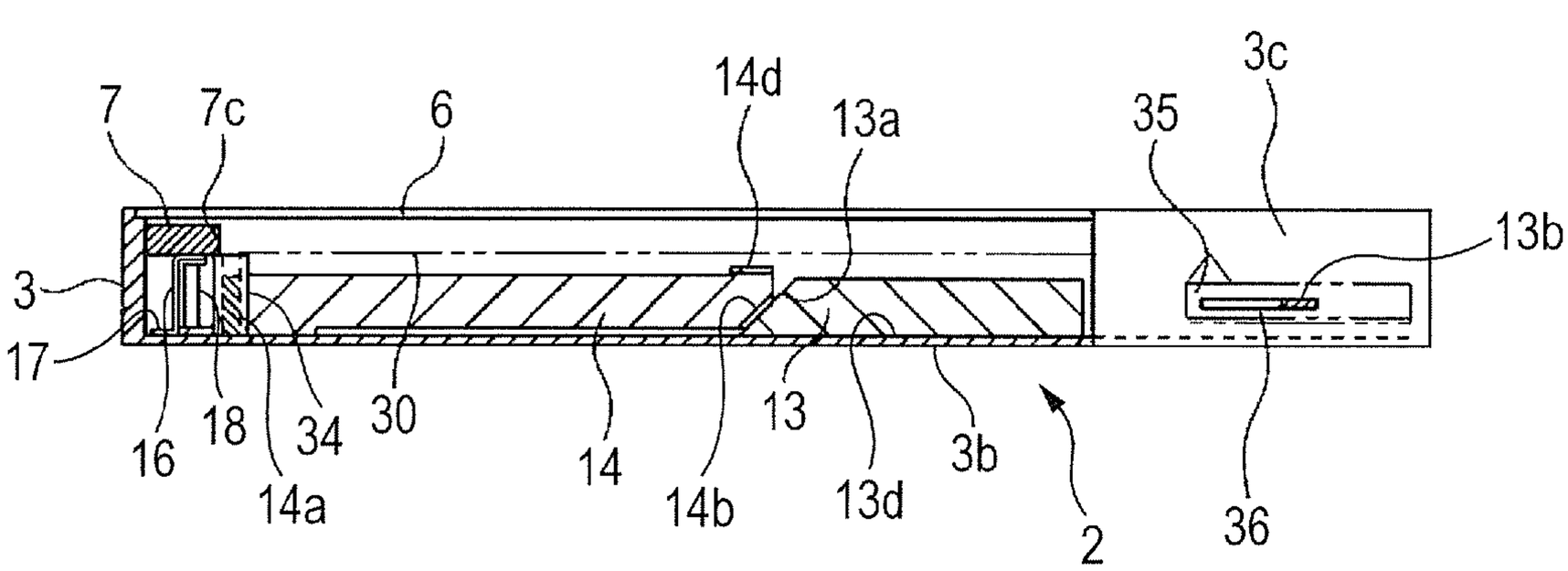


FIG. 14A

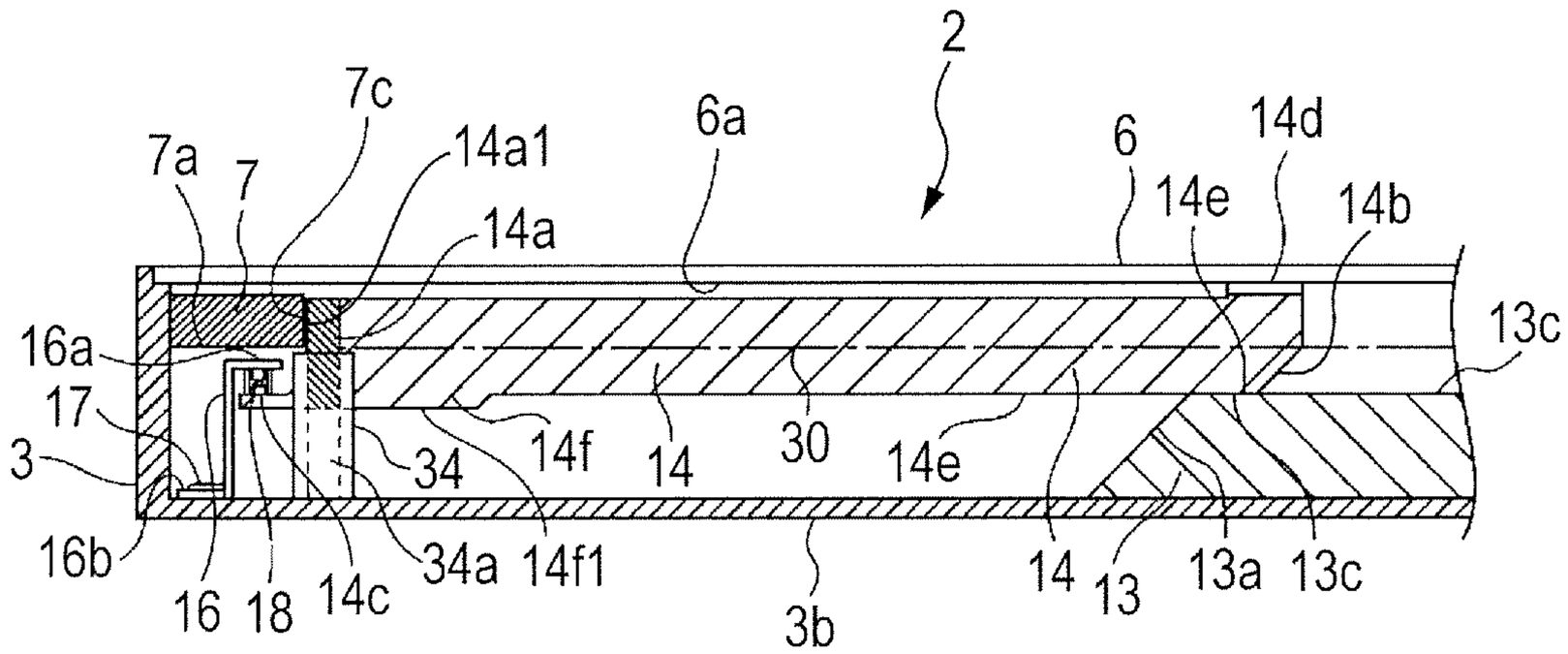


FIG. 14B

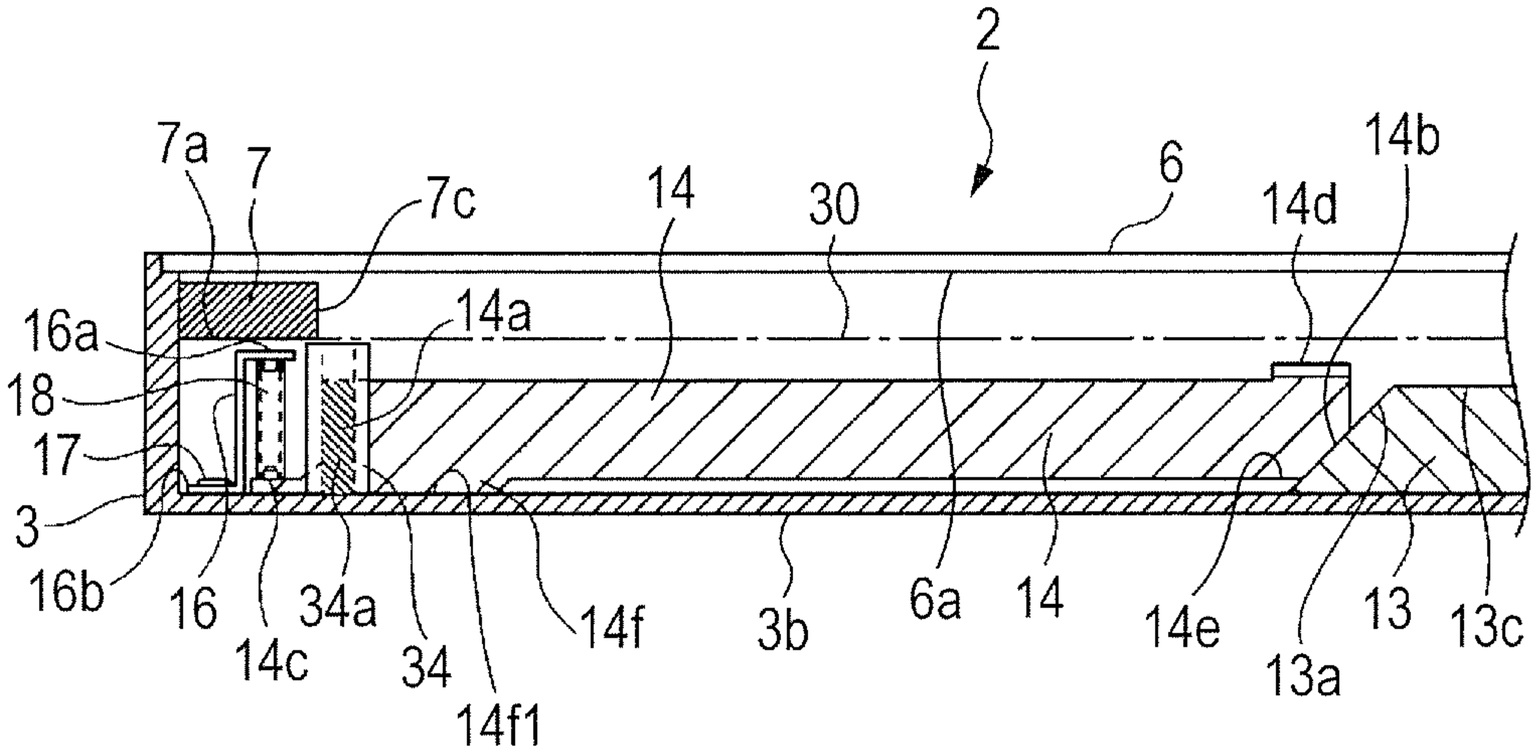


FIG. 15

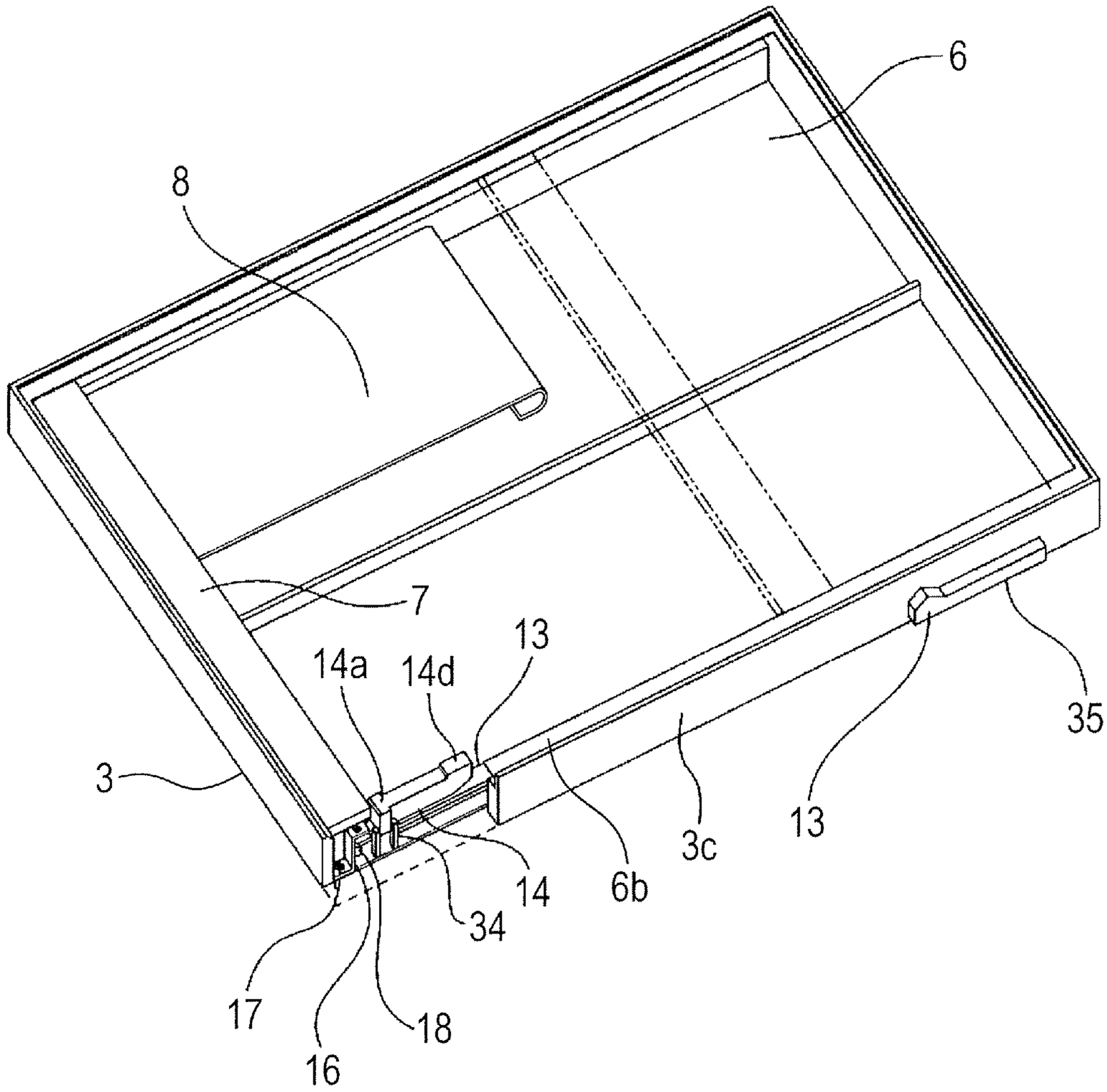


FIG. 16

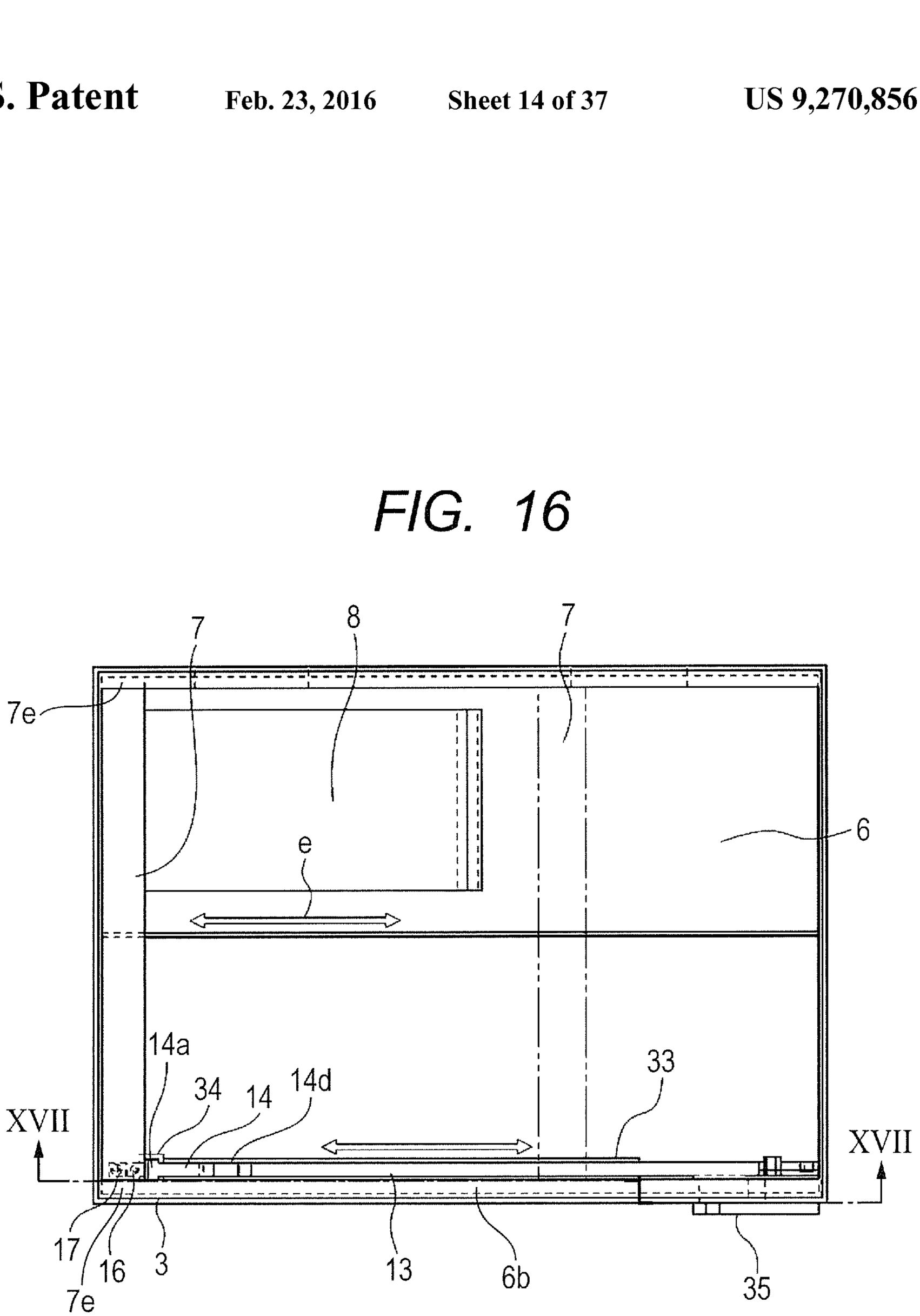


FIG. 17A

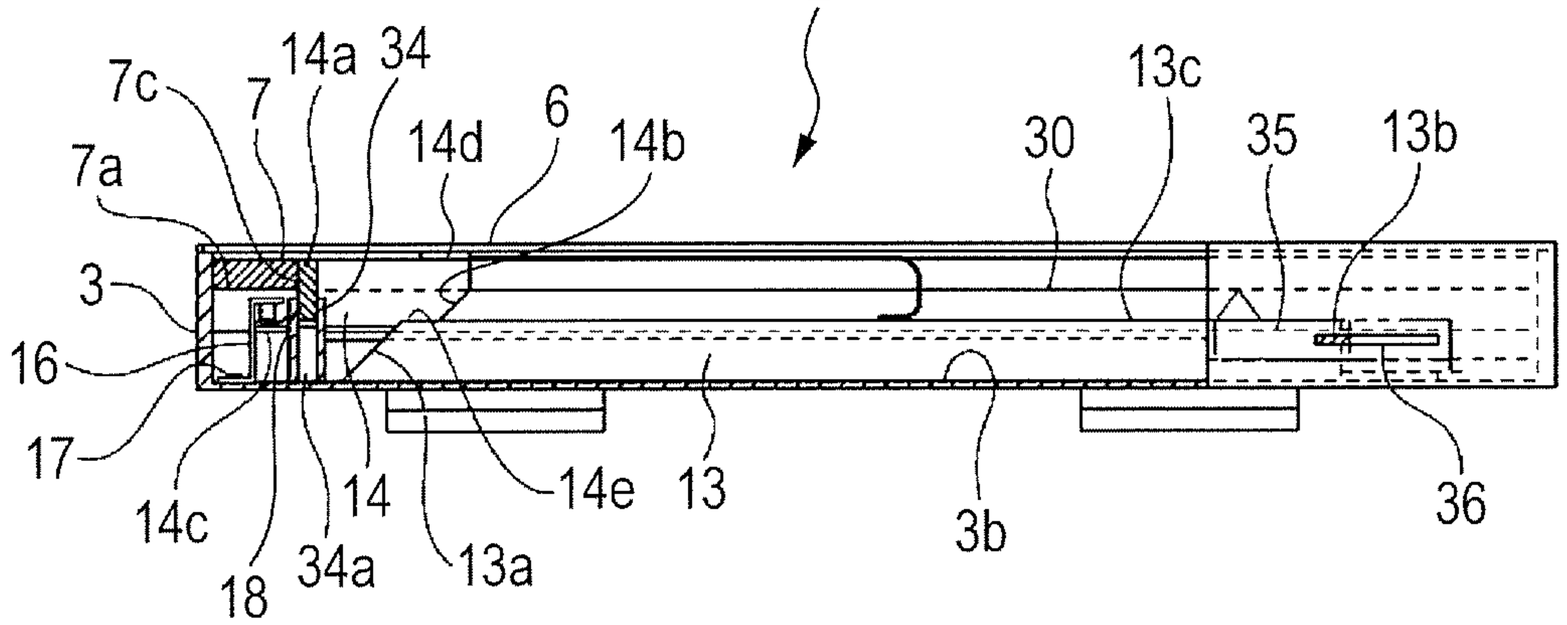


FIG. 17B

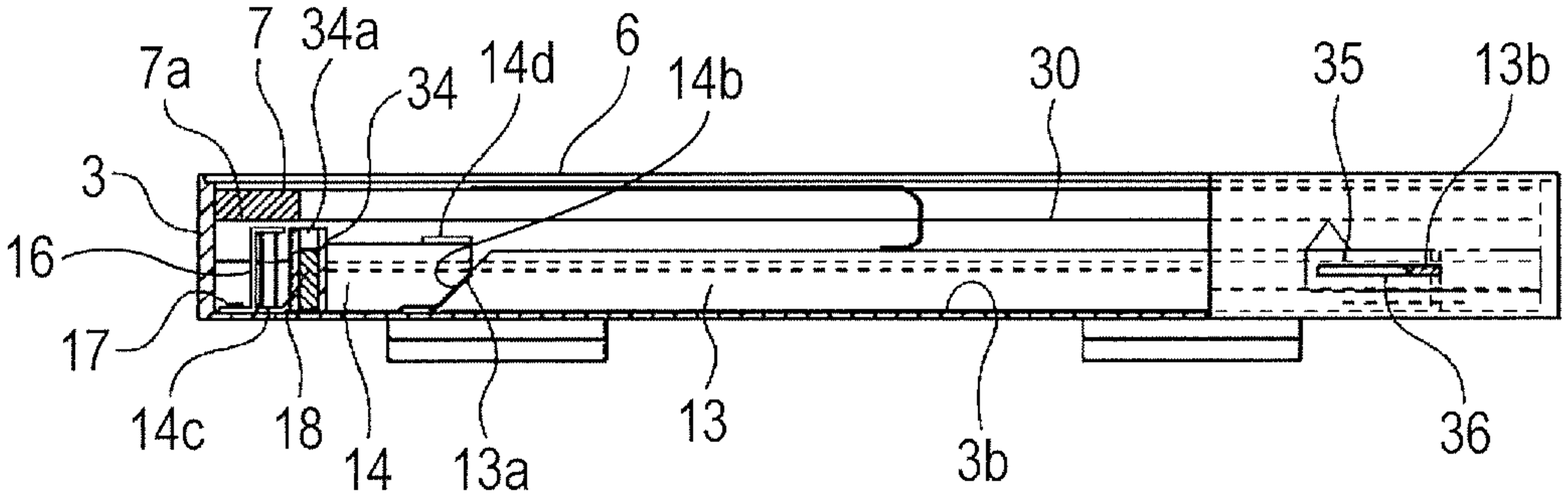
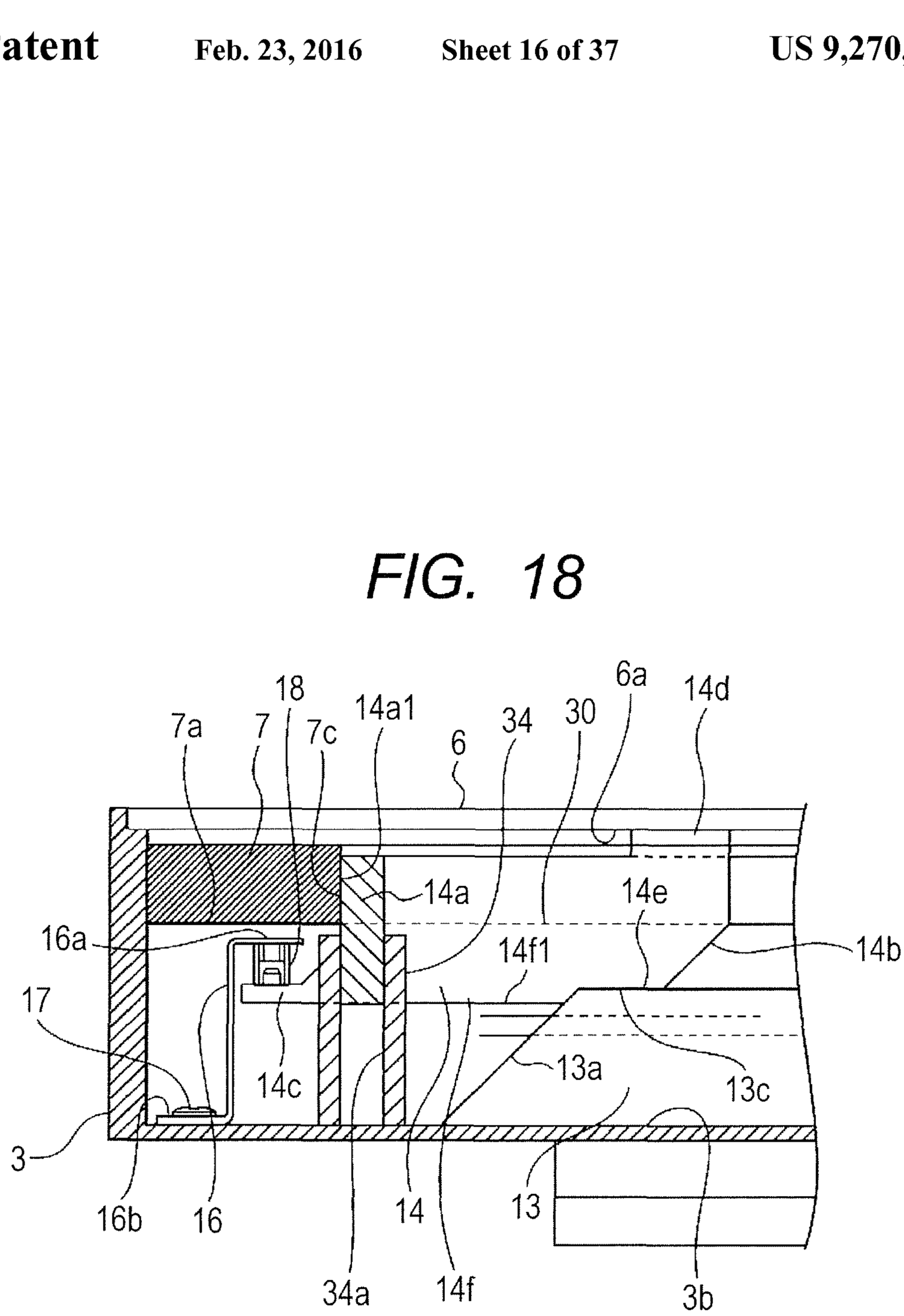


FIG. 18


18
7a
7
7c
14a1
6
34
30
6a
14d
14a
14e
16a
14f1
14b
17
14c
13a
13c
3
16b
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13
34a
14f
3b

FIG. 19

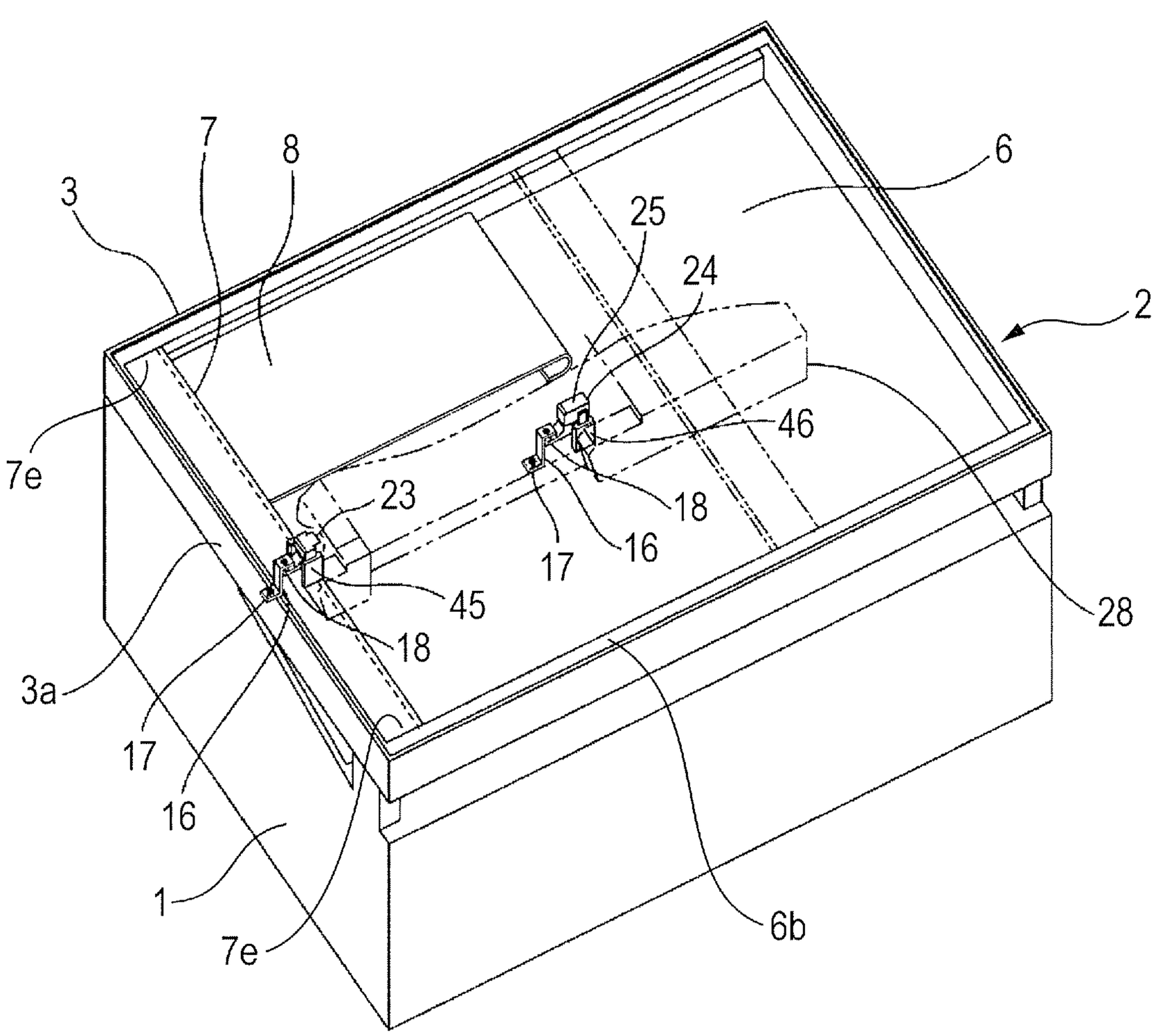


FIG. 20

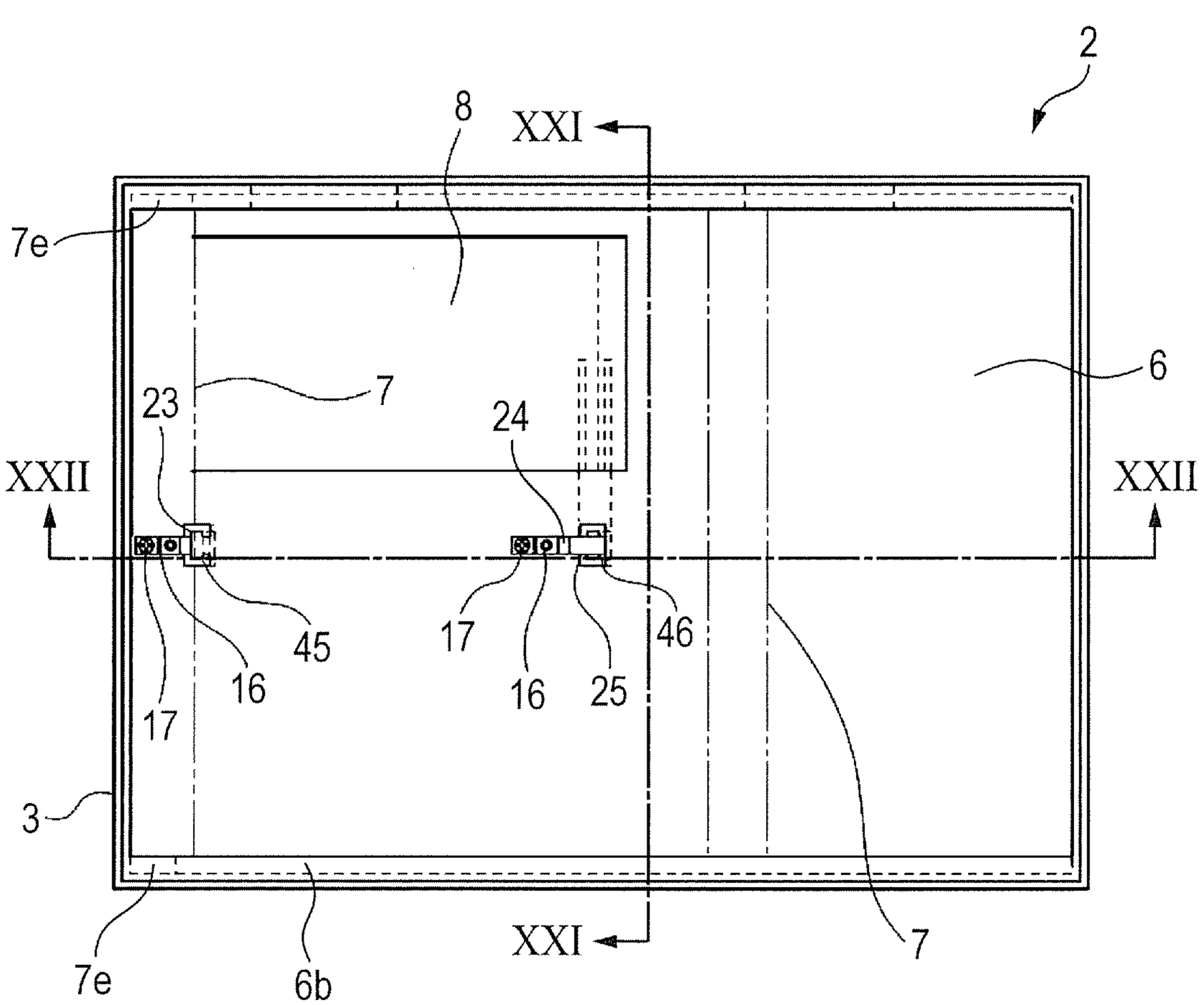


FIG. 21

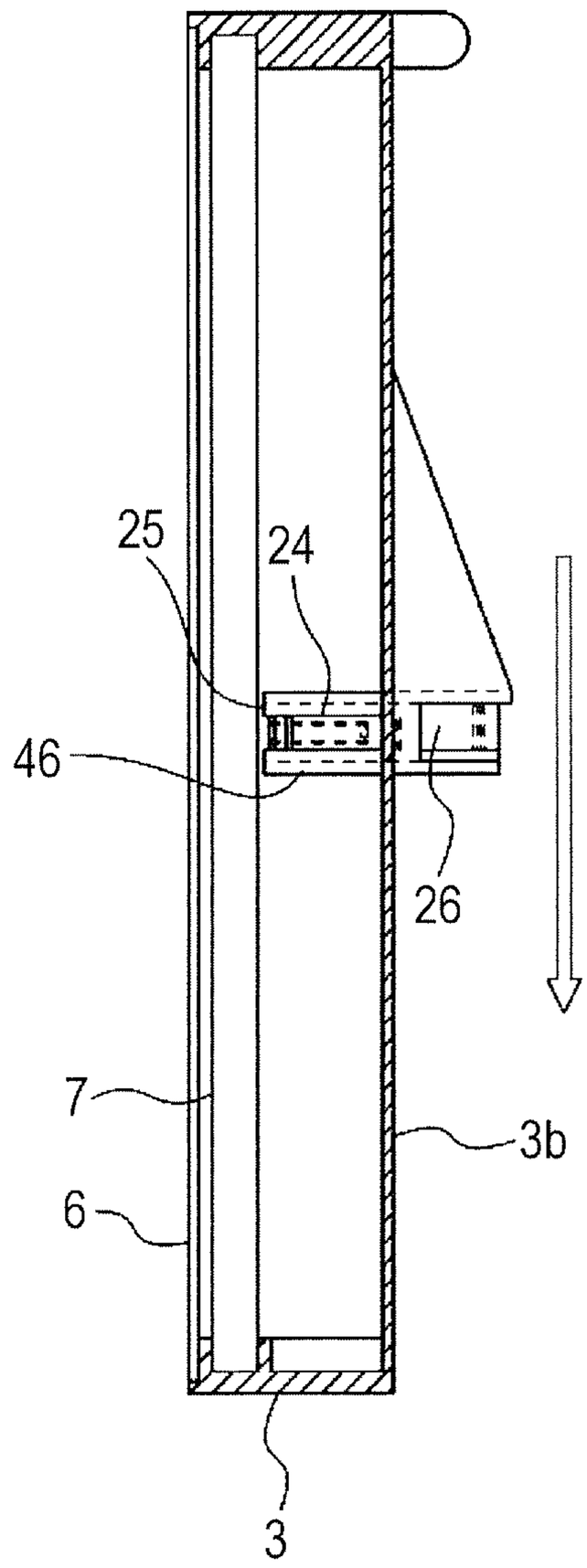


FIG. 22A

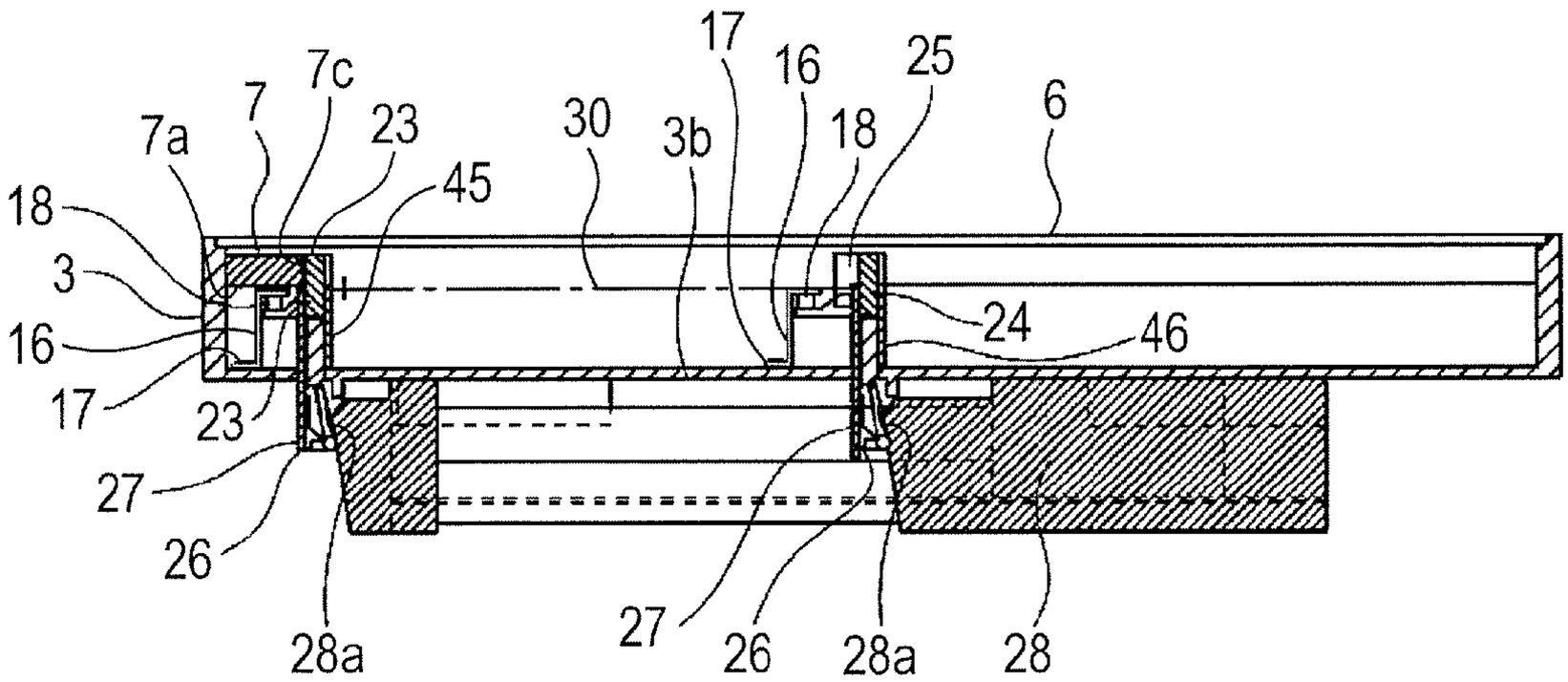


FIG. 22B

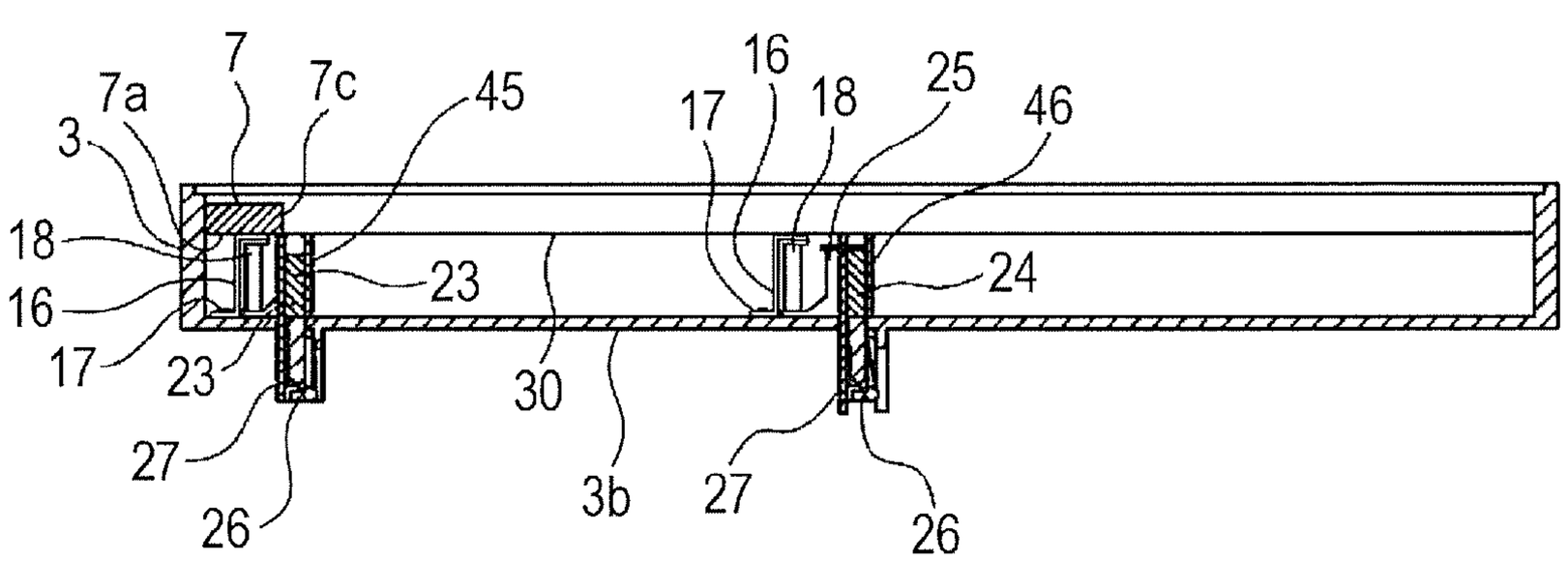


FIG. 23A

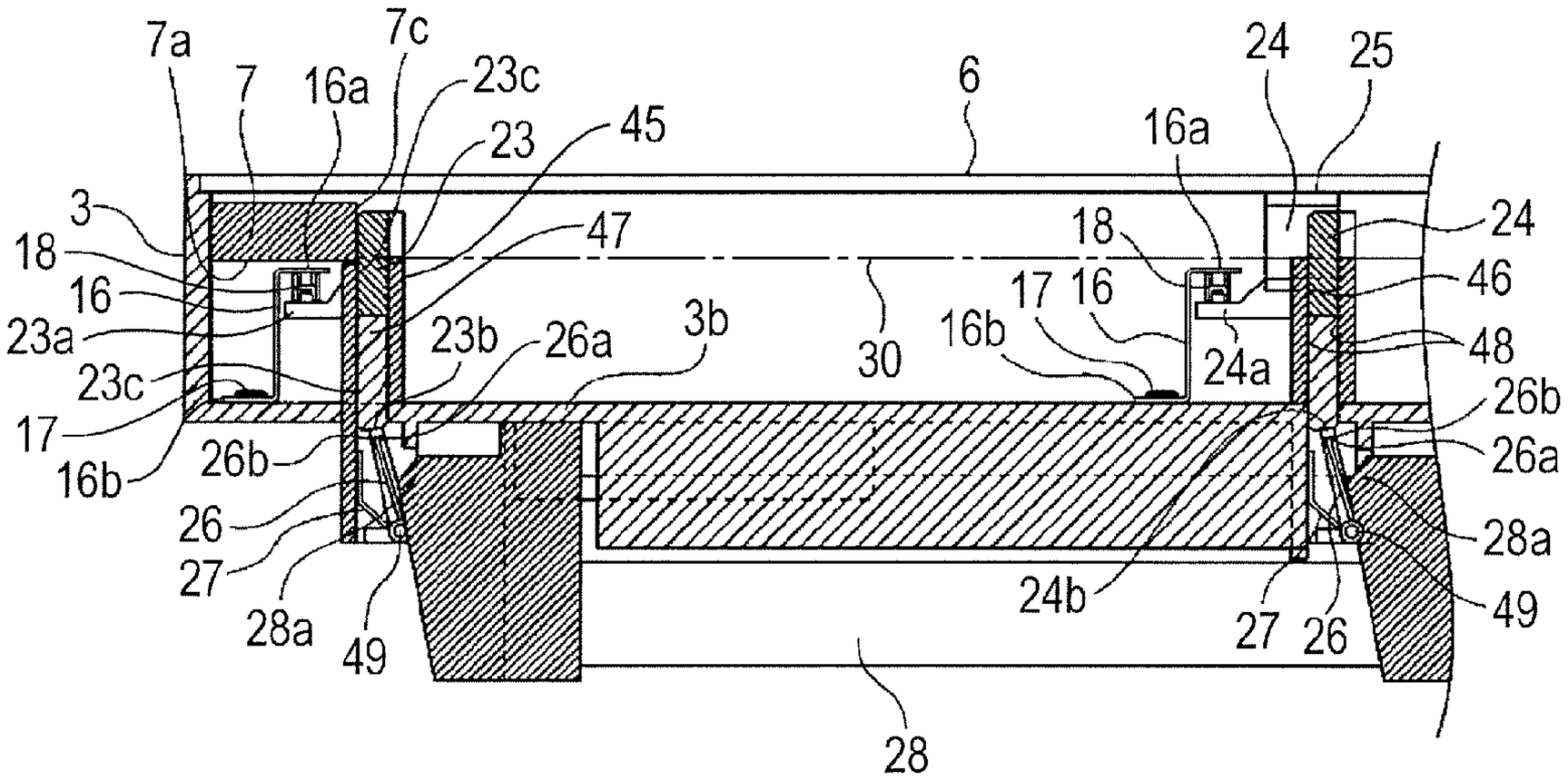


FIG. 23B

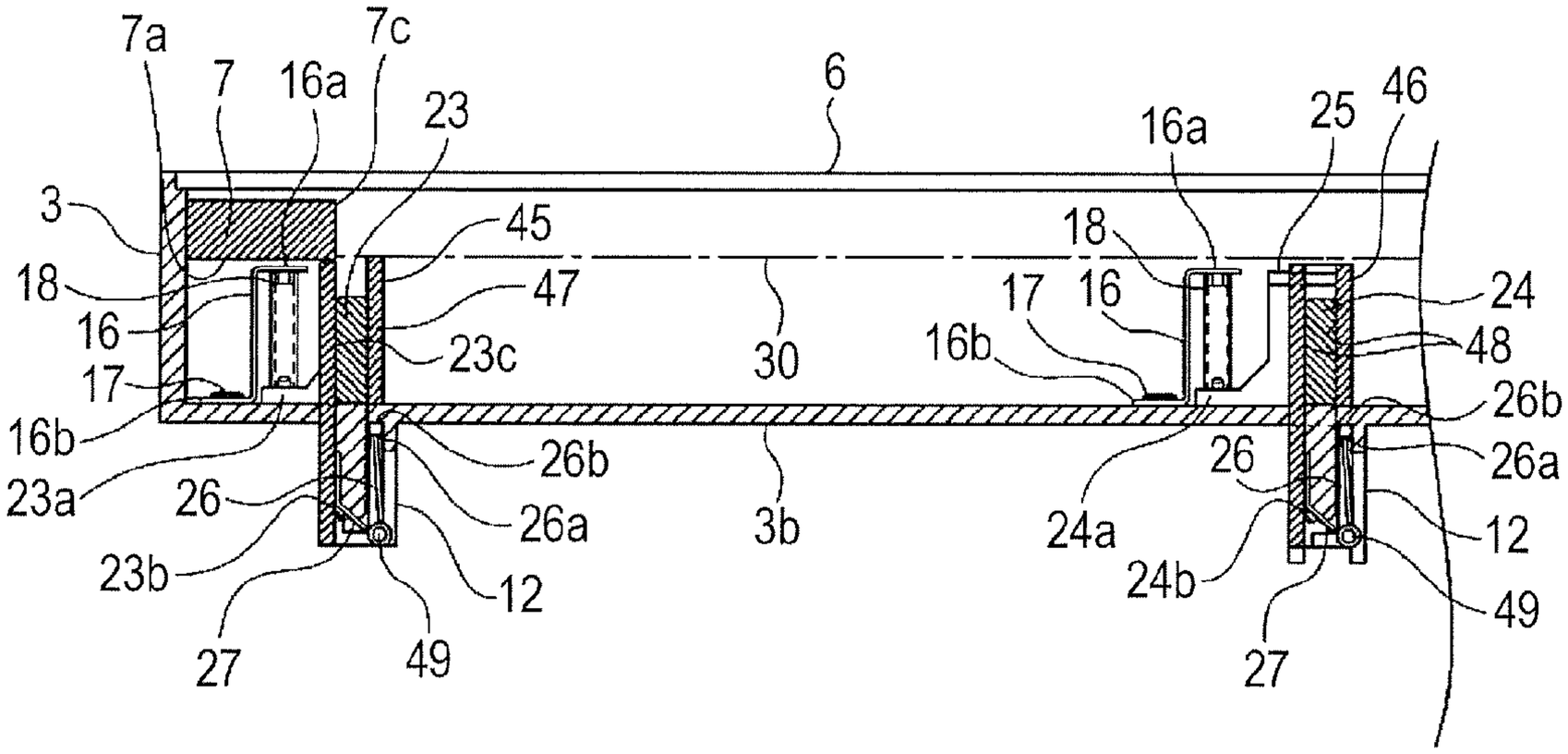


FIG. 24B

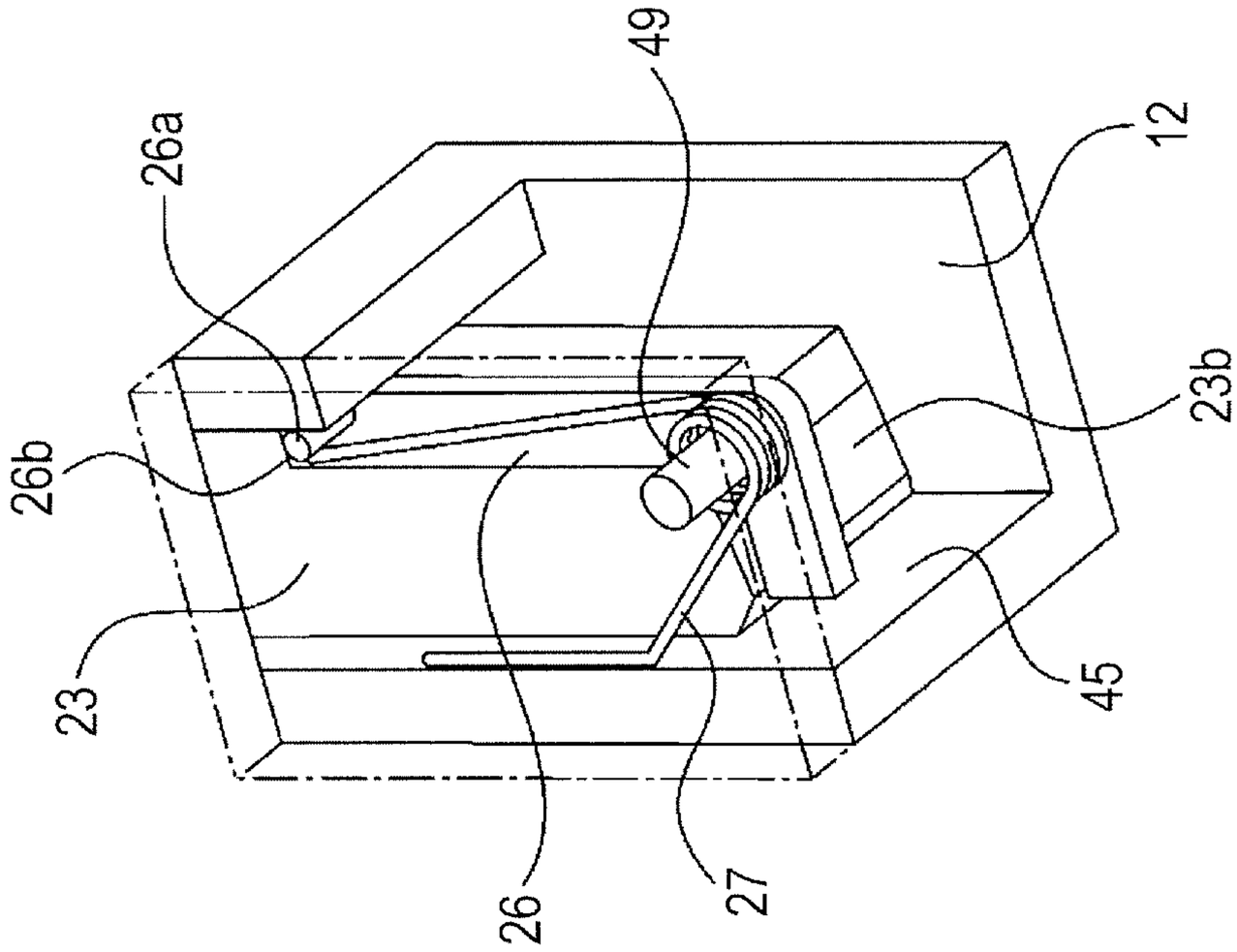


FIG. 24A

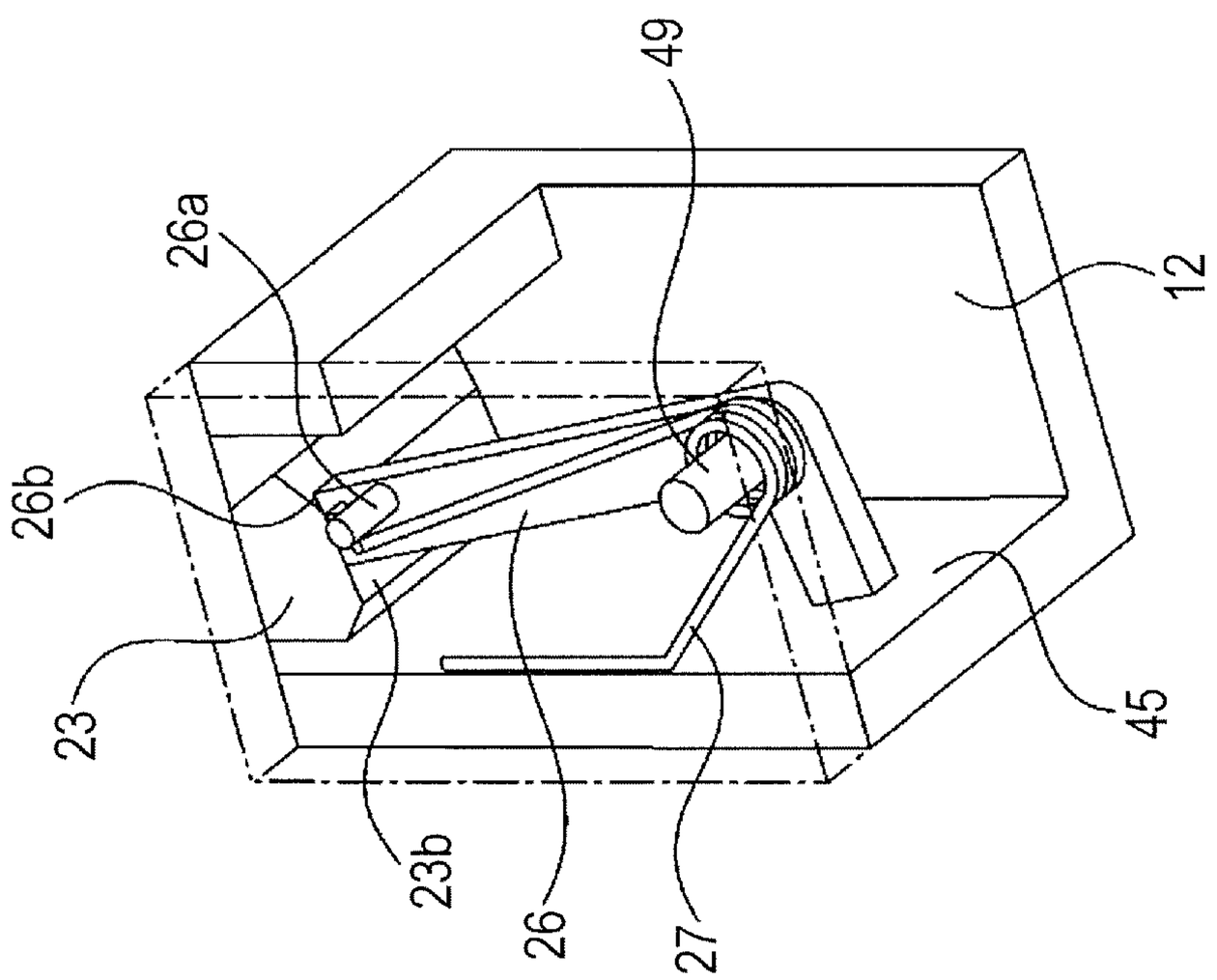


FIG. 25

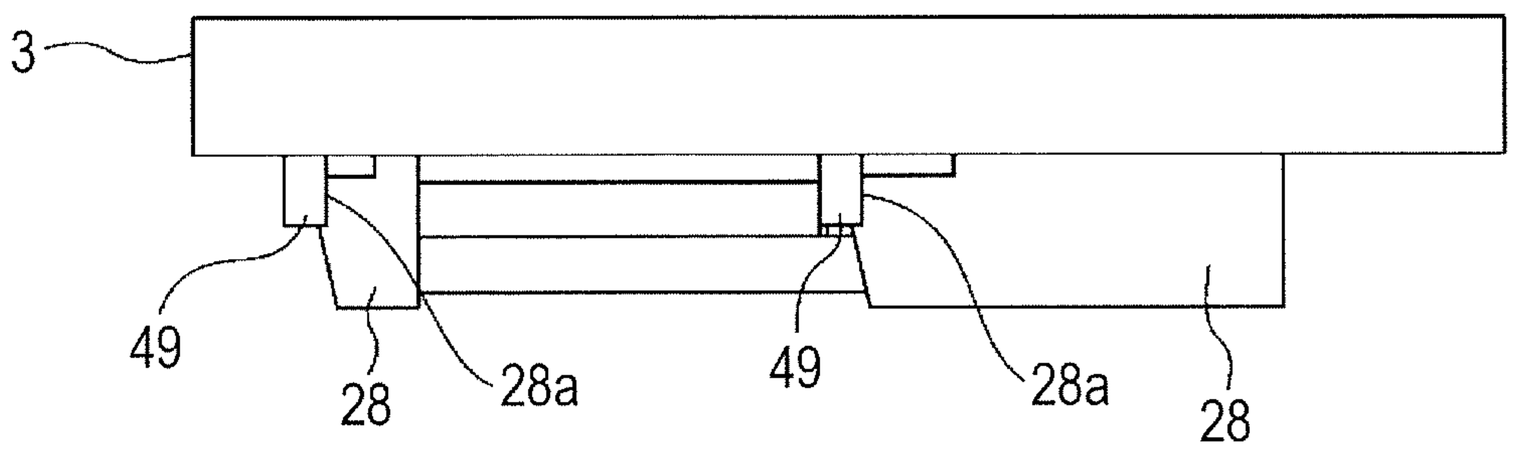
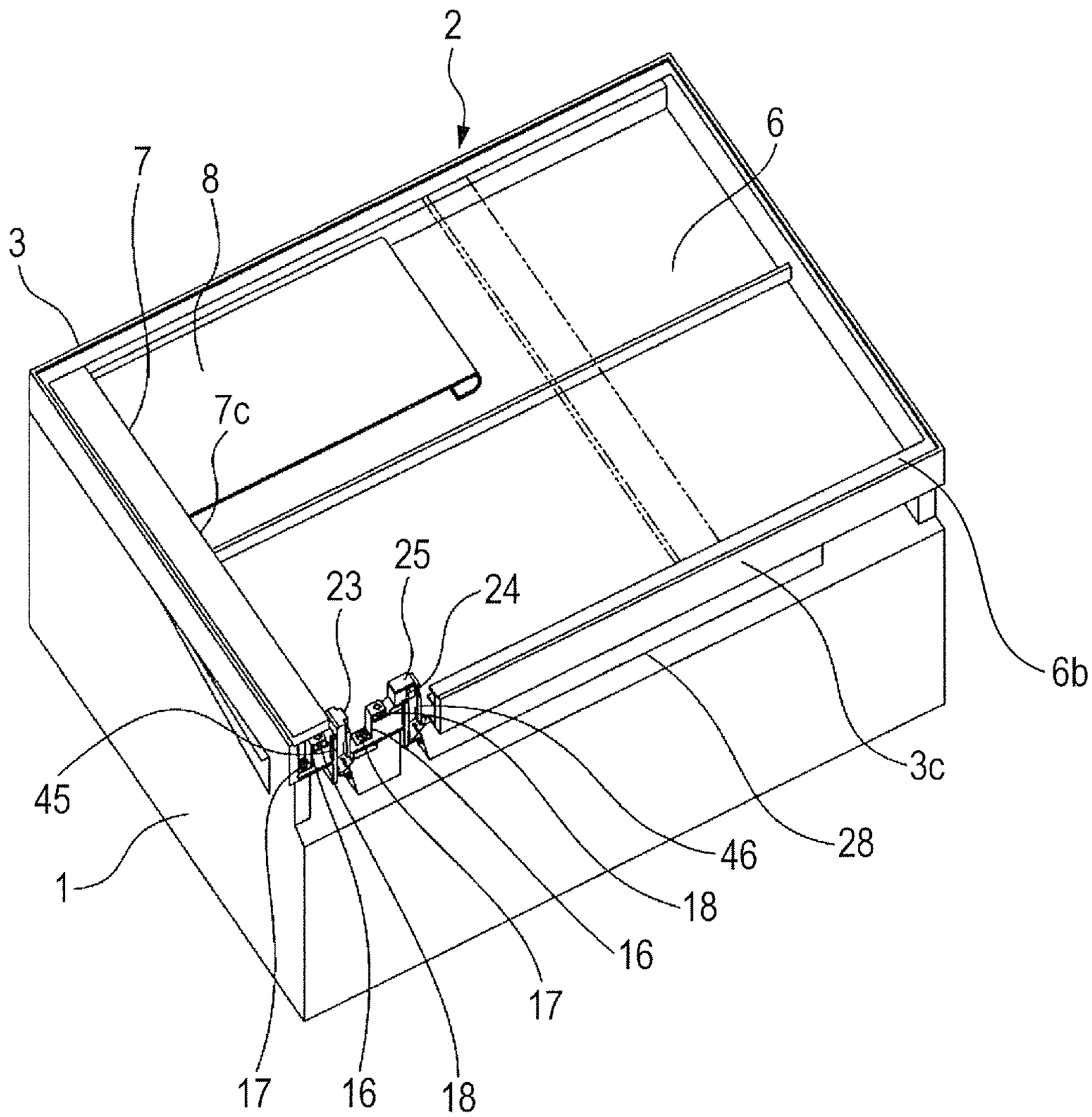

3
49
28
28a
49
28a
28

FIG. 26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7
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FIG. 27A

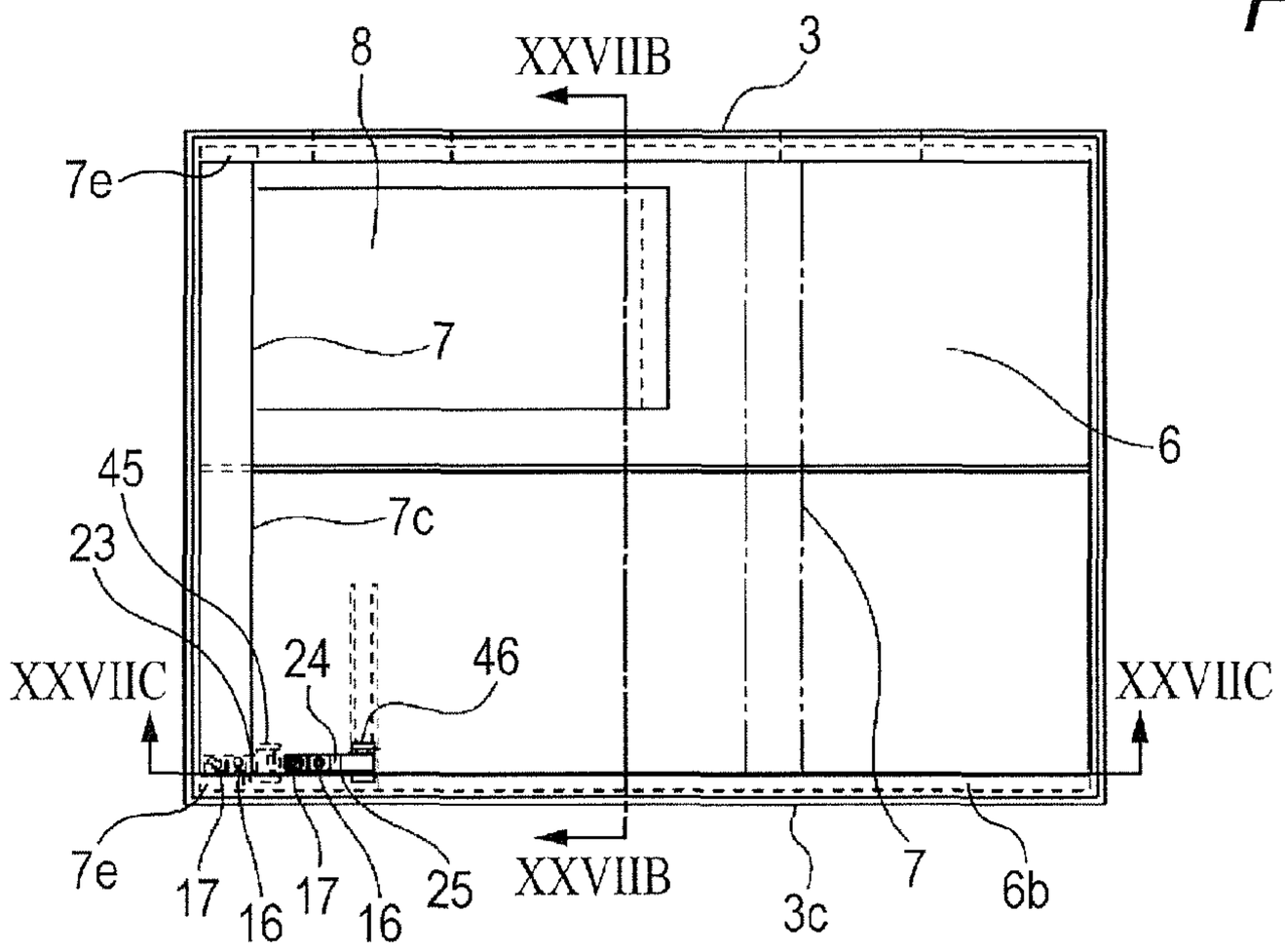


FIG. 27B

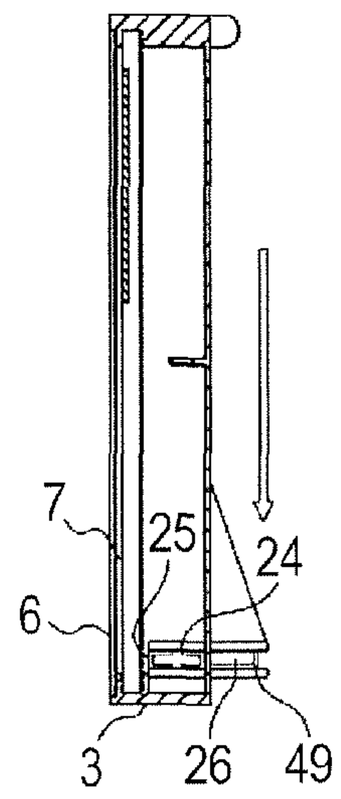


FIG. 27C

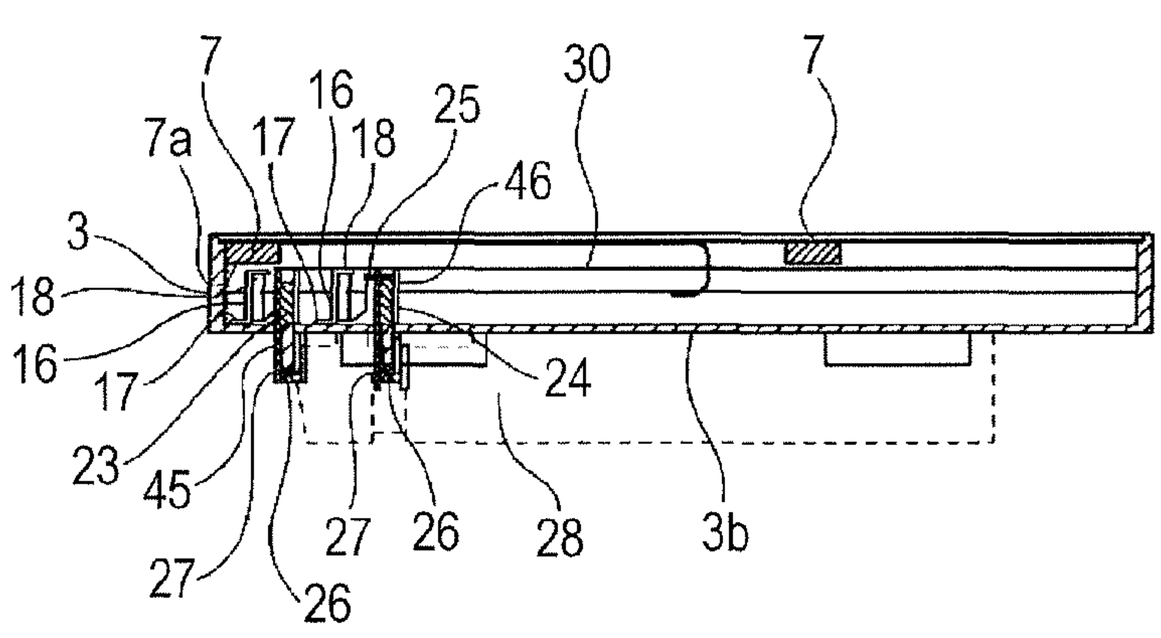


FIG. 28A

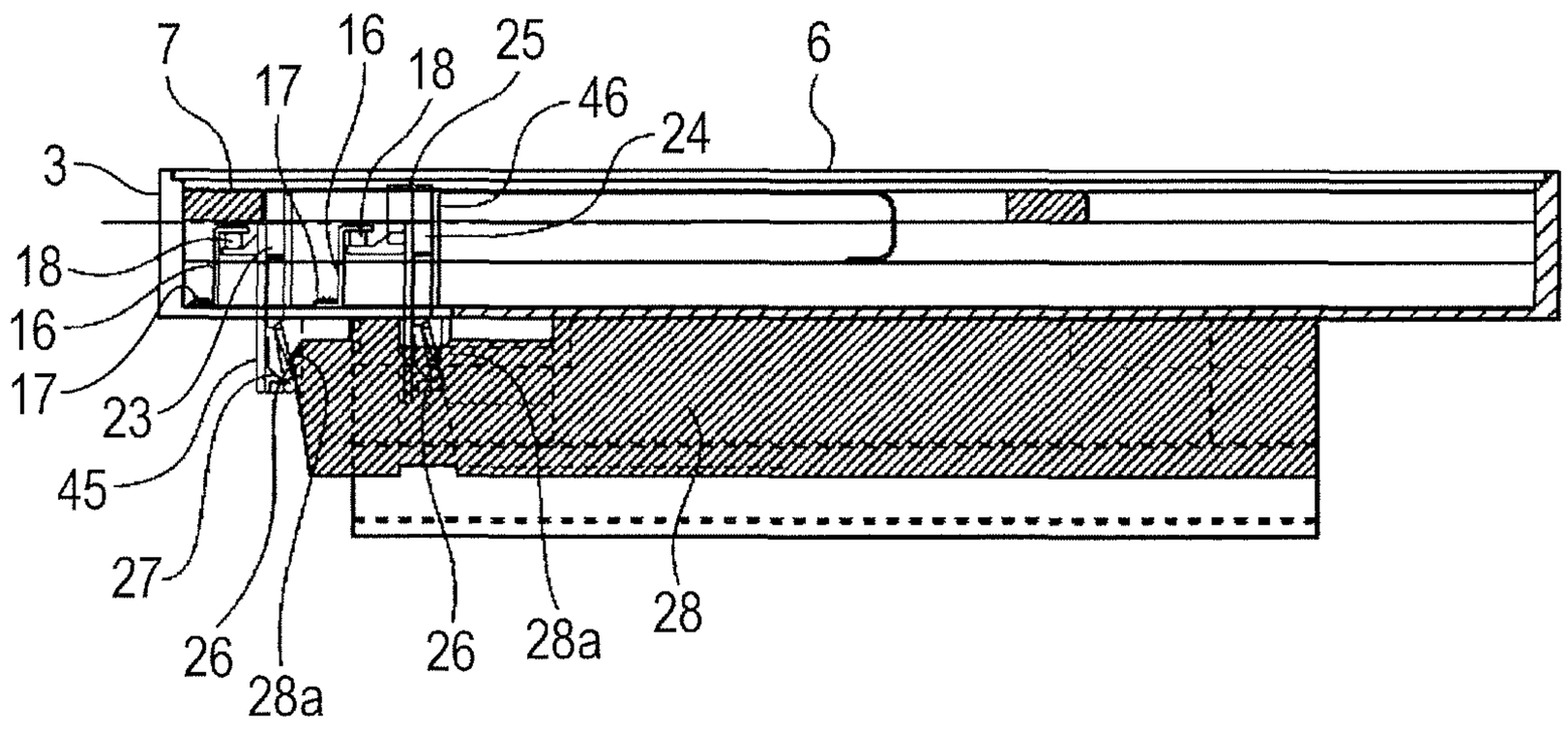


FIG. 28B

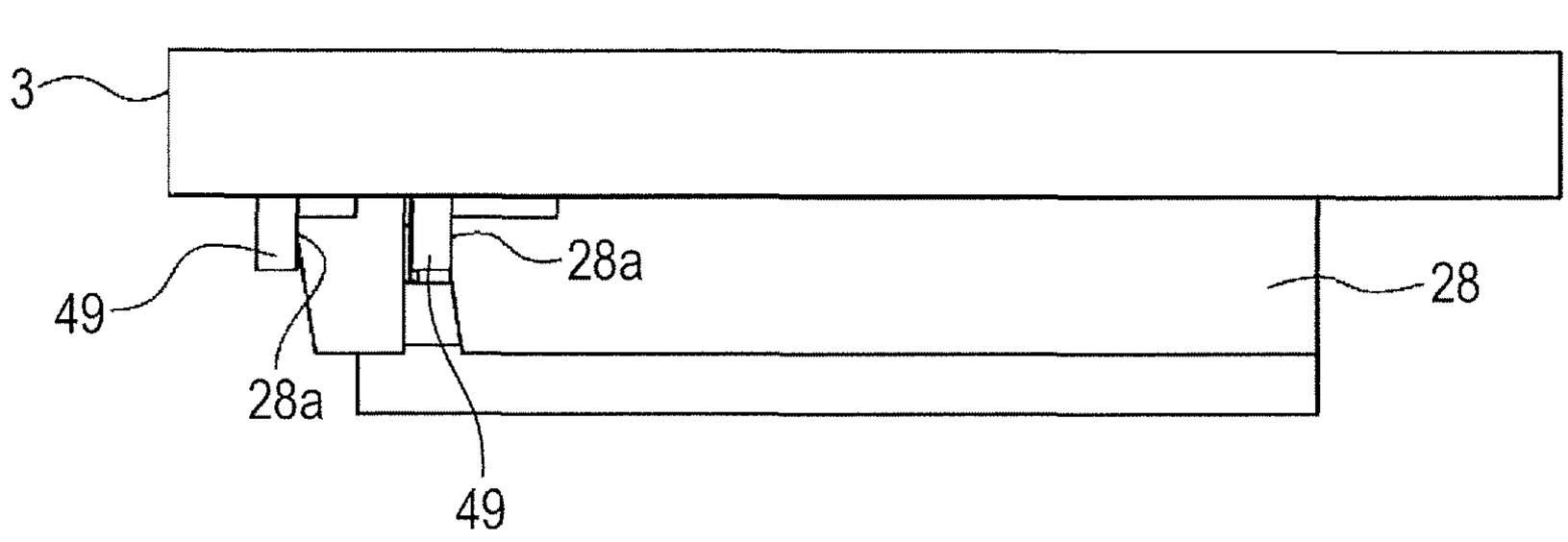
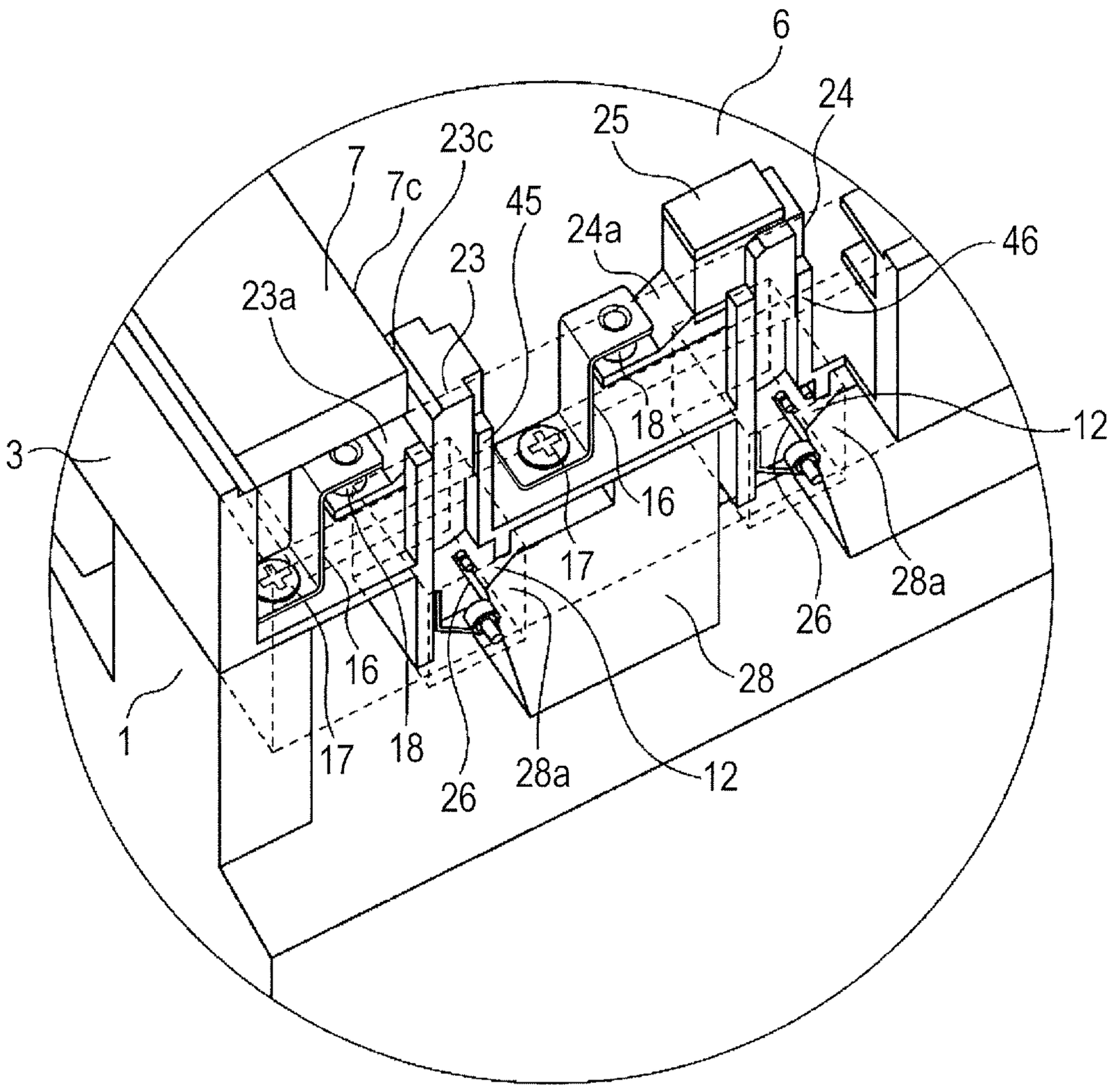


FIG. 29


6
24
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23c
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7c
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24a
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26
28a
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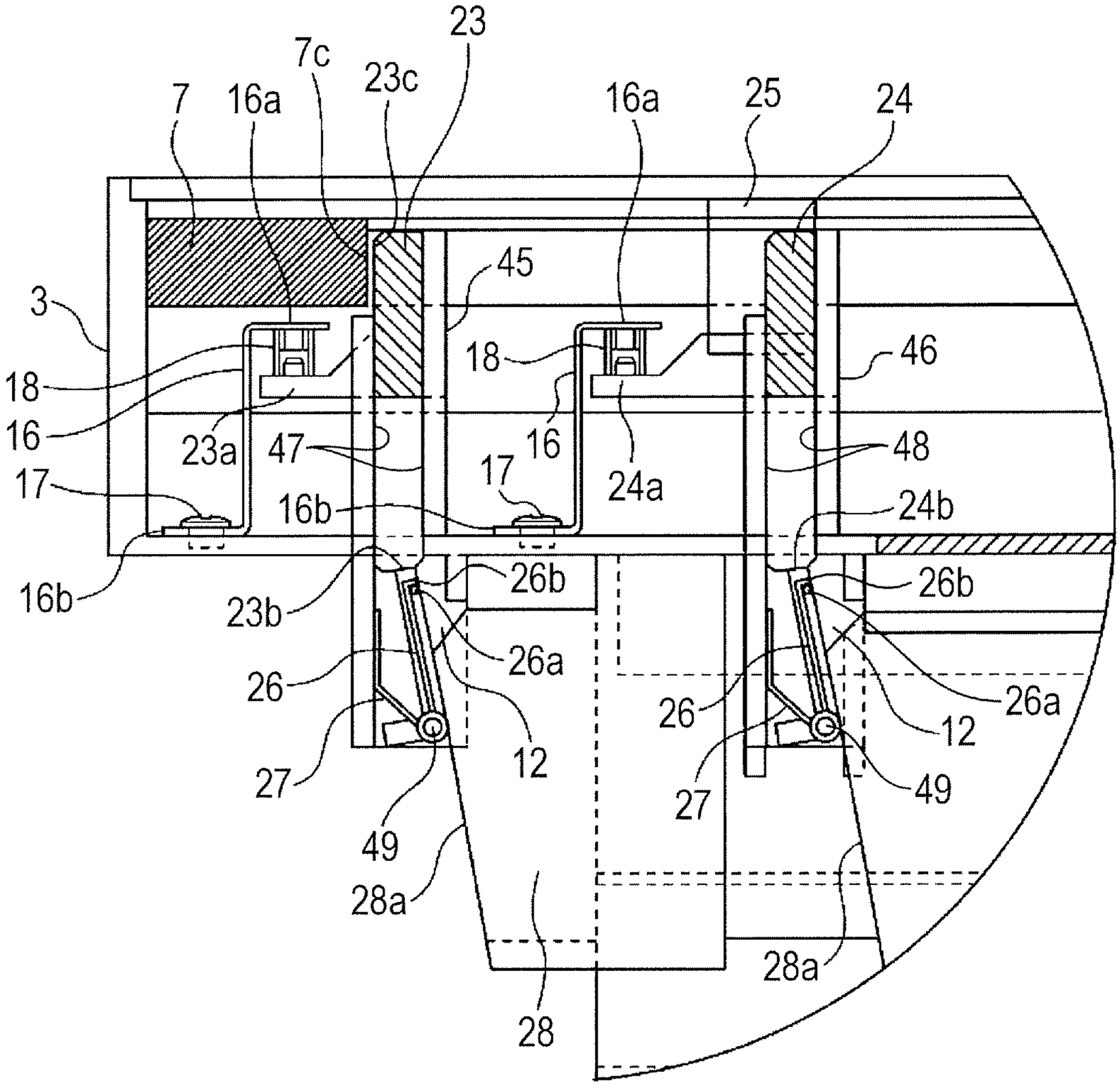
FIG. 30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16b
24b
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FIG. 31A

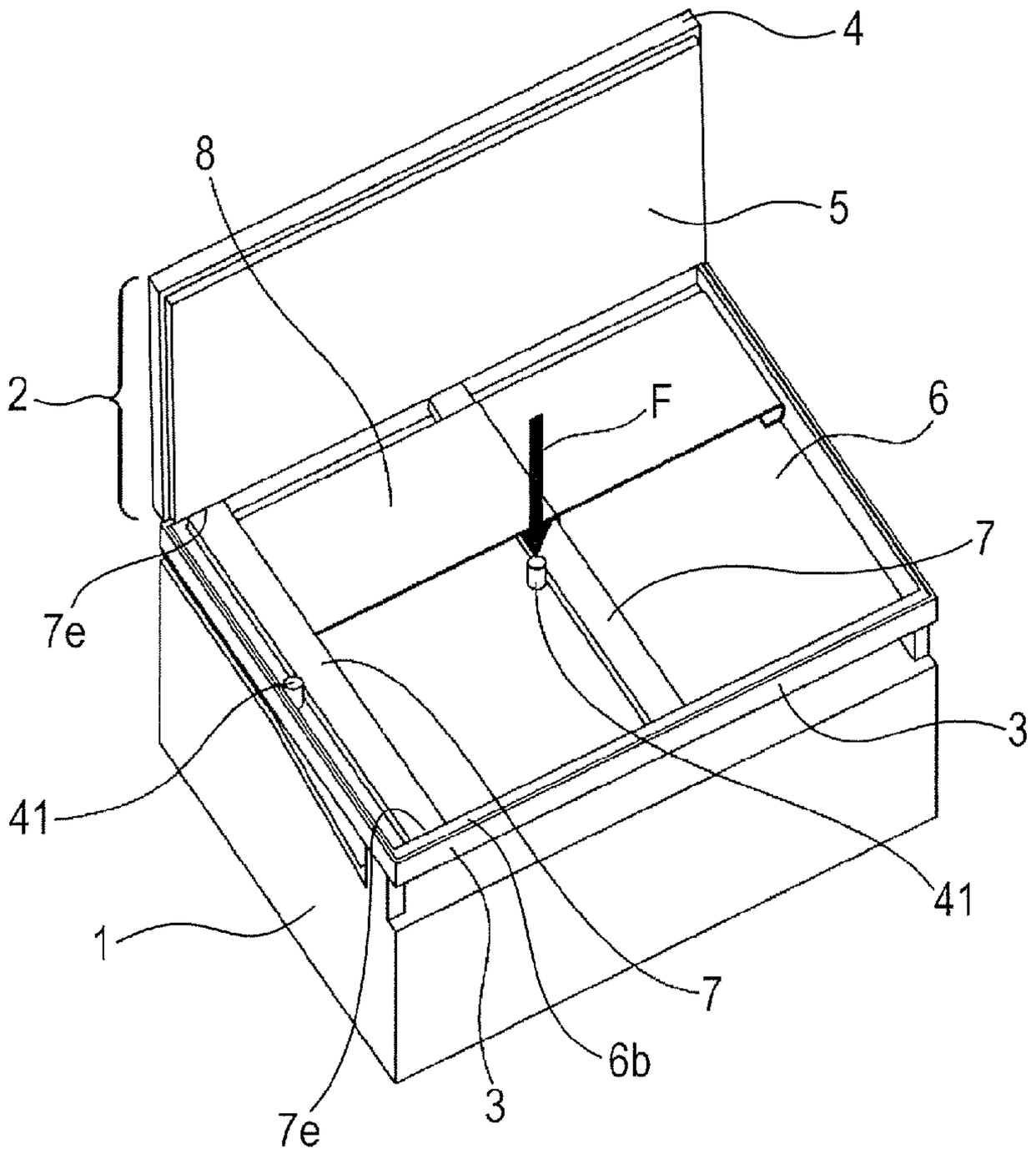

FIG. 31B

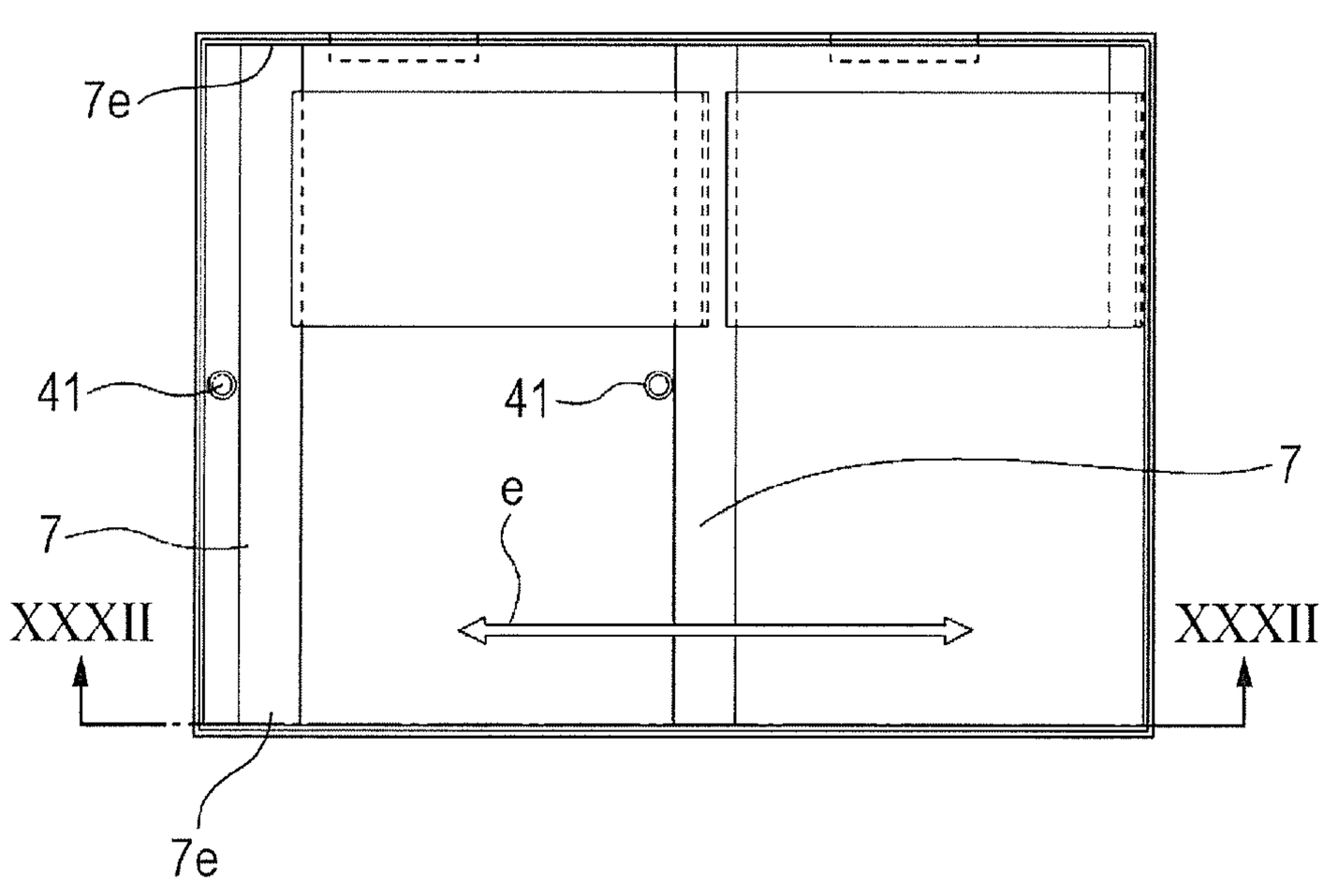

FIG. 32A

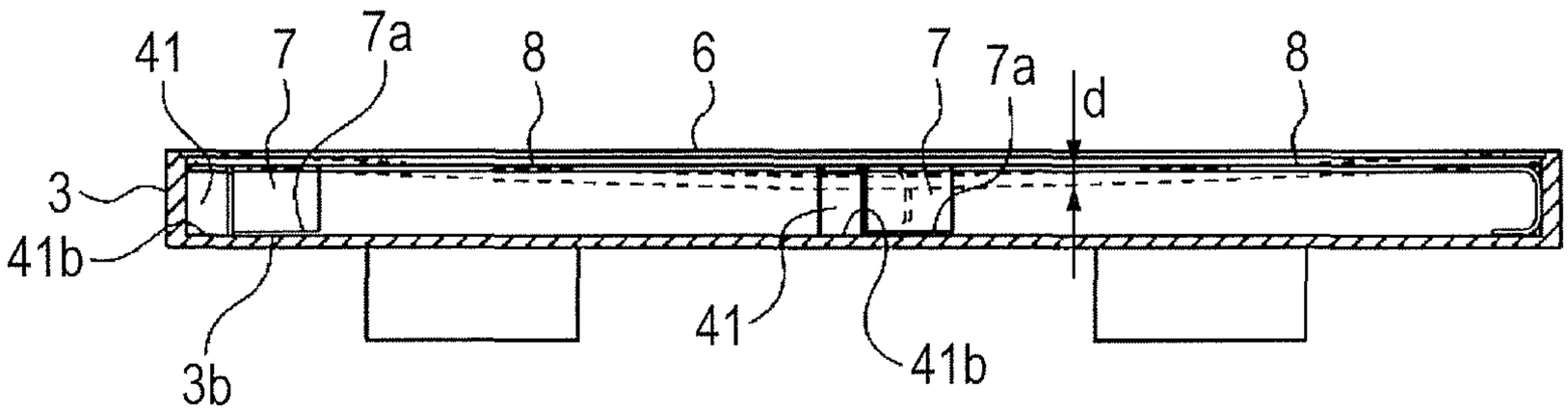

FIG. 32B

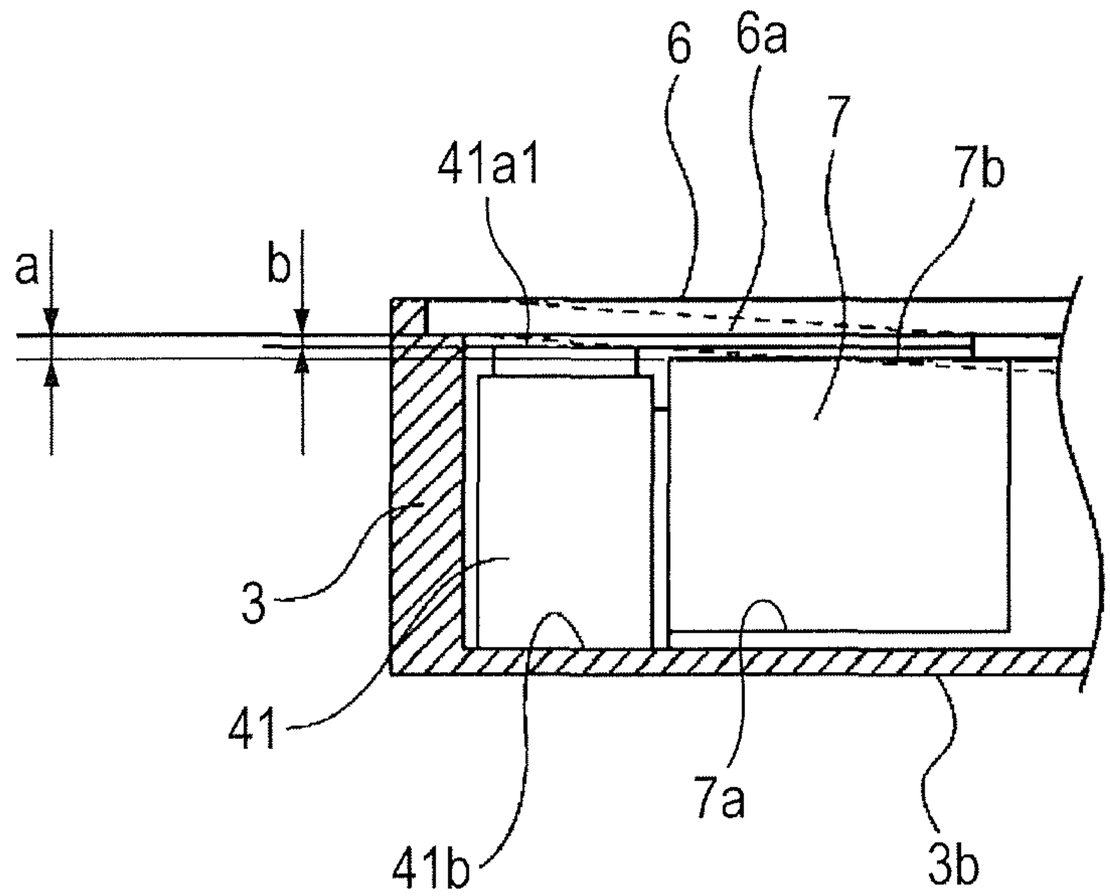

FIG. 33A

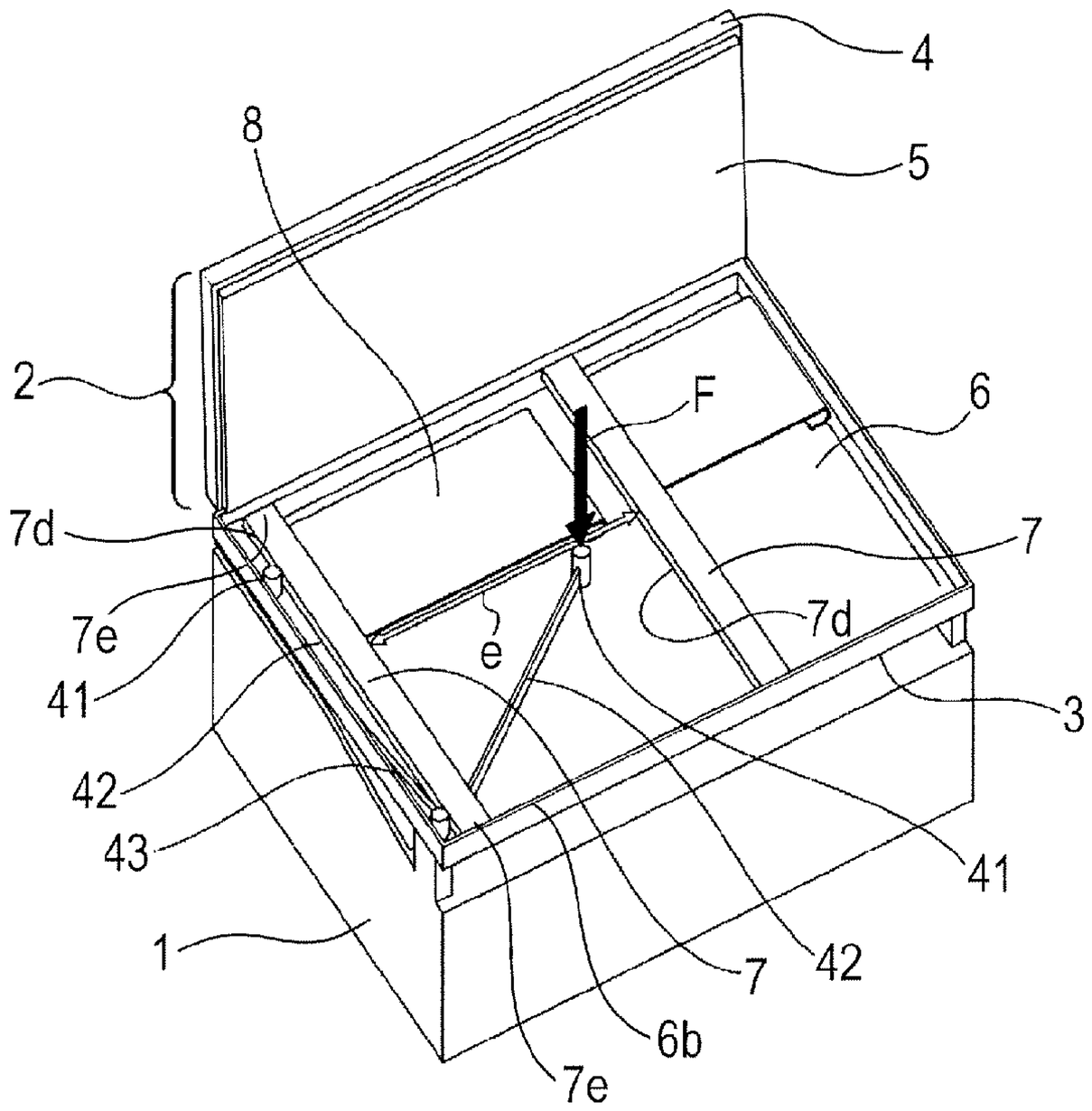

FIG. 33B

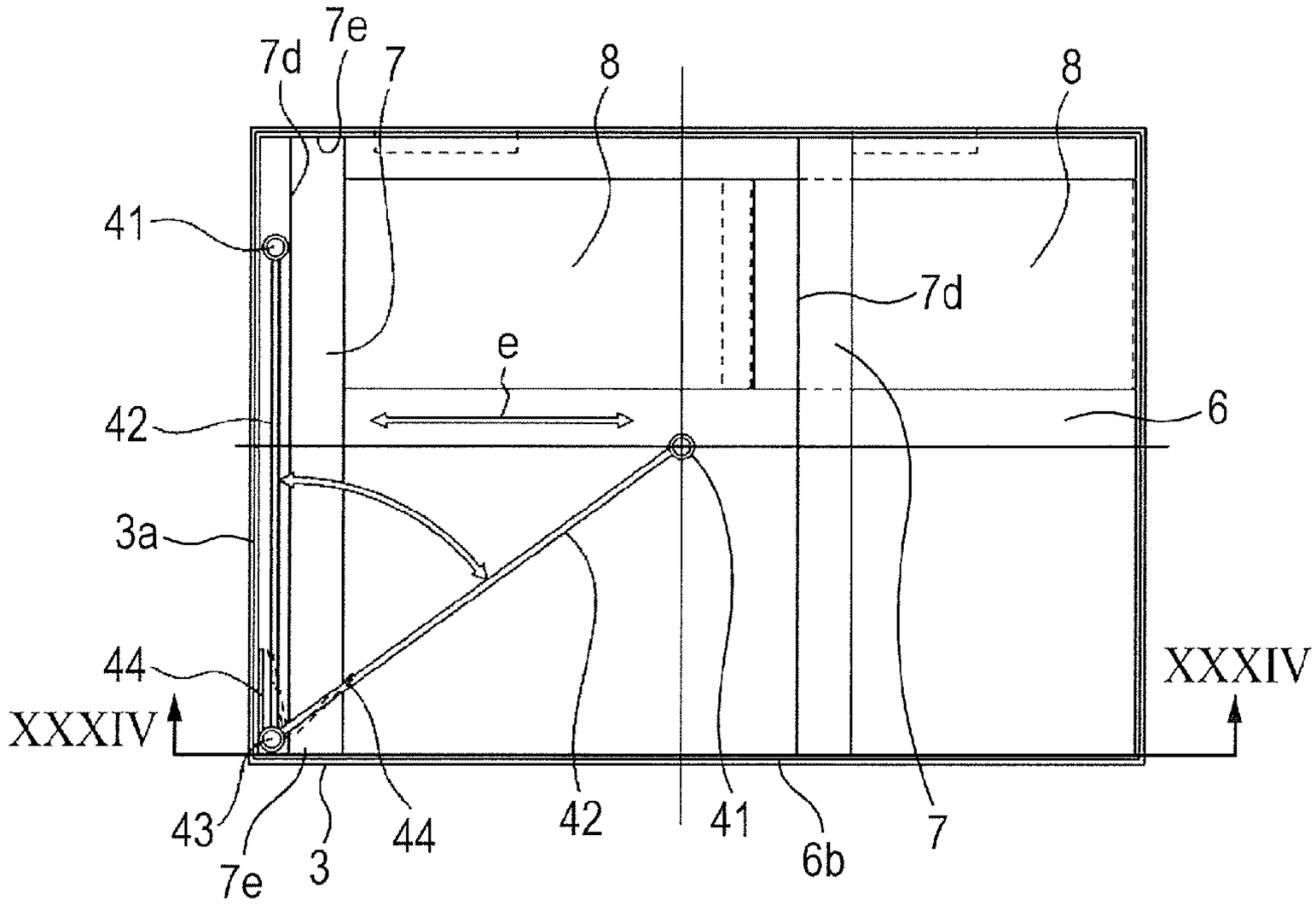

FIG. 34A

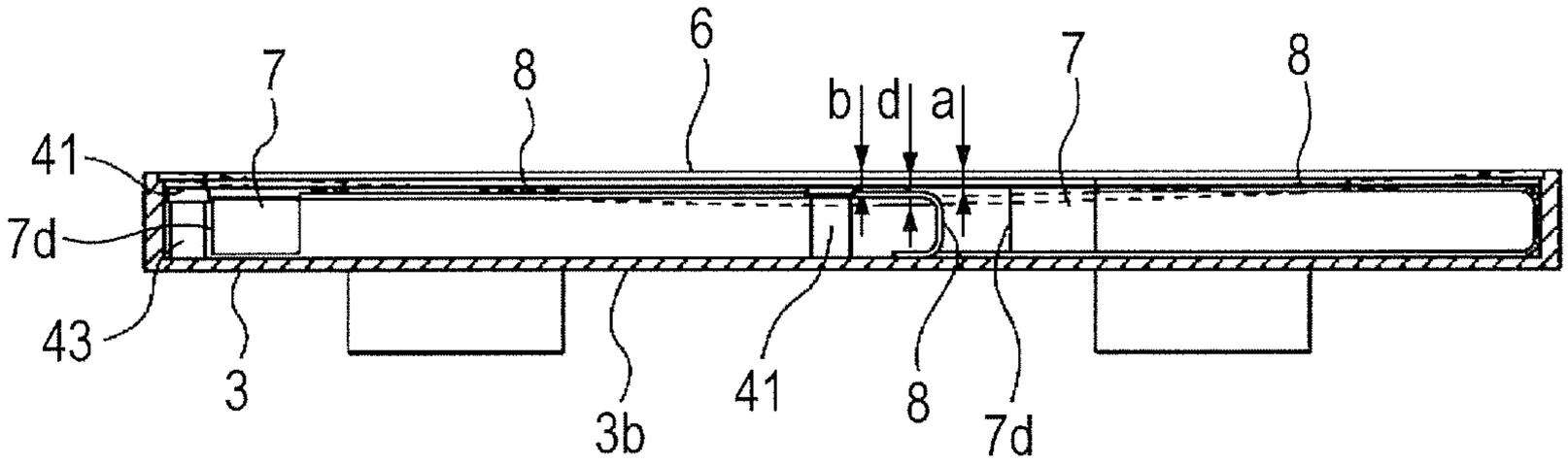

FIG. 34B

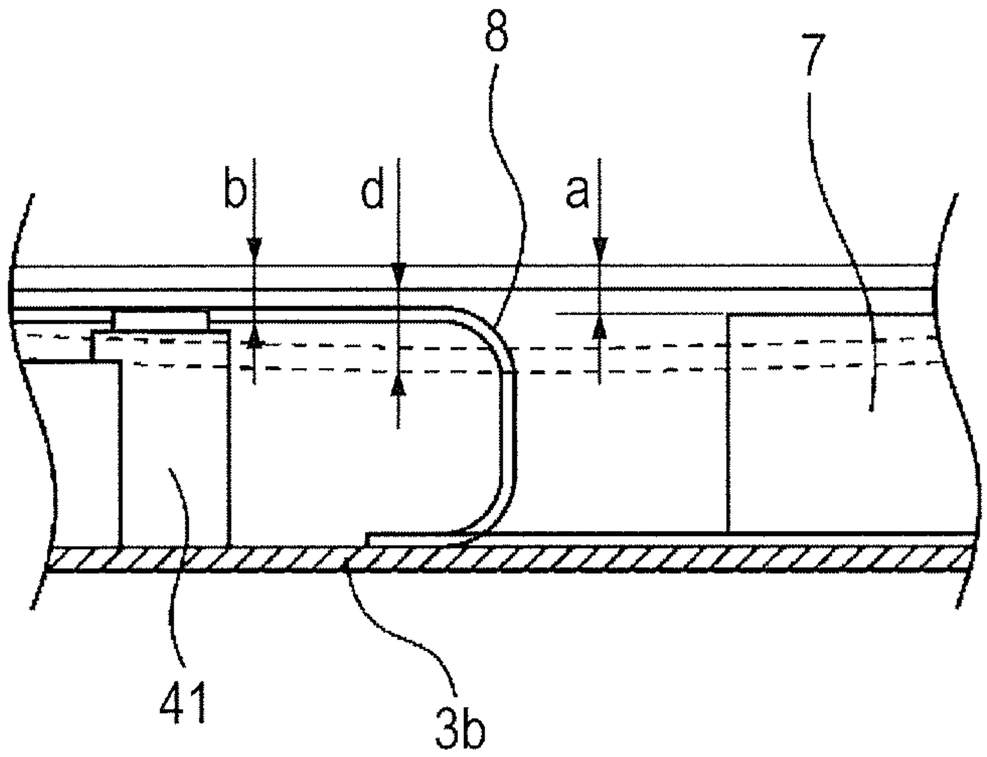

FIG. 35

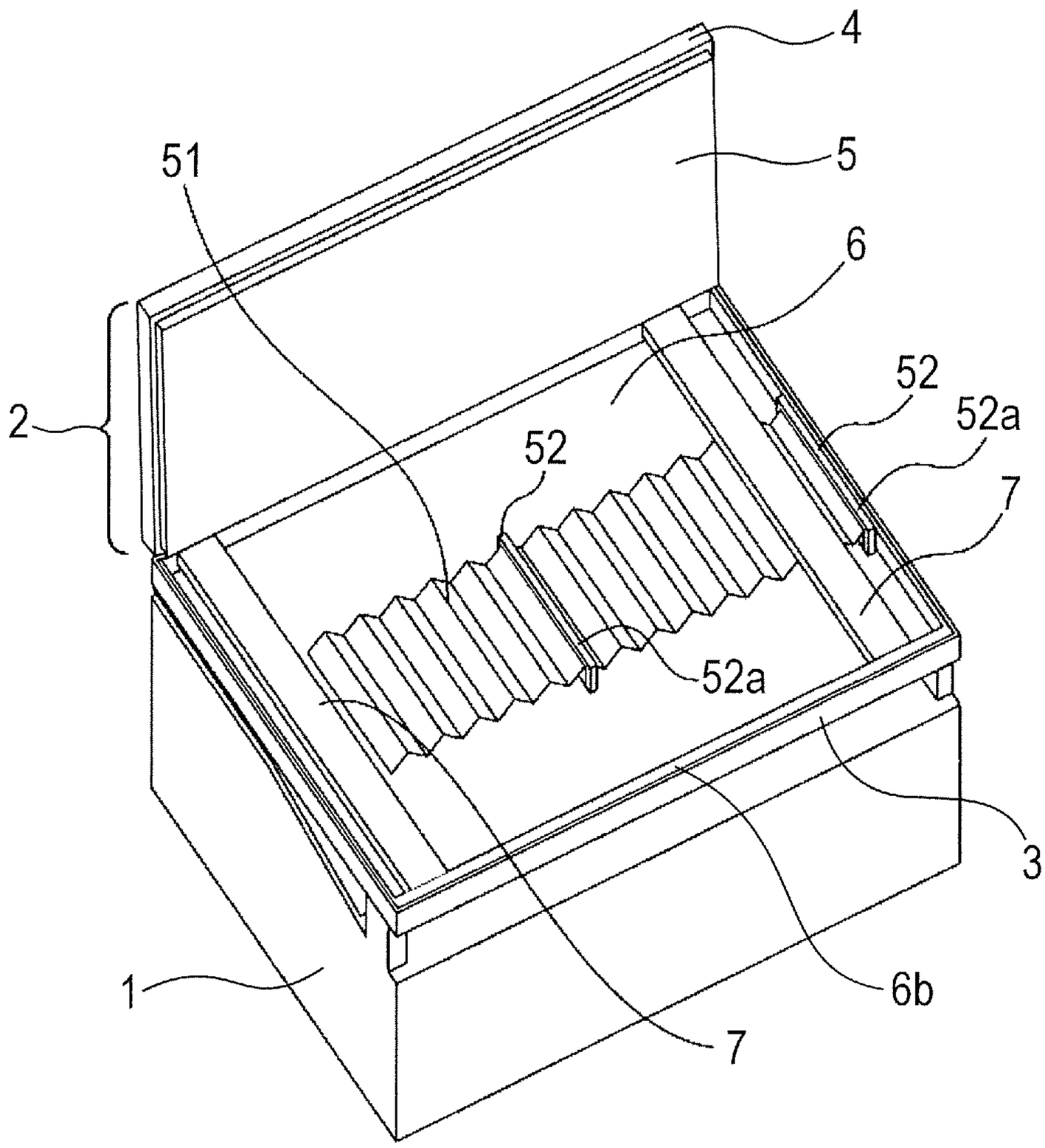

FIG. 36A

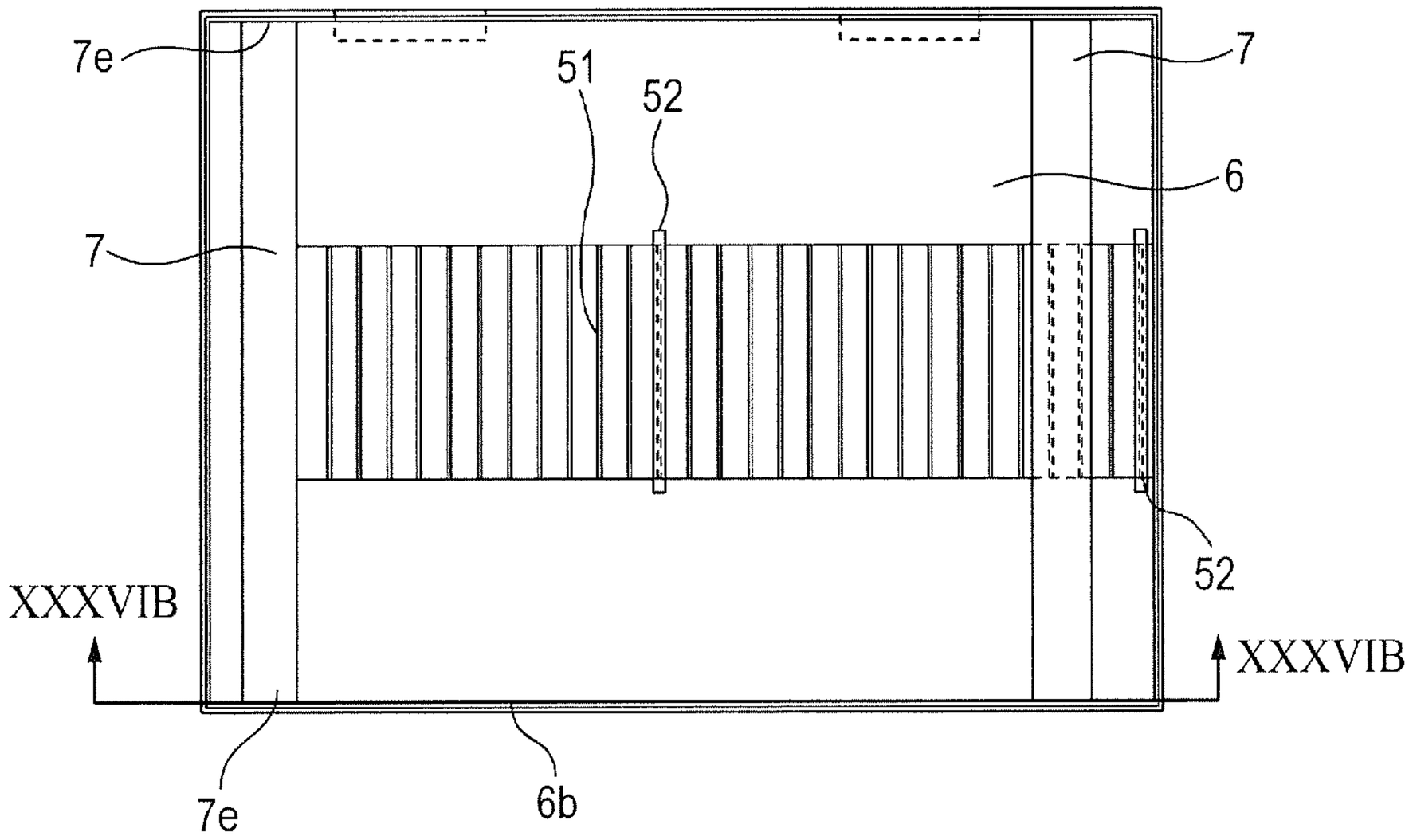

FIG. 36B

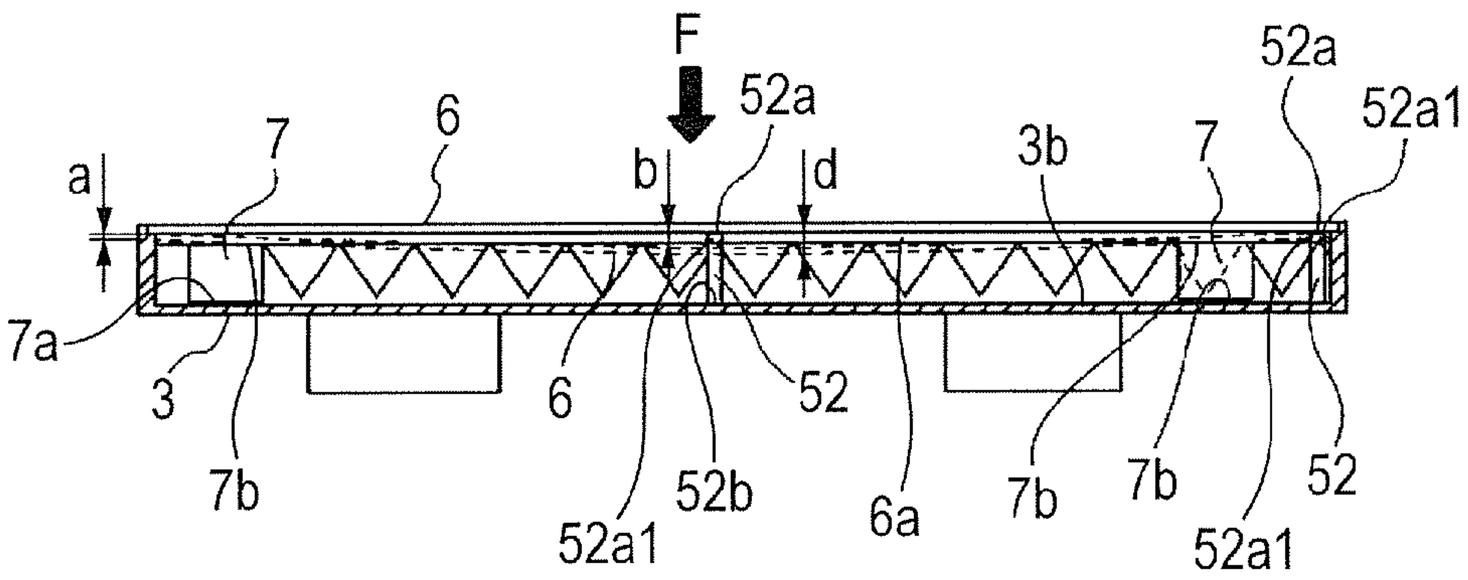

FIG. 37A

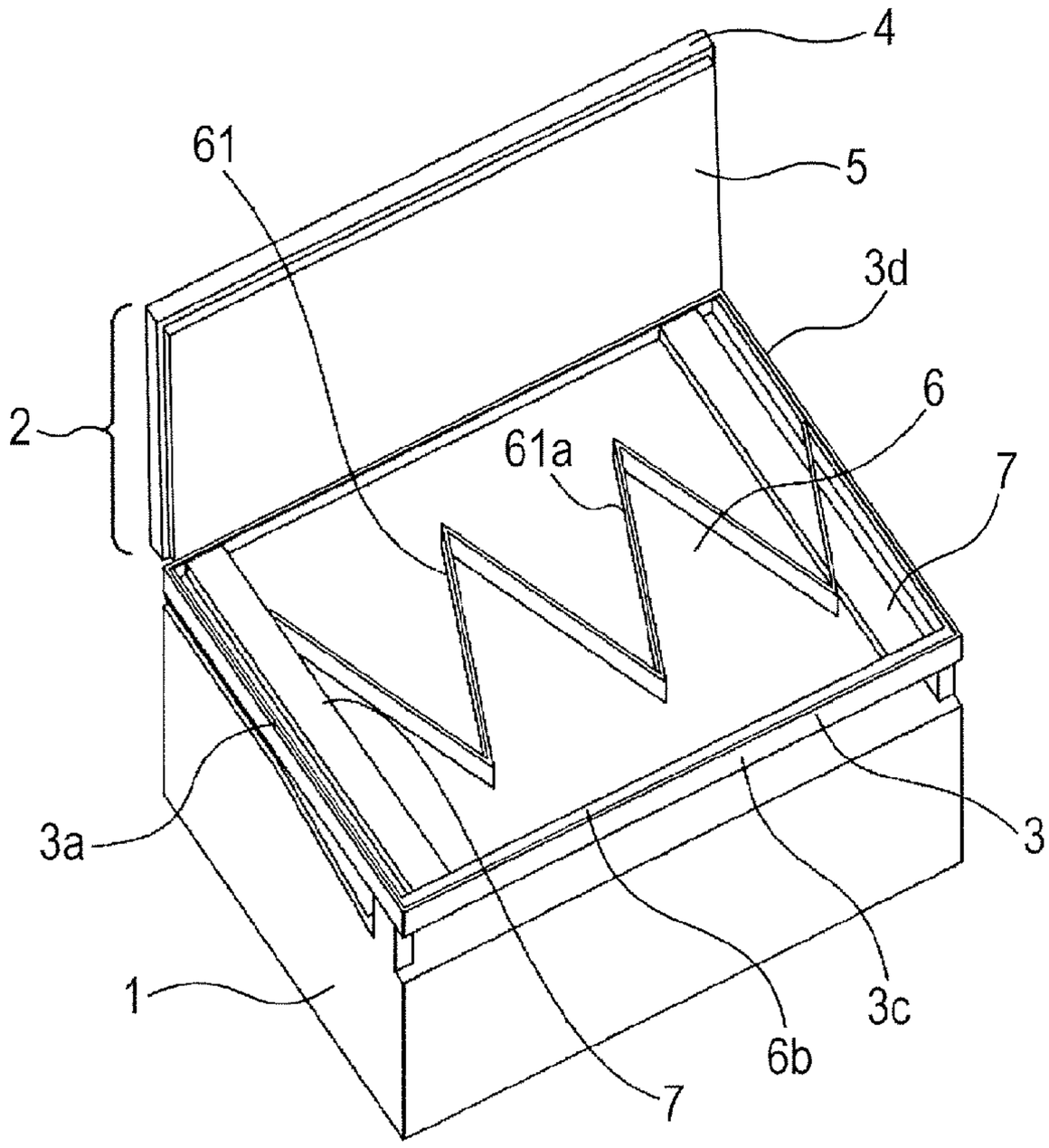

FIG. 37B

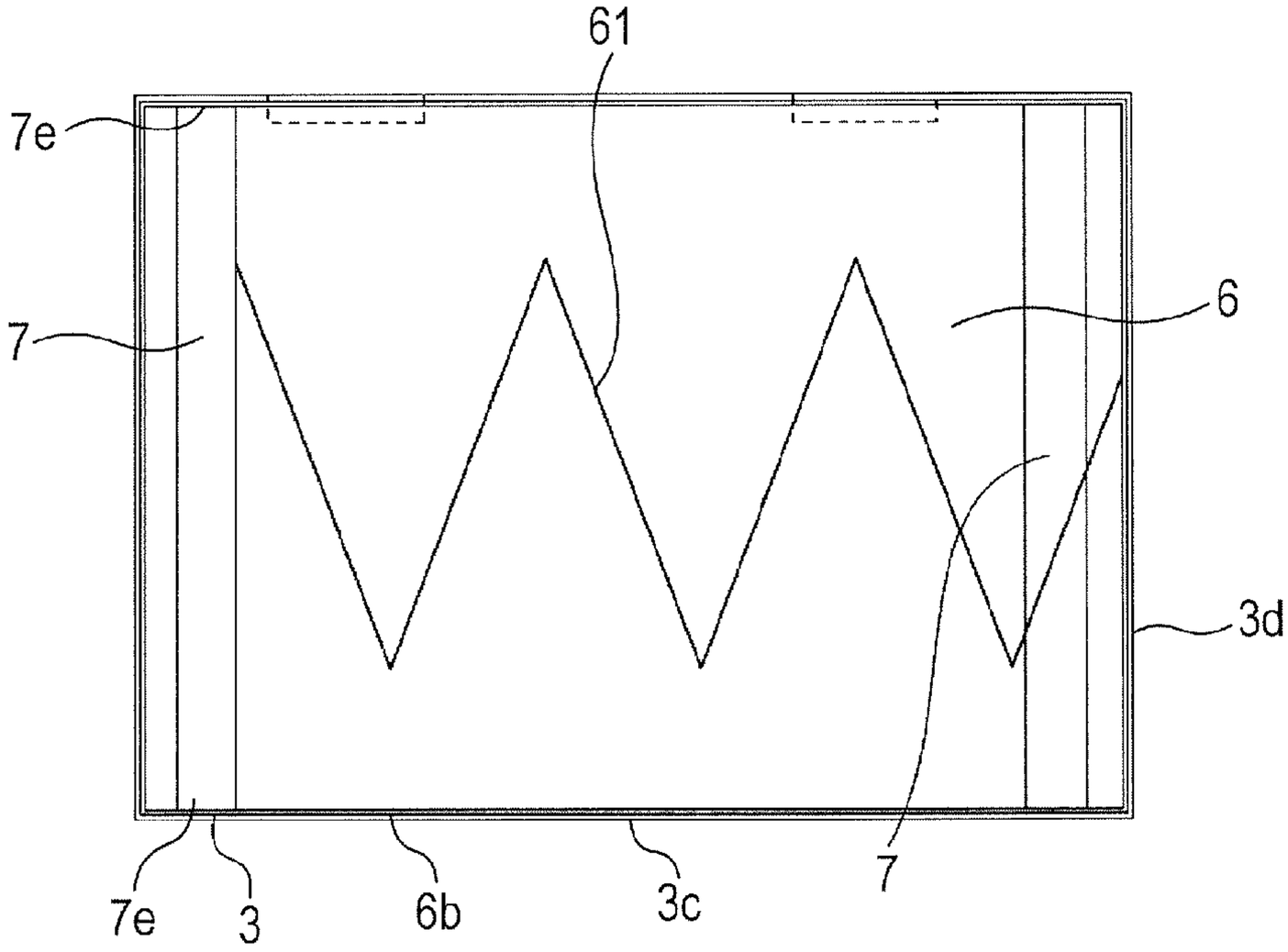

FIG. 38

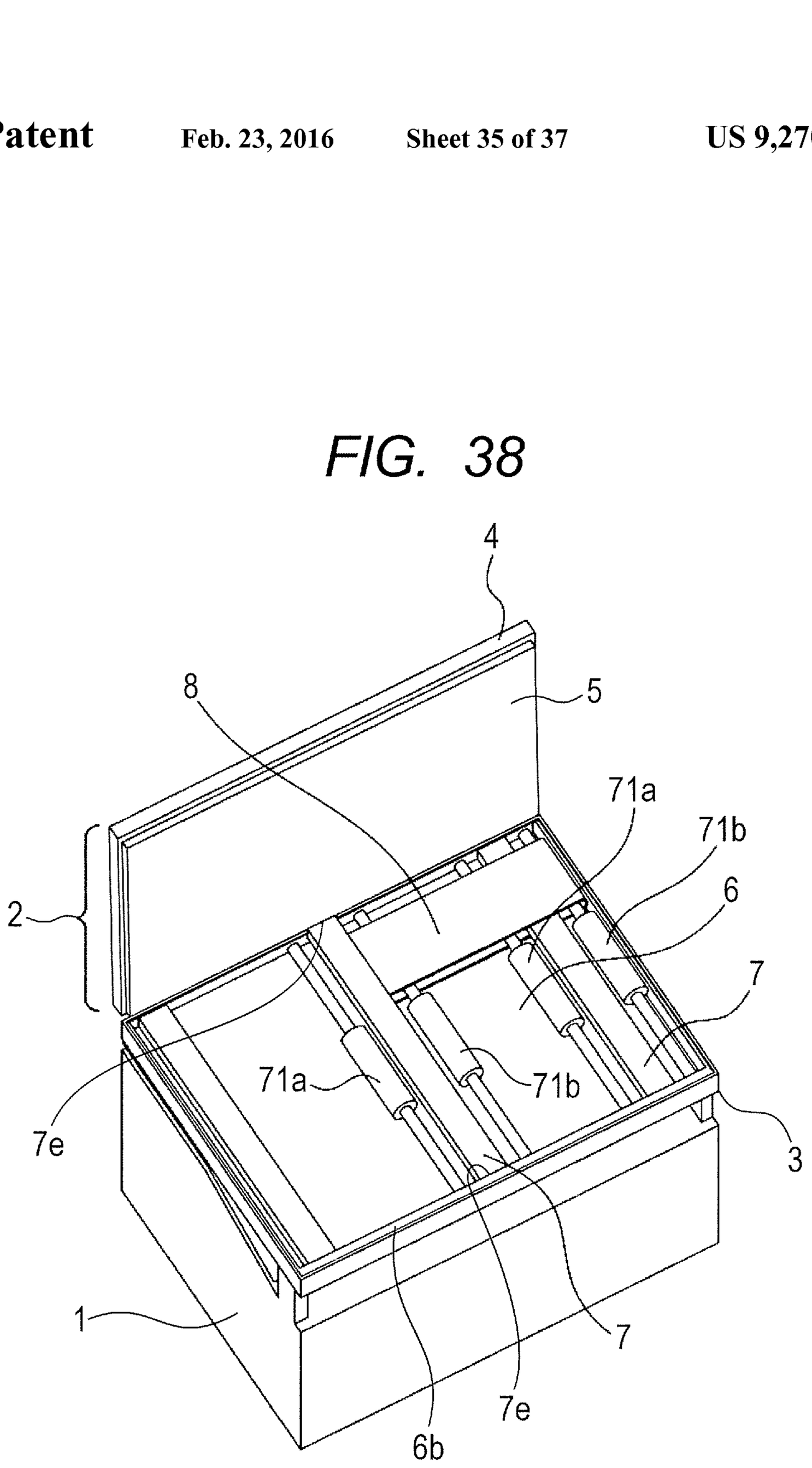

FIG. 39A

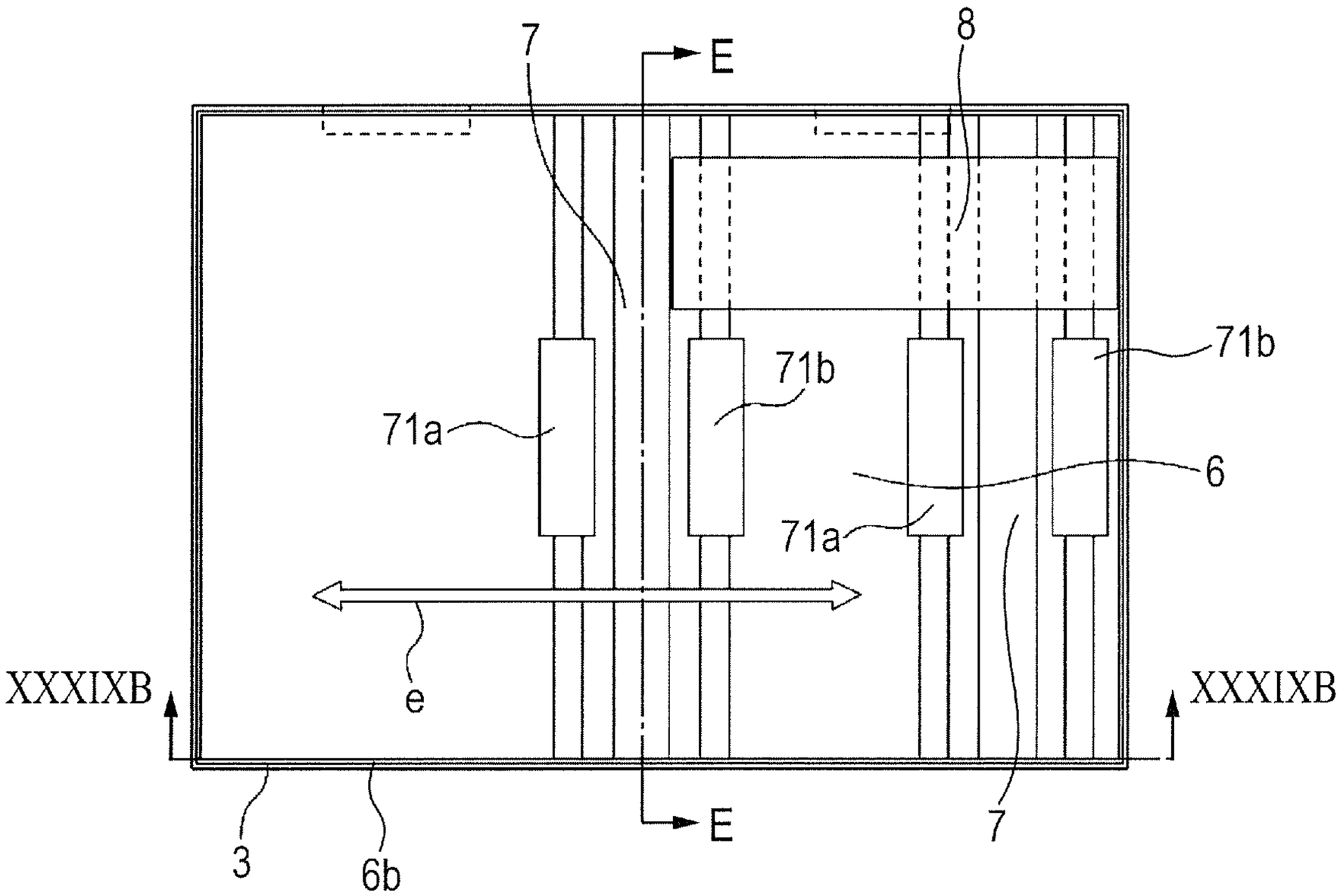

FIG. 39B

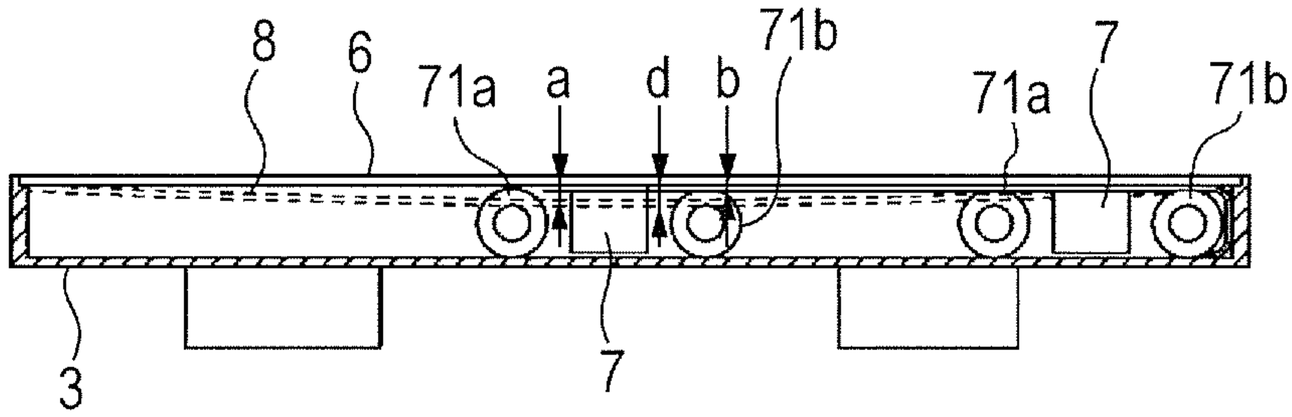

FIG. 40A

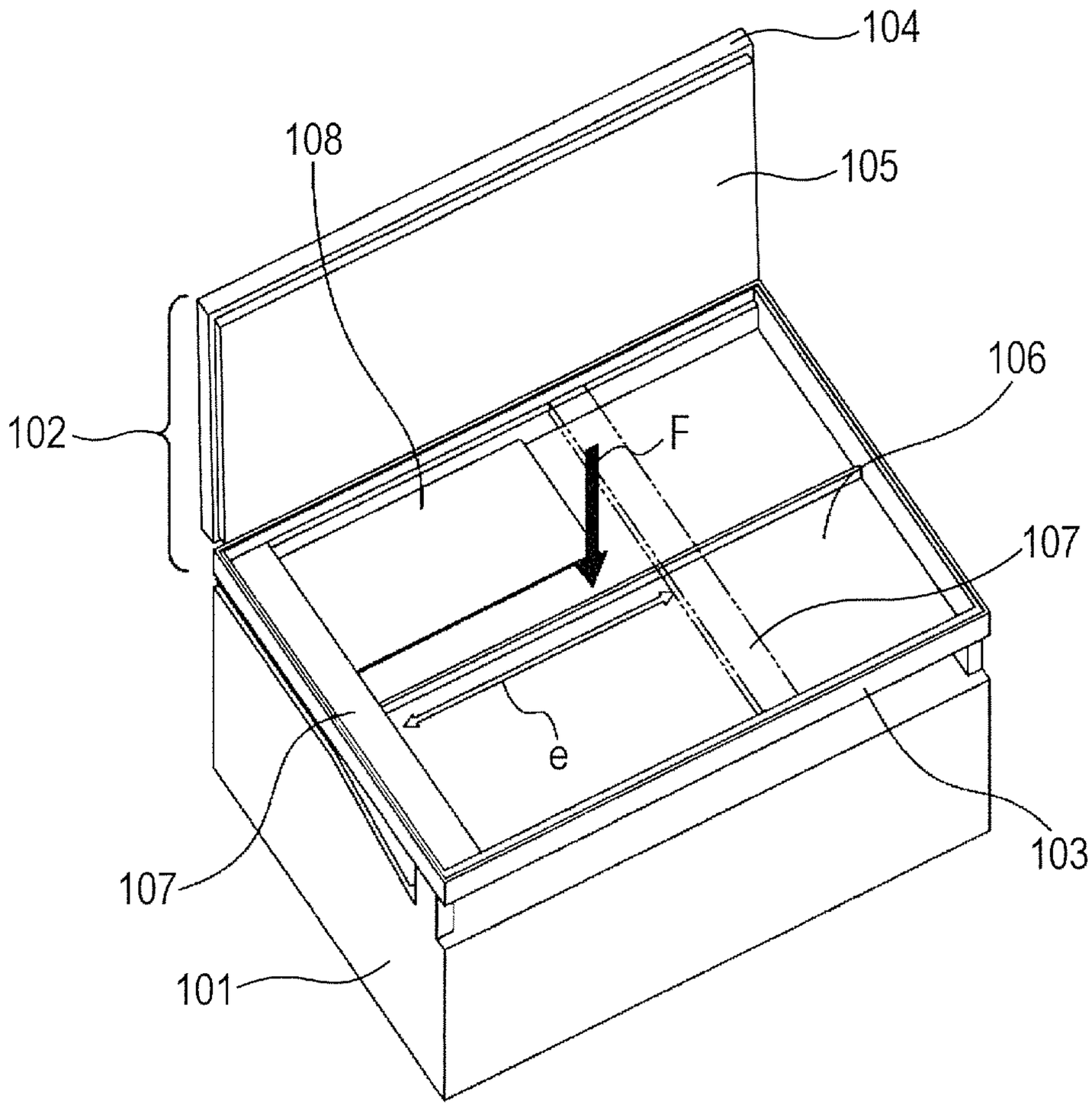

FIG. 40B

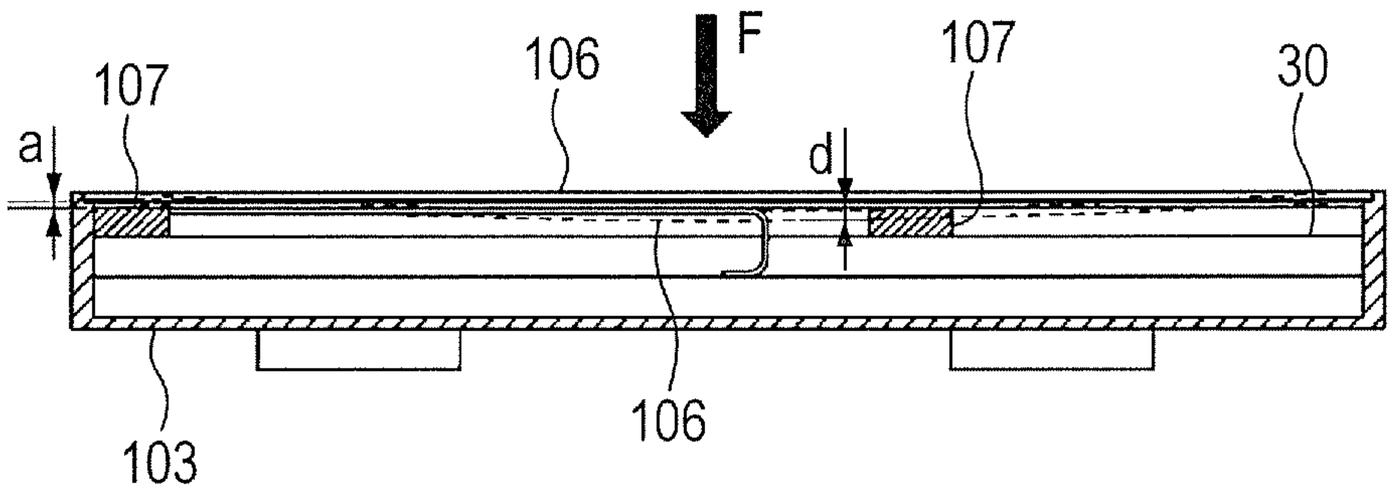

IMAGE READING APPARATUS AND IMAGE FORMING APPARATUS INCLUDING THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image reading apparatus, and an image forming apparatus including the image reading apparatus.

2. Description of the Related Art

Referring to FIGS. **40**A and **40**B, a configuration of an image reading apparatus according to a comparative example is described. In FIGS. **40**A and **40**B, an image forming apparatus **101** is a laser beam printer or the like. An image reading apparatus **102** is arranged above the image forming apparatus **101**, and the image reading apparatus **102** and the image forming apparatus **101** are used as a multifunction peripheral. The image reading apparatus **102** includes an original placing glass **106** on which an original is to be placed, and a casing **103** for supporting the original placing glass **106**. Further, the image reading apparatus **102** includes a cover **104** having a pressure plate **105** for aligning the original with the original placing glass **106**, and an image sensor section **107** serving as an image reading unit which is freely movable inside the casing **103**. A drive unit (not shown) for driving the image sensor section **107** causes the image sensor section **107** to scan the original, to thereby read an image of the original.

A signal line bundle **108** is connected to the image sensor section **107**. In order not to interrupt the movement of the image sensor section **107**, the signal line bundle **108** is provided so as to be movable in association with the movement of the image sensor section **107** while being curved in parallel to the arrow "e" direction of FIG. **40**A corresponding to a moving direction of the image sensor section **107**. In the image reading apparatus **102**, the image sensor section **107** moves relative to the original placing glass **106** from a home position indicated by the solid line of FIG. **40**A to a reading position indicated by the two-dot chain lines of FIG. **40**A. The signal line bundle **108** is arranged so as not to interrupt the operation of the image sensor section **107** while being held in contact with a lower surface of the original placing glass **106**.

The original placing glass **106** is supported at its outer peripheral edges by the casing **103**. The original placing glass **106** and the image sensor section **107** are arranged in proximity. When the image reading apparatus **102** receives a force by a drop impact in the arrow "F" direction of FIGS. **40**A and **40**B in a period in which the image reading apparatus **102** is transported, the original placing glass **106** is distorted. At this time, the lower surface of the original placing glass **106** can not be supported except the image sensor section **107**. Thus, the original placing glass **106**, the image sensor section **107**, or both of the original placing glass **106** and the image sensor section **107** may be damaged. In view of this, the thickness of a packaging material is increased to improve its shock absorbing performance, and the thickness of the glass itself is increased to enhance the strength of the original placing glass **106**.

As a result, there is a problem in that the image reading apparatus **102** and the image forming apparatus **101** including the image reading apparatus **102** cannot be reduced in size and weight. Further, there is a problem in that a packaging volume is increased and accordingly the cost of distribution is increased.

Japanese Patent Application Laid-Open No. 2010-034787 describes a configuration in which a dust removing member including a contact cleaning section for cleaning the back surface side of the original placing glass is mounted to a carriage which is provided so as to be capable of traveling along the back surface side of the original placing glass. The contact cleaning section of this configuration may be brought into contact with the back surface of the original placing glass, but cannot sufficiently support the original placing glass which receives a force by a drop impact.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an image reading apparatus capable of preventing damage to an original placing glass due to a shock in distribution without increasing the thickness of a packaging material, and capable of reducing the size and weight of the image reading apparatus through reduction in thickness of the original placing glass.

Further, it is another object of the present invention to provide an image reading apparatus, including: a placing member on which an original is to be placed; a reading section arranged so as to be opposed to the original across the placing member and reading an image of the original placed on the placing member; a casing which supports an outer peripheral edge portion of the placing member; and a support member supporting a portion other than the outer peripheral edge portion of the placing member, the support member having an abutment portion abutting against the casing, the support member being capable of supporting the placing member under a state in which the abutment portion abuts against the casing.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to a first embodiment.

FIG. **2** is an explanatory plan view for illustrating a configuration of the image reading apparatus according to the first embodiment.

FIG. **3** is a sectional view taken along the arrow V-V of FIG. **2**, for illustrating a state in which a support unit of the image reading apparatus according to the first embodiment is set at a support position for supporting an original placing glass from a lower side thereof.

FIG. **4** is an enlarged perspective view for illustrating a configuration of the support unit of the image reading apparatus according to the first embodiment.

FIG. **5**A is a partially enlarged view of FIG. **3**.

FIG. **5**B is a partially enlarged view of the sectional view taken along the arrow V-V of FIG. **2**, for illustrating a state in which the support unit of the image reading apparatus according to the first embodiment is set at a retracted position retracted from the original placing glass.

FIG. **6** is an explanatory plan view for illustrating a configuration of an image reading apparatus according to a second embodiment.

FIG. **7** is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to a third embodiment.

FIG. **8** is an explanatory sectional view for illustrating a state in which a support unit of the image reading apparatus according to the third embodiment is set at the support position for supporting the original placing glass from the lower side thereof.

FIG. **9** is an enlarged perspective view for illustrating a configuration of the support unit of the image reading apparatus according to the third embodiment.

FIG. **10** is a partially enlarged view of FIG. **8**.

FIG. **11** is an explanatory perspective view for illustrating a configuration of an image reading apparatus according to a fourth embodiment.

FIG. **12** is an explanatory plan view for illustrating the configuration of the image reading apparatus according to the fourth embodiment.

FIG. **13**A is a sectional view taken along the arrow XIII-XIII of FIG. **12**, for illustrating a state in which a support unit of the image reading apparatus according to the fourth embodiment is set at the support position for supporting the original placing glass from the lower side thereof.

FIG. **13**B is a sectional view taken along the arrow XIII-XIII of FIG. **12**, for illustrating a state in which the support unit of the image reading apparatus according to the fourth embodiment is set at the retracted position retracted from the original placing glass.

FIG. **14**A is a partially enlarged view of FIG. **13**A.

FIG. **14**B is a partially enlarged view of FIG. **13**B.

FIG. **15** is an explanatory perspective view for illustrating a configuration of an image reading apparatus according to a fifth embodiment.

FIG. **16** is an explanatory plan view for illustrating the configuration of the image reading apparatus according to the fifth embodiment.

FIG. **17**A is a sectional view taken along the arrow XVII-XVII of FIG. **16**, for illustrating a state in which a support unit of the image reading apparatus according to the fifth embodiment is set at the support position for supporting the original placing glass from the lower side thereof.

FIG. **17**B is a sectional view taken along the arrow XVII-XVII of FIG. **16**, for illustrating a state in which the support unit of the image reading apparatus according to the fifth embodiment is set at the retracted position retracted from the original placing glass.

FIG. **18** is a partially enlarged view of FIG. **17**A.

FIG. **19** is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to a sixth embodiment.

FIG. **20** is an explanatory plan view for illustrating a configuration of the image reading apparatus according to the sixth embodiment.

FIG. **21** is a sectional view taken along the arrow XXI-XXI of FIG. **20**.

FIG. **22**A is a sectional view taken along the arrow XXII-XXII of FIG. **20**, for illustrating a state in which a support unit of the image reading apparatus according to the sixth embodiment is set at the support position for supporting the original placing glass from the lower side thereof.

FIG. **22**B is a sectional view taken along the arrow XXII-XXII of FIG. **20**, for illustrating a state in which the support unit of the image reading apparatus according to the sixth embodiment is set at the retracted position retracted from the original placing glass.

FIG. **23**A is a partially enlarged view of FIG. **22**A.

FIG. **23**B is a partially enlarged view of FIG. **22**B.

FIGS. **24**A and **24**B are partially enlarged perspective views of FIG. **22**A and **22**B, respectively.

FIG. **25** is a schematic explanatory view of FIG. **22**A.

FIG. **26** is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to a seventh embodiment.

FIG. **27**A is an explanatory plan view for illustrating a configuration of the image reading apparatus according to the seventh embodiment.

FIG. **27**B is a sectional view taken along the arrow XXVIIB-XXVIIB of FIG. **27**A.

FIG. **27**C is a sectional view taken along the arrow XXVIIC-XXVIIC of FIG. **27**A, for illustrating a state in which a support unit of the image reading apparatus according to the seventh embodiment is set at the retracted position retracted from the original placing glass.

FIG. **28**A is a sectional view taken along the arrow XXVIIC-XXVIIC of FIG. **27**A, for illustrating a state in which the support unit of the image reading apparatus according to the seventh embodiment is set at the support position for supporting the original placing glass from the lower side thereof.

FIG. **28**B is a schematic explanatory view of FIG. **28**A.

FIG. **29** is an enlarged perspective view for illustrating a configuration of the support unit of the image reading apparatus according to the seventh embodiment.

FIG. **30** is a partially enlarged view of FIG. **28**A.

FIG. **31**A is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to an eighth embodiment.

FIG. **31**B is an explanatory plan view for illustrating a configuration of the image reading apparatus according to the eighth embodiment.

FIG. **32**A is a sectional view taken along the arrow XXXII-XXXII of FIG. **31**B.

FIG. **32**B is a partially enlarged view of FIG. **32**A.

FIG. **33**A is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to a ninth embodiment.

FIG. **33**B is an explanatory plan view for illustrating a configuration of the image reading apparatus according to the ninth embodiment.

FIG. **34**A is a sectional view taken along the arrow XXXIV-XXXIV of FIG. **33**B.

FIG. **34**B is a partially enlarged view of FIG. **34**A.

FIG. **35** is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to a tenth embodiment.

FIG. **36**A is an explanatory plan view for illustrating a configuration of the image reading apparatus according to the tenth embodiment.

FIG. **36**B is a sectional view taken along the arrow XXXVIB-XXXVIB of FIG. **36**A.

FIG. **37**A is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to an eleventh embodiment.

FIG. **37**B is an explanatory plan view for illustrating a configuration of the image reading apparatus according to the eleventh embodiment.

FIG. **38** is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to a twelfth embodiment.

FIG. **39**A is an explanatory plan view for illustrating a configuration of the image reading apparatus according to the twelfth embodiment.

FIG. **39**B is a sectional view taken along the arrow XXXIXB-XXXIXB of FIG. **39**A.

FIG. **40**A is an explanatory perspective view for illustrating a configuration of an image forming apparatus including an image reading apparatus according to a comparative example.

FIG. **40**B is an explanatory sectional view of the image reading apparatus according to the comparative example.

DESCRIPTION OF THE EMBODIMENTS

In the following, image forming apparatuses each including an image reading apparatus according to exemplary embodiments of the present invention are described with reference to the attached drawings. Note that, dimensions, materials, shapes, relative positions of components, and the like to be described in the following embodiments may be changed as appropriate depending on a configuration of an apparatus to which the present invention is applied, or various conditions. The scope of the present invention is not limited to the following embodiments.

(First Embodiment)

Referring to FIGS. **1** to **5**B, an image forming apparatus including an image reading apparatus according to a first embodiment of the present invention is described.

FIG. **1** is a perspective view of a case where an image reading apparatus **2** is arranged above an image forming apparatus **1**. FIG. **2** is a plan view of the image reading apparatus alone. FIG. **3** is a sectional view taken along the arrow V-V of FIG. **2**. FIG. **4** is an enlarged perspective view for illustrating a main part of a support unit. FIGS. **5**A and **5**B are enlarged sectional views for illustrating the main part of the support unit. In FIGS. **1** to **5**B, the image forming apparatus **1** includes an image forming unit for forming an image on a sheet-like recording material (not shown), such as a paper sheet, based on image information read by the image reading apparatus **2**.

The image reading apparatus **2** includes an original placing glass **6** serving as a placing member on which a book (not shown) or a sheet-like original (not shown) is to be placed, a casing **3** for supporting an outer peripheral edge portion **6***b* of the original placing glass **6**, and a cover **4**. A pressure plate **5** aligns the original placed on the original placing glass **6** (on the original placing glass) with a surface of the original placing glass **6** (an original placing glass surface). An image sensor section **7** serves as an image reading unit, which is opposed to the original placed on the original placing glass **6** at a position below the original placing glass **6**, and is provided so as to be movable along the original placing glass **6** inside the casing **3** (within the casing). Specifically, abutment portions **7***e* situated at both ends of the image sensor section **7** abut against the casing **3** and are supported movably. The image sensor section **7** includes a light emitting element (not shown) and a light receiving element (not shown). As illustrated in FIG. **1**, the original placing glass **6** is a light transmissive member which causes light to pass therethrough. The original (not shown) placed on the original placing glass **6** is irradiated with light from the light emitting element of the image sensor section **7** via the original placing glass **6**, and reflection light from the original is received by the light receiving element of the image sensor section **7** via the original placing glass **6** so that the image sensor section **7** reads an image of the original (not shown) placed on the original placing glass **6**.

Next, an overview of a reading operation to be performed by the image sensor section **7** is described. In FIGS. **1** and **2**, the image sensor section **7** is movable by a drive unit (not shown) such as a motor. The image sensor section **7** is movable in the arrow "e" direction of FIGS. **1** and **2** from a position of a left end portion of the original placing glass **6** of FIGS. **1** and **2**, which is also a home position at the time when the image reading apparatus **2** is transported, to a position of the reading operation, which is set in accordance with the size of the original placed on the original placing glass **6**.

In FIGS. **1** to **5**B, plate-like support members **9** and **10** serve as the support unit for supporting the original placing glass **6** from a lower side thereof by abutting against the lower surface of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3** (outer peripheral edge portion **6***b*). A signal line bundle **8** is connected to the image sensor section **7**.

The support members **9** and **10** of this embodiment include a shaft portion **95**, which is rotatably held by a bearing portion **31** provided so as to pass through a side surface **3***a* of the casing **3** and a bearing portion **32** provided on a bottom surface **3***b* of the casing **3**, and pivot integrally with the shaft portion **95**. One end portion of the shaft portion **95** passes through the side surface **3***a* of the casing **3** and protrudes to an outside, and at the protruding portion, there is provided a tab portion **91** for a pivot operation. When the tab portion **91** is pivoted, the support members **9** and **10** integrally pivot about the shaft portion **95**. Accordingly, the support members **9** and **10** are movable between a support position of FIG. **5**A for supporting the original placing glass **6** and a retracted position of FIG. **5**B retracted from the original placing glass **6**. A part of the shaft portion **95** of the support member **9** or **10**, which abuts against the bearing portion **31** or the bearing portion **32**, corresponds to an abutment portion **95***a* of the support member **9** or **10**, which is supported by the casing **3**.

As illustrated in FIG. **5**B, the retracted position of the support members **9** and **10** is set as a position at which the support members **9** and **10** do not interfere with the moving operation of the image sensor section **7**. In this embodiment, the support members **9** and **10** pivot about the shaft portion **95**. At the retracted position of FIG. **5**B retracted from the original placing glass **6**, the support members **9** and **10** are retracted to a position below a trajectory **30** of movement of a lower surface **7***a*, which is the lowermost end portion of the image sensor section **7**, so that the moving operation of the image sensor section **7** is not hindered (movement of the image sensor section **7** is not restricted). Accordingly, the support members **9** and **10** for supporting the original placing glass **6** are movable to the retracted position below the trajectory **30**, which is situated out of the movement trajectory of the image sensor section **7**, and hence the image sensor section **7** is not interrupted at the time of the reading operation.

One end portion (left end portion of FIGS. **1** to **5**B) **9***a* of the support member **9** serves also as a restraining unit for restraining the image sensor section **7** at a predetermined position of the left end portion of FIGS. **1** to **5**B, which corresponds to the home position, in association with the movement of the support member **9** through the pivot operation. In other words, the one end portion **9***a* of the support member **9** functions as a restricting member for restricting the movement of the image sensor section **7** from the home position.

As illustrated in FIG. **4**, an elastic member **10***a* is fixed to a tip end portion of the support member **10**. When the support member **10** pivots about the shaft portion **95** and is situated at the support position of FIG. **5**A for supporting the original placing glass **6**, the elastic member **10***a* abuts against a lower surface **6***a* of the original placing glass **6** and supports a center portion of the original placing glass **6**. The support member **10** supports the center portion of the original placing glass **6**, and accordingly a force received by the support member **10** from the lower surface of the original placing glass **6** is transferred via the abutment portions **95***a* of the shaft portion **95** to the bearing portions **31** and **32** of the casing **3** having a relatively high strength. Therefore, it is possible to restrict

flexure of the original placing glass **6** due to a vibration and shock at the time when the apparatus is transported, and thus to prevent damage to the original placing glass **6**.

It is assumed that "a" represents a separation distance between an upper surface **7***b* of the image sensor section **7** and the lower surface **6***a* of the original placing glass **6**, and "b" represents a separation distance between the support member **10** and the lower surface **6***a* of the original placing glass **6**. As illustrated in FIG. **5**A, the upper surface **7***b* of the image sensor section **7** is opposed to the lower surface **6***a* of the original placing glass **6** at the separation distance "a". The support member **10** is opposed to the original placing glass **6** at the separation distance "b" that is smaller than the separation distance "a". The elastic member **10***a* abuts against the lower surface **6***a* of the original placing glass **6**, and hence FIG. **5**A illustrates a case where the separation distance "b" is zero.

The original placing glass **6** indicated by the broken lines of FIG. **5**A schematically represents a limit to its shape which keeps the original placing glass **6** from damage thereto. FIG. **5**A illustrates a maximum flexure amount "d" of the original placing glass **6** in this case under a state in which the support member **10** is situated at a position (position of the elastic member **10***a*) abutting against the original placing glass **6** (hereinafter referred to simply as maximum flexure amount "d"). When the separation distance "b" between the support member **10** and the original placing glass **6** is set smaller than the maximum flexure amount "d" of the original placing glass **6**, the original placing glass **6** is supported by the support member **10** before the original placing glass **6** is damaged. Thus, when the image reading apparatus **2** is transported under a state illustrated in FIG. **5**A, the original placing glass **6** is brought into a state of being supported from an inner side of the casing **3**. The original placing glass **6** is not distorted inward due to the vibration and shock at the time of transportation, resulting in a satisfactory holding state. In other words, the support member **10** is set at the support position as illustrated in FIG. **5**A when the image reading apparatus **2** is not operated, that is, when the image sensor section **7** is not moved. Accordingly, it is possible to prevent the damage to the original placing glass **6** due to the vibration and shock.

As long as the separation distance "b" between the support member **10** and the original placing glass **6** is smaller than the separation distance "a" between the image sensor section **7** and the original placing glass **6**, even when the original placing glass **6** is distorted downward, the original placing glass **6** abuts against the support member **10** and is supported by the support member **10** before the original placing glass **6** comes into contact with the image sensor section **7**. Accordingly, even when the original placing glass **6** is distorted downward, the original placing glass **6** does not come into contact with the image sensor section **7**, and hence the image sensor section **7** can be protected at the same time as well.

Next, a method of supporting the original placing glass **6** and canceling the support thereof is described with reference to FIGS. **4**, **5**A, and **5**B. The operation of supporting the original placing glass **6** and the operation of canceling the support thereof are switched therebetween by pivoting, about the shaft portion **95**, the tab portion **91** that is integrally fixed to the shaft portion **95** and is exposed to the outside from the side surface **3***a* of the casing **3**. As indicated by the solid lines of FIG. **4** and as illustrated in FIG. **5**A, the support members **9** and **10** are held upright to be set at the support position for supporting the original placing glass **6**. Alternatively, as indicated by the two-dot chain lines of FIG. **4** and as illustrated in FIG. **5**B, the support members **9** and **10** are tilted horizontally to be set at the retracted position retracted from the original placing glass **6**.

By configuring the tip end portion of the support member **10** with the elastic member **10***a*, the shock can be absorbed when the original placing glass **6** is distorted downward and comes into contact with the elastic member **10***a* as illustrated in FIG. **5**A, and hence the original placing glass **6** can be protected.

Next, a method of restraining the image sensor section **7** and canceling the restraint thereof is described with reference to FIGS. **4**, **5**A, and **5**B. The operation of restraining the image sensor section **7** and the operation of canceling the restraint thereof are switched therebetween by pivoting, about the shaft portion **95**, the tab portion **91** that is integrally fixed to the shaft portion **95** and is exposed to the outside from the side surface **3***a* of the casing **3**.

As indicated by the solid lines of FIG. **4** and as illustrated in FIG. **5**A, the support member **9** is held upright. Then, the one end portion **9***a* of the support member **9** is caused to face a side surface **7***c* of the image sensor section **7** situated at the left end portion of FIGS. **4**, **5**A, and **5**B, which is the home position of the image sensor section **7**, so that the support member **9** is set at a restraining position for restraining the image sensor section **7**. Alternatively, as indicated by the two-dot chain lines of FIG. **4** and as illustrated in FIG. **5**B, the support member **9** is tilted horizontally to be set at a canceling position (restriction canceling position) for canceling the restraint (restriction) of the image sensor section **7**. At this time, the operation of supporting the original placing glass **6** and the operation of canceling the support thereof are performed by the support members **9** and **10** simultaneously with the above-mentioned operations, respectively.

Accordingly, when the image reading apparatus **2** is transported, the original placing glass **6** is supported by the support members **9** and **10**, and the image sensor section **7** is restrained and fixed by the support member **9**. When the image reading apparatus **2** is operated, the original placing glass **6** and the image sensor section **7** can be released at the same time. In other words, the support member **10** is set at the support position as illustrated in FIG. **5**A when the image reading apparatus **2** is not operated, that is, when the image sensor section **7** is not moved, and accordingly the support member **9** is situated at the restraining position at the same time. Therefore, it is possible to prevent the movement of the image sensor section **7** from the predetermined position (home position) due to the vibration and shock.

The bearing portion **31**, which is provided at the side surface **3***a* of the casing **3**, and the shaft portion **95** are maintained in a freely slidable, gapless state by a seal member (not shown), and hence dust does not enter the casing **3**. As a result, the image reading operation can be performed satisfactorily by the image sensor section **7**.

The abutment area of the support members **9** and **10** abutting against the lower surface **6***a* of the original placing glass **6**, and the number of the support members **9** and **10** may be increased as appropriate depending on the area and thickness of the original placing glass **6**. For example, the support member **9** may further be extended in an axial direction of the shaft portion **95**, and the number of the support members **10** may be increased so that the vicinity of the center of the original placing glass **6** is supported.

The tab portion **91** is pivoted and the support members **9** and **10** move between the support position illustrated in FIG. **5**A and the retracted position illustrated in FIG. **5**B. At this time, there may arise a need to avoid friction between the support member **10** and the lower surface **6***a* of the original

placing glass **6**. In this case, the separation distance "b" between the support member **10** and the original placing glass **6** may be set so as to provide a small gap within the range in which the separation distance "b" is smaller than the separation distance "a" between the image sensor section **7** and the original placing glass **6**.

The image sensor section **7** automatically performs a sequence of returning to the left end portion of FIGS. **4**, **5**A, and **5**B as the home position at, for example, a timing at which a user turns OFF the power of the image reading apparatus **2**. Accordingly, at the time of transportation, no time and effort is required for moving the image sensor section **7** to the home position, and it is only necessary to pivot the support member **9** to the support position for supporting the original placing glass **6**, which is also the restraining position for restraining the image sensor section **7**. Accordingly, convenience of the user can be enhanced.

The rigidity of the shaft portion **95** is sufficiently high, and the support member **10** and the bearing portion **32** are situated in proximity in the axial direction. Therefore, when the support member **10** receives the force from the lower surface of the original placing glass **6**, the shaft portion **95** that receives the force via the support member **10** is not distorted substantially. Alternatively, when the support member **10** receives the force from the lower surface of the original placing glass **6**, the shaft portion **95** may be distorted downward and abut against the bottom surface **3***b* of the casing **3**, to thereby transfer the force to the casing **3**. In this case, a lower surface of the shaft portion **95** functions as the abutment portions of the support members **9** and **10**. When it is assumed that "c" represents a separation distance between the lower surface of the shaft portion **95** and the bottom surface **3***b*, and when a relationship of b+c<d is satisfied, the original placing glass **6** is supported through an intermediation of the support member **10** before the original placing glass **6** is damaged. Further, when a relationship of b+c<a is satisfied, even in a case where the original placing glass **6** is distorted downward, the original placing glass **6** does not come into contact with the image sensor section **7**, and hence the image sensor section **7** can be protected at the same time as well.

Further, the abutment portions **7***e* of the image sensor **7** and the abutment portion **95***a* of the support member **9** are different from each other, and the force transferred from the original placing glass **6** to the support member **9** is not transferred substantially to the image sensor **7**, but is transferred to the casing **3** via the abutment portion **95***a* of the support member **9**. Therefore, it is also possible to prevent damage to the image sensor **7**.

(Second Embodiment)

Next, referring to FIG. **6**, an image reading apparatus according to a second embodiment of the present invention is described. In the first embodiment, under a state in which the tab portion **91** is pivoted and the support members **9** and **10** are set at the support position illustrated in FIG. **5**A, the height of the support member **9** is lower than the height of the support member **10**. In this embodiment, as illustrated in FIG. **6**, a step portion **9***b* is provided at a part of the support member **9** so that the support member **9** has the same height as the support member **10**. An elastic member **9***c* is provided at a tip end portion of the step portion **9***b*. The bearing portion **32** of this embodiment is provided between the support members **9** and **10**. Other components are similar to those in the first embodiment, and similar effects can be obtained. With the configuration of this embodiment, the lower surface of the original placing glass **6** is received simultaneously at a plurality of support points, and hence the original placing glass **6** can be supported more firmly.

(Third Embodiment)

Next, referring to FIGS. **7** to **10**, an image forming apparatus including an image reading apparatus according to a third embodiment of the present invention is described. In this embodiment, as illustrated in FIGS. **7**, **8**, **9**, and **10**, the support member **10** of the second embodiment is omitted. Other components are similar to those in the first and second embodiments. Also with this configuration, similar effects to those in the first and second embodiments can be obtained. With the configuration of this embodiment, it is possible to support the original placing glass **6** with a simple and less complex configuration, and to prevent the damage to the original placing glass **6** while suppressing increase in cost and weight of the apparatus.

(Fourth Embodiment)

Next, referring to FIGS. **11** to **14**B, a configuration of an image reading apparatus according to a fourth embodiment of the present invention is described. In the first to third embodiments, the tab portion **91** is pivoted about the shaft portion **95** to pivot the support members **9** and **10** to the support position and to the retracted position. In this embodiment, a support member **14** serves as the support unit for supporting the original placing glass **6** by abutting against the lower surface **6***a* of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3**, and the support member **14** is raised and lowered inside the casing **3**.

A guide rail **33** is provided at substantially a center portion of the bottom surface **3***b* of the casing **3** along a moving direction of the image sensor section **7** (lateral direction of FIG. **12**). A slider **13** is movable in the lateral direction of FIG. **12** while engaging with the guide rail **33**.

The slider **13** is L-shaped in plain view. A protruding portion **13***b* having a rectangular prism shape is provided at one end portion of the slider **13**, and the protruding portion **13***b* passes through a long hole **36** formed in a side surface **3***c* of the casing **3** along a lateral direction of FIGS. **13**A and **13**B, and protrudes into the outside. A tab portion **35** for a slide operation is provided at the protruding portion **13***b*. The tab portion **35** is slid along the long hole **36** in the lateral direction of FIGS. **13**A and **13**B. Accordingly, the slider **13** moves integrally with the tab portion **35** in the lateral direction of FIGS. **12**, **13**A, and **13**B while engaging with the guide rail **33**. An inclined surface **13***a* is provided at another end portion of the slider **13** which is opposed to the support member **14**.

A pair of opposing guide rails **34** having a C-shaped cross section is provided upright in a vertical direction of FIGS. **13**A, **13**B, **14**A, and **14**B at a position on the bottom surface **3***b* of the casing **3** and on an extension line of the guide rail **33**. A fitting portion **14***a* having a T-shaped cross section is provided at one end portion of the support member **14**, and the fitting portion **14***a* is fitted in a guide rail **34***a* of the guide rails **34** so that the fitting portion **14***a* can be raised and lowered along the guide rail **34***a*. An inclined surface **14***b* corresponding to the inclined surface **13***a* of the slider **13** is provided at another end portion of the support member **14**. An elastic member **14***d*, which abuts against the lower surface **6***a* of the original placing glass **6** and supports the original placing glass **6**, is provided above the inclined surface **14***b*.

A spring-supported portion **14***c* is provided at a tip end portion of the fitting portion **14***a*, which is provided at the one end portion of the support member **14**. A lower piece **16***b* of a pressurization bracket **16** having a Z-shaped cross section is fixed with a screw **17** on the bottom surface **3***b* of the casing **3**. A coil-like pressurization spring **18** is locked between an upper piece **16***a* of the pressurization bracket **16** and the spring-supported portion **14***c* of the support member **14**. The

support member **14** is constantly biased in a downward direction of FIGS. **14**A and **14**B by an elastic force of the pressurization spring **18**.

FIGS. **13**A and **14**A illustrate a positional relationship of the respective components at the time when the image reading apparatus **2** is transported. The support member **14** is raised to be set at the support position for supporting the original placing glass **6**, and the lower surface **6***a* of the original placing glass **6** is supported by the elastic member **14***d* of the support member **14**. A side surface **14***a***1** of the fitting portion **14***a* of the support member **14** faces the side surface **7***c* of the image sensor section **7** situated at the home position, and accordingly the image sensor section **7** is held in a state of being restrained.

FIGS. **13**B and **14**B illustrate a positional relationship of the respective components at the time when the image reading apparatus **2** performs the reading operation. The support member **14** is lowered to be set at the retracted position retracted from the original placing glass **6**, and the original placing glass **6** and the image sensor section **7** are held in a state in which the support and restraint thereof are canceled.

As illustrated in FIG. **13**B, under a state in which the support member **14** is lowered to be set at the retracted position retracted from the original placing glass **6**, the inclined surface **14***b* of the support member **14** slidably abuts against the inclined surface **13***a* of the slider **13**. Then, the tab portion **35** coupled to the slider **13** is slid on an outer side of the side surface **3***c* of the casing **3** along the long hole **36** in a leftward direction of FIGS. **13**A and **13**B. Accordingly, the slider **13** moves integrally with the tab portion **35** in the leftward direction of FIGS. **13**A and **13**B while engaging with the guide rail **33**.

Then, the inclined surface **14***b* of the support member **14** slides in abutment against the inclined surface **13***a* of the slider **13**, and in this state, the support member **14** is raised along the guide rails **34** against the biasing force of the pressurization spring **18**. Then, as illustrated in FIG. **13**A, a lower surface **14***e* of the support member **14** is placed on an upper surface **13***c* of the slider **13**, and the support member **14** is set at the support position for supporting the center portion of the lower surface **6***a* of the original placing glass **6**. At this time, the support member **14** and the slider **13** may be regarded collectively as a support member capable of supporting the original placing glass **6**, and at this time, a lower surface **13***d* of the slider **13** functions as an abutment surface at which the support member abuts against the casing **3** and is supported by the casing **3**.

The support member **14** is movable at a predetermined separation distance between the support member **14** and the lower surface **6***a* of the original placing glass **6**. As illustrated in FIG. **13**A, the support member **14** is raised to be set at the support position for supporting the lower surface **6***a* of the original placing glass **6**. When the support member **14** is raised along the guide rails **34**, the elastic member **14***d* abuts against the lower surface **6***a* of the original placing glass **6** in a normal direction to the lower surface **6***a*. Therefore, the elastic member **14***d* can be caused to abut against the lower surface **6***a* of the original placing glass **6** more smoothly as compared to the first embodiment, in which the elastic member **10***a* abuts against the lower surface **6***a* while moving in a direction substantially parallel to the lower surface **6***a*, and thus a load on the user can be reduced.

The side surface **14***a***1** of the fitting portion **14***a* provided at the one end portion of the support member **14**, which protrudes from upper end portions of the guide rails **34**, is caused to face the side surface **7***c* of the image sensor section **7** situated at the left end portion of FIGS. **12** to **14**B, to thereby restrain the image sensor section **7**. The left end portion of FIGS. **12** to **14**B corresponds to the home position of the image sensor section **7**.

The fitting portion **14***a* provided at the one end portion of the support member **14** serves also as the restraining unit for restraining the image sensor section **7** at the home position in association with the movement of the support member **14**.

When the tab portion **35** coupled to the slider **13** is slid on the outer side of the side surface **3***c* of the casing **3** along the long hole **36** in a rightward direction of FIGS. **13**A and **13**B, the slider **13** moves integrally with the tab portion **35** in the rightward direction of FIGS. **13**A and **13**B while engaging with the guide rail **33**. Then, under the state illustrated in FIG. **14**A, the upper surface **13***c* of the slider **13** moves in a rightward direction of FIGS. **14**A and **14**B while sliding along the lower surface **14***e* of the support member **14**.

Then, the inclined surface **13***a* of the slider **13** and the inclined surface **14***b* of the support member **14** slide in abutment against each other. The inclined surface **14***b* of the support member **14** slides in abutment against the inclined surface **13***a* of the slider **13**, and in this state, the support member **14** is lowered along the guide rails **34** by a self-weight thereof and the biasing force of the pressurization spring **18**. Then, as illustrated in FIG. **14**B, a lower surface **14***f***1** of a step portion **14***f* provided on the one end portion side of the support member **14** abuts against the bottom surface **3***b* of the casing **3** so that the support member **14** is set at the retracted position retracted from the original placing glass **6**.

When the support member **14** is lowered to be set at the retracted position of FIGS. **13**B and **14**B retracted from the original placing glass **6**, the support member **14** is retracted to a position below the trajectory **30** of the movement of the lower surface **7***a*, which is the lowermost end portion of the image sensor section **7**. Accordingly, the moving operation of the image sensor section **7** is not hindered. The support member **14** for supporting the original placing glass **6** is movable to the retracted position below the trajectory **30**, which is situated out of the movement trajectory of the image sensor section **7**, and hence the image sensor section **7** is not interrupted at the time of the reading operation. Other components are similar to those in the above-mentioned embodiments, and similar effects can be obtained. Further, as in this embodiment, the elastic member abuts against the lower surface of the original placing glass in the normal direction to the lower surface. Accordingly, the elastic member can be caused to abut against the lower surface of the original placing glass more smoothly as compared to the first embodiment, and thus the load on the user can be reduced.

(Fifth Embodiment)

Next, referring to FIGS. **15** to **18**, a configuration of an image reading apparatus according to a fifth embodiment of the present invention is described. In the fourth embodiment, the elastic member **14***d* of the support member **14** is arranged at a position of substantially the center portion of the lower surface **6***a* of the original placing glass **6**. In this embodiment, the elastic member **14***d* of the support member **14** is arranged at a position in the vicinity of the home position of the image sensor section **7** in the lower surface **6***a* of the original placing glass **6** and in the vicinity of the side surface **3***c* on which the tab portion **35** is provided.

The guide rail **33** is provided on the bottom surface **3***b* of the casing **3** and in the vicinity of the side surface **3***c* thereof along a moving direction of the image sensor section **7** (lateral direction of FIG. **16**). The elongated slider **13** is movable in the lateral direction of FIG. **16** while engaging with the guide rail **33**.

The slider **13** is L-shaped in a plain view. The protruding portion **13***b* having a rectangular prism shape is provided at the one end portion of the slider **13**, and this protruding portion **13***b* passes through the long hole **36** formed in the side surface **3***c* of the casing **3** along a lateral direction of FIGS. **17**A and **17**B, and protrudes to the outside. The tab portion **35** for a slide operation is provided at the protruding portion **13***b*. The tab portion **35** is slid along the long hole **36** in the lateral direction of FIGS. **17**A and **17**B, and accordingly the slider **13** moves integrally with the tab portion **35** in the lateral direction of FIGS. **16**, **17**A, and **17**B while engaging with the guide rail **33**. The inclined surface **13***a* is provided at the other end portion of the slider **13** which is opposed to the support member **14**.

The guide rail **34** having a C-shaped cross section is provided upright at a position on the bottom surface **3***b* of the casing **3** and on the extension line of the guide rail **33**. The fitting portion **14***a* having a T-shaped cross section is provided at the one end portion of the support member **14**, and the fitting portion **14***a* is fitted in the guide rail **34***a* of the guide rail **34** so that the fitting portion **14***a* can be raised and lowered along the guide rail **34***a*. The inclined surface **14***b* corresponding to the inclined surface **13***a* of the slider **13** is provided at the other end portion of the support member **14**. The elastic member **14***d*, which abuts against the lower surface **6***a* of the original placing glass **6** and supports the original placing glass **6**, is provided above the inclined surface **14***b*.

The spring-supported portion **14***c* is provided at a tip end portion of the fitting portion **14***a*, which is provided at the one end portion of the support member **14**. The lower piece **16***b* of the pressurization bracket **16** having a Z-shaped cross section is fixed with the screw **17** on the bottom surface **3***b* of the casing **3**. The coil-like pressurization spring **18** is locked between the upper piece **16***a* of the pressurization bracket **16** and the spring-supported portion **14***c* of the support member **14**. The support member **14** is constantly biased in a downward direction of FIG. **17**B by an elastic force of the pressurization spring **18**.

FIGS. **17**A and **18** illustrate a positional relationship of the respective components at the time when the image reading apparatus **2** is transported. The support member **14** is raised to be set at the support position for supporting the original placing glass **6**, and the lower surface **6***a* of the original placing glass **6** is supported by the elastic member **14***d* of the support member **14**. The side surface **14***a***1** of the fitting portion **14***a* of the support member **14** faces the side surface **7***c* of the image sensor section **7** situated at the home position, and accordingly the image sensor section **7** is held in a state of being restrained.

FIG. **17**B illustrates a positional relationship of the respective components at the time when the image reading apparatus **2** performs the reading operation. The support member **14** is lowered to be set at the retracted position retracted from the original placing glass **6**, and the original placing glass **6** and the image sensor section **7** are held in a state in which the support and restraint thereof are canceled.

As illustrated in FIG. **17**B, under a state in which the support member **14** is lowered to be set at the retracted position retracted from the original placing glass **6**, the inclined surface **14***b* of the support member **14** slidably abuts against the inclined surface **13***a* of the slider **13**. Then, the tab portion **35** coupled to the slider **13** is slid on an outer side of the side surface **3***c* of the casing **3** along the long hole **36** in a leftward direction of FIGS. **17**A and **17**B. Accordingly, the slider **13** moves integrally with the tab portion **35** in the leftward direction of FIGS. **17**A and **17**B while engaging with the guide rail **33**.

Then, the inclined surface **14***b* of the support member **14** slides in abutment against the inclined surface **13***a* of the slider **13**, and in this state, the support member **14** is raised along the guide rail **34** against the biasing force of the pressurization spring **18**. Then, as illustrated in FIGS. **17**A and **18**, the lower surface **14***e* of the support member **14** is placed on the upper surface **13***c* of the slider **13**, and the support member **14** is set at the support position for supporting the lower surface **6***a* of the original placing glass **6**.

The support member **14** is movable at a predetermined separation distance between the support member **14** and the lower surface **6***a* of the original placing glass **6**. As illustrated in FIGS. **17**A and **18**, the support member **14** is raised to be set at the support position for supporting the lower surface **6***a* of the original placing glass **6**.

Then, the side surface **14***a***1** of the fitting portion **14***a* provided at the one end portion of the support member **14**, which protrudes from the upper end portion of the guide rail **34**, is caused to face the side surface **7***c* of the image sensor section **7** situated at the left end portion of FIGS. **17**A, **17**B, and **18**, to thereby restrain the image sensor section **7**. The left end portion of FIGS. **17**A, **17**B, and **18** corresponds to the home position of the image sensor section **7**.

The fitting portion **14***a* provided at the one end portion of the support member **14** serves also as the restraining unit for restraining the image sensor section **7** at the home position in association with the movement of the support member **14**.

When the tab portion **35** coupled to the slider **13** is slid on the outer side of the side surface **3***c* of the casing **3** along the long hole **36** in a rightward direction of FIG. **17**B, the slider **13** moves integrally with the tab portion **35** in the rightward direction of FIG. **17**B while engaging with the guide rail **33**.

Then, under the state illustrated in FIG. **18**, the upper surface **13***c* of the slider **13** moves in a rightward direction of FIG. **17**B while sliding along the lower surface **14***e* of the support member **14**, and the inclined surface **13***a* of the slider **13** slides in abutment against the inclined surface **14***b* of the support member **14**. The inclined surface **14***b* of the support member **14** slides in abutment against the inclined surface **13***a* of the slider **13**, and in this state, the support member **14** is lowered along the guide rail **34** by the self-weight thereof and the biasing force of the pressurization spring **18**. Then, as illustrated in FIG. **17**B, the lower surface **14***f***1** of the step portion **14***f* provided on the one end portion side of the support member **14** abuts against the bottom surface **3***b* of the casing **3** so that the support member **14** is set at the retracted position retracted from the original placing glass **6**.

When the support member **14** is lowered to be set at the retracted position of FIG. **17**B retracted from the original placing glass **6**, the support member **14** is retracted to a position below the trajectory **30** of the movement of the lower surface **7***a*, which is the lowermost end portion of the image sensor section **7**. Accordingly, the moving operation of the image sensor section **7** is not hindered. The support member **14** for supporting the original placing glass **6** is movable to the retracted position below the trajectory **30**, which is situated out of the movement trajectory of the image sensor section **7**, and hence the image sensor section **7** is not interrupted at the time of the reading operation. Other components are similar to those in the above-mentioned embodiments, and similar effects can be obtained. In this embodiment, the elastic member abuts against the lower surface of the original placing glass in the normal direction to the lower surface. Thus, similarly to the fourth embodiment, the elastic member can be caused to abut against the lower surface of the original placing glass more smoothly as compared to the first embodiment, and thus the load on the user can be reduced.

(Sixth Embodiment)

Next, referring to FIGS. **19** to **25**, a configuration of an image reading apparatus according to a sixth embodiment of the present invention is described. In the first to fourth embodiments, the tab portions **91** and **35** for operating the support members **9** and **14** are provided on the outer side of the side surfaces **3***a* and **3***c* of the casing **3**, respectively.

In this embodiment, the image reading apparatus **2** is transported under a state in which a packaging material **28** is set. In association with a user's operation of placing the packaging material **28** onto the image reading apparatus **2** at the time of packaging work, a support member **24** serving as the support unit supports the lower surface **6***a* of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3**. Further, in association with a user's operation of removing the packaging material **28** from the image reading apparatus **2** at the time of unpackaging work, the support of the lower surface **6***a* of the original placing glass **6** is canceled.

The support member **24** is movable between the support position for supporting the lower surface **6***a* of the original placing glass **6** and the retracted position retracted from the lower surface **6***a* of the original placing glass **6**.

In association with the operation of placing and removing the packaging material **28**, a restraining member **23** serving as the restraining unit is movable between the restraining position for restraining the image sensor section **7** at the home position and the canceling position for canceling the restraint of the image sensor section **7**.

In this embodiment, the restraining member **23** and the support member **24** are provided separately. The restraining member **23** is arranged in the vicinity of the home position of the image sensor section **7** and at substantially a center portion of the image sensor section **7** in its longitudinal direction. An elastic member **25** of the support member **24** is arranged at a position of substantially the center portion of the lower surface **6***a* of the original placing glass **6**.

As illustrated in FIGS. **20** and **21**, guide rails **45** and guide rails **46** are provided upright in a vertical direction of FIGS. **22**A, **22**B, **23**A, and **23**B at positions on the bottom surface **3***b* of the casing **3**. The guide rails **45** are provided in the vicinity of the home position at the left end portion illustrated in FIG. **20**, and the guide rails **46** are provided at the center portion of the bottom surface **3***b* illustrated in FIG. **20**. The guide rails **45** are formed of a pair of opposing rail members having a C-shaped cross section and serving as guide rails **47**, which pass through the bottom surface **3***b* of the casing **3** and communicate the inner side and the outer side of the casing **3**. The guide rails **46** are formed of a pair of opposing rail members having a C-shaped cross section and serving as guide rails **48**, which pass through the bottom surface **3***b* of the casing **3** and communicate the inner side and the outer side of the casing **3**.

The guide rails **45** for guiding the restraining member **23** so that the restraining member **23** can be raised and lowered are arranged in the vicinity of the home position of the image sensor section **7** and at substantially the center portion of the image sensor section **7** in its longitudinal direction. The guide rails **46** for guiding the support member **24** so that the support member **24** can be raised and lowered are arranged at a position of substantially the center portion of the lower surface **6***a* of the original placing glass **6**.

In the guide rails **47**, the restraining member **23** having a T-shaped cross section, which is movable along the guide rails **45** in the vertical direction of FIGS. **22**A, **22**B, **23**A, and **23**B while engaging with the guide rails **47**, is fitted along the guide rails **47** so that the restraining member **23** can be raised and lowered. Similarly, in the guide rails **48**, the support member **24** having a T-shaped cross section, which is movable along the guide rails **46** in the vertical direction of FIGS. **22**A, **22**B, **23**A, and **23**B while engaging with the guide rails **48**, is fitted along the guide rails **48** so that the support member **24** can be raised and lowered.

In this embodiment, the guide rails **45** for holding the restraining member **23** so that the restraining member **23** can be raised and lowered are provided on the left end portion side of FIGS. **22**A, **22**B, **23**A, and **23**B, which corresponds to the home position of the image sensor section **7**. The guide rails **46** for holding the support member **24** so that the support member **24** can be raised and lowered are provided at the position of substantially the center portion of the lower surface **6***a* of the original placing glass **6**. The elastic member **25**, which abuts against the lower surface **6***a* of the original placing glass **6** and supports the original placing glass **6**, is provided at an upper portion of the support member **24**.

A spring-supported portion **23***a* protruding from the guide rails **45** is provided at an intermediate portion of the restraining member **23** in the vertical direction. A spring-supported portion **24***a* protruding from the guide rails **46** is provided at an intermediate portion of the support member **24** in the vertical direction.

The lower pieces **16***b* of the pressurization brackets **16** each having a Z-shaped cross section are fixed with the screws **17**, respectively, on the bottom surface **3***b* of the casing **3**. The coil-like pressurization springs **18** are locked between the spring-supported portion **23***a* of the restraining member **23** and the upper piece **16***a* of the corresponding pressurization bracket **16**, and between the spring-supported portion **24***a* of the support member **24** and the upper piece **16***a* of the corresponding pressurization bracket **16**.

The restraining member **23** and the support member **24** are constantly biased in a downward direction of FIGS. **22**A, **22**B, **23**A, and **23**B by the elastic forces of the respective pressurization springs **18**.

A rocker arm **26** having an L-shaped cross section and pivotable about a support shaft **49** is provided at a lower end portion of each of the guide rails **45** and the guide rails **46** protruding from the bottom surface **3***b* of the casing **3** to the outside. A torsion coil spring **27** fitted onto the support shaft **49** is provided on a side surface of each rocker arm **26**. One end portion of the torsion coil spring **27** is locked at a locking portion **26***a* provided on the side surface of the rocker arm **26**. Another end portion of the torsion coil spring **27** abuts against one inner wall surface of each of the guide rails **45** and the guide rails **46**.

The rocker arm **26** is constantly biased about the support shaft **49** in a clockwise direction of FIGS. **23**A and **23**B by an elastic force of the torsion coil spring **27**. Therefore, under a state in which the packaging material **28** is placed through an opening portion **12** provided at a part of the inner wall surface of each of the guide rails **45** and the guide rails **46**, as illustrated in FIG. **23**A, a long piece of the rocker arm **26** abuts against a wall surface **28***a* of the packaging material **28** and is held in a stationary state.

A procedure of canceling the restraining state of the image sensor section **7** and the holding of the original placing glass **6** is described. Under a state in which the packaging material **28** is removed, as illustrated in FIG. **23**B, the biasing force of the torsion coil spring **27** is set sufficiently large against frictional resistance occurring between a top surface **26***b* of the rocker arm **26** and a lower end portion **23***b* of the restraining member **23**. Therefore, the rocker arm **26** pivots until the long piece of the rocker arm **26** strikes another inner wall surface of the guide rails **45**. Similarly, the biasing force of the torsion coil spring **27** is set sufficiently large against frictional

resistance occurring between the top surface **26***b* of the rocker arm **26** and a lower end portion **24***b* of the support member **24**. Therefore, the rocker arm **26** pivots until the long piece of the rocker arm **26** strikes another inner wall surface of the guide rails **46**.

In the manner described above, the locking state of the restraining member **23** and the support member **24** is canceled, and the restraining member **23** and the support member **24** are lowered along the guide rails **45** and the guide rails **46**, respectively. Through the above-mentioned series of operations, the restraining state of the image sensor section **7** and the holding of the original placing glass **6** are canceled.

A procedure of setting the image sensor section **7** into the restraining state and holding the original placing glass **6** is described. FIGS. **24**A and **24**B are partially enlarged perspective views of FIGS. **22**A and **22**B, respectively. In FIGS. **24**A and **24**B, the wall on the front side of the drawing sheet is indicated by the chain lines so that the inner structure is visible. In FIGS. **24**A and **24**B, the opening portion **12** is formed at a part of the inner wall surface of each of the guide rails **45** and the guide rails **46**, against which the long piece of the rocker arm **26** abuts. A finger (not shown) is inserted through the opening portion **12**, and the restraining member **23** is raised along the guide rails **45** against the biasing force of the pressurization spring **18**. Further, the rocker arm **26** is pivoted about the support shaft **49** in a counterclockwise direction of FIG. **23**A against the biasing force of the torsion coil spring **27**. Then, at a position at which the top surface **26***b* of the rocker arm **26** strikes the lower end portion **23***b* of the restraining member **23**, the rocker arm **26** is temporarily held with the finger. Subsequently, the packaging material **28** is replaced for the finger and inserted through the opening portion so that the wall surface **28***a* supports the rocker arm **26** against the biasing force of the torsion coil spring. Subsequently, a finger (not shown) is inserted through the opening portion **12** of the guide rails **46**, and the support member **24** is raised along the guide rails **46** against the biasing force of the pressurization spring **18**. Further, the rocker arm **26** is pivoted about the support shaft **49** in the counterclockwise direction of FIG. **23**A against the biasing force of the torsion coil spring **27**. Then, at a position at which the top surface **26***b* of the rocker arm **26** strikes the lower end portion **24***b* of the support member **24**, the rocker arm **26** is temporarily held with the finger. Subsequently, the packaging material **28** is replaced for the finger and inserted through the opening portion so that the wall surface **28***a* supports the rocker arm **26** against the biasing force of the torsion coil spring. In this state, the rocker arm **26** may be regarded as a part of the casing **3**, and the lower end portion **24***b* of the support member **24** functions as an abutment surface of the support member **24** which is supported by the casing **3**.

When setting the image sensor section **7** into the restraining state and holding the original placing glass **6**, it is assumed that the image sensor section **7** is moved in advance to the home position thereof.

At the time of unpackaging, the holding state of the image sensor section **7** and the original placing glass **6** can be canceled by only removing the packaging material **28**. Therefore, such an operation is easy for the user, and further, packaging can be performed again.

As shown in FIG. **23**B, the restraining member **23** and the support member **24** are lowered to be set at the retracted positions retracted from the image sensor section **7** and the original placing glass **6**, respectively. In this case, the restraining member **23** and the support member **24** are retracted to positions below the trajectory **30** of the movement of the lower surface **7***a*, which is the lowermost end portion of the image sensor section **7**. Accordingly, the moving operation of the image sensor section **7** is not hindered.

Accordingly, the restraining member **23** for restraining the image sensor section **7** at the home position and the support member **24** for supporting the original placing glass **6** are movable to the retracted positions below the trajectory **30**, which are situated out of the movement trajectory of the image sensor section **7**, and hence the image sensor section **7** is not interrupted at the time of the reading operation.

In this embodiment, the packaging material **28** restricts the rocker arm **26** to indirectly perform the operation of raising and lowering the restraining member **23** for restraining the image sensor section **7** and the support member **24** for supporting the lower surface **6***a* of the original placing glass **6**. Alternatively, the rocker arm **26** may be omitted and a part of the packaging material **28** may directly abut against the restraining member **23** for restraining the image sensor section **7** and the support member **24** for supporting the lower surface **6***a* of the original placing glass **6**, to thereby perform the operation of raising and lowering the restraining member **23** and the support member **24**. Other components are similar to those in the above-mentioned embodiments, and similar effects can be obtained. According to this embodiment, at the time of unpackaging, the holding state of the original placing glass **6** and the restraining state of the image sensor section **7** can be canceled by only removing the packaging material. Therefore, the user does not need to carry out the canceling operation separately from the operation of removing the packaging material, and hence the usability is improved.

(Seventh Embodiment)

Next, referring to FIGS. **26** to **30**, a configuration of an image reading apparatus according to a seventh embodiment of the present invention is described. In the sixth embodiment, the restraining member **23** is arranged in the vicinity of the home position of the image sensor section **7** and at substantially the center portion of the image sensor section **7** in its longitudinal direction. Further, the elastic member **25** of the support member **24** is arranged at the position of substantially the center portion of the lower surface **6***a* of the original placing glass **6**.

In this embodiment, as illustrated in FIGS. **26** to **27**C, the restraining member **23** is arranged in the vicinity of the home position of the image sensor section **7** and in the vicinity of the side surface **3***c* of the casing **3**. The elastic member **25** of the support member **24** is arranged within the range of the lower surface **6***a* of the original placing glass **6** at a position in the vicinity of the side surface **3***c* of the casing **3** and in proximity to the restraining member **23**.

The guide rails **45** and the guide rails **46** are provided upright in a vertical direction of FIGS. **28**A, **28**B, and **30** at positions on the bottom surface **3***b* of the casing **3** and in the vicinity of the side surface **3***c* thereof. The guide rails **45** are formed of a pair of opposing rail members having a C-shaped cross section and serving as the guide rails **47**, which pass through the bottom surface **3***b* of the casing **3** and communicate the inner side and the outer side of the casing **3**. The guide rails **46** are formed of a pair of opposing rail members having a C-shaped cross section and serving as the guide rails **48**, which pass through the bottom surface **3***b* of the casing **3** and communicate the inner side and the outer side of the casing **3**.

The guide rails **45** for guiding the restraining member **23** so that the restraining member **23** can be raised and lowered are arranged in the vicinity of the home position of the image sensor section **7** and in the vicinity of the side surface **3***c* of the casing **3**. The guide rails **46** for guiding the support member **24** so that the support member **24** can be raised and lowered are arranged within the range of the lower surface **6***a* of the

original placing glass **6** at the position in the vicinity of the side surface **3***c* of the casing **3** and adjacent to the guide rails **45**.

Also in this embodiment, the image reading apparatus **2** is transported in a state of being packaged with use of the packaging material **28**. After that, in association with the user's operation of placing the packaging material **28** for packaging the image reading apparatus **2** at the time of packaging work, the support member **24** serving as the support unit supports the lower surface **6***a* of the original placing glass **6**. Further, in association with the user's operation of removing the packaging material **28** at the time of unpackaging work, the support of the lower surface **6***a* of the original placing glass **6** is canceled. The support member **24** supports the lower surface **6***a* of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3**. The support member **24** is movable between the support position for supporting the lower surface **6***a* of the original placing glass **6** and the retracted position retracted from the lower surface **6***a* of the original placing glass **6**.

In association with the operation of placing and removing the packaging material **28**, the restraining member **23** serving as the restraining unit is movable between the restraining position for restraining the image sensor section **7** at the home position and the canceling position for canceling the restraint of the image sensor section **7**. The restraining member **23** and the support member **24** are configured separately. Protruding portions **28***a* of the packaging material **28** are provided at positions corresponding to the respective rocker arms **26**. When the packaging material **28** is fixed to a bottom portion of the image reading apparatus **2**, the protruding portions **28***a* of the packaging material **28** enter the respective opening portions **12** and abut against the rocker arms **26**. Other components are similar to those in the sixth embodiment. At the time of unpackaging, the holding state of the original placing glass **6** and the restraining state of the image sensor section **7** can be canceled by only removing the packaging material. Therefore, the user does not need to carry out the canceling operation separately from the operation of removing the packaging material, and hence the usability is improved.

(Eighth Embodiment)

Next, referring to FIGS. **31**A, **31**B, **32**A, and **32**B, a configuration of an image reading apparatus according to an eighth embodiment of the present invention is described. In this embodiment, a support member **41** serves as the support unit for supporting the original placing glass **6** by abutting against the lower surface **6***a* of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3**, and the support member **41** moves in association with the movement of the image sensor section **7**. The support member **41** is movable at a predetermined separation distance between the support member **41** and the lower surface **6***a* of the original placing glass **6**. Components similar to those in the first to seventh embodiments are represented by the same reference symbols, and description thereof is therefore omitted herein.

The image sensor section **7** is movable in the arrow "e" direction of FIG. **31**B from a position of the left end portion of the original placing glass **6** illustrated in FIGS. **31**A, **31**B, **32**A, and **32**B to a position of the reading operation, which is set in accordance with the size of the original placed on the original placing glass **6**.

The image sensor section **7** moves by the drive unit (not shown) such as a motor. The position of the left end portion of the original placing glass **6** illustrated in FIGS. **31**A, **31**B, **32**A, and **32**B corresponds to the home position of the image sensor section **7**.

The support member **41** of this embodiment is formed into a columnar or cylindrical shape having a height corresponding to a separation distance between the bottom surface **3***b* of the casing **3** and the lower surface **6***a* of the original placing glass **6**. An elastic member **41***a*, which abuts against the lower surface **6***a* of the original placing glass **6** and supports the original placing glass **6**, is provided at an upper portion of the support member **41**. The support member **41** is integrally fixed to the image sensor section **7**, and moves in association with the movement of the image sensor section **7**.

As illustrated in FIG. **32**B, the upper surface **7***b* of the image sensor section **7** is opposed to the lower surface **6***a* of the original placing glass **6** at the separation distance "a". An upper surface **41***a***1** of the elastic member **41***a* of the support member **41** is opposed to the lower surface **6***a* of the original placing glass **6** at the separation distance "b" that is smaller than the separation distance "a".

When the image reading apparatus **2** is transported, as illustrated in FIGS. **31**A and **31**B, the image sensor section **7** is fixed in a state of being moved to a position of substantially the center portion of the original placing glass **6**. The support member **41** integrally fixed to the image sensor section **7** supports the lower surface **6***a* of the original placing glass **6** at substantially the center portion of the original placing glass **6**.

The broken lines in the sectional view of FIG. **32**A schematically indicate a limit to the shape of the original placing glass **6** which keeps the original placing glass **6** from damage thereto. FIG. **32**A illustrates the maximum flexure amount "d" in this case. When the separation distance "b" between the upper surface **41***a***1** of the elastic member **41***a* of the support member **41** and the lower surface **6***a* of the original placing glass **6** is set smaller than the maximum flexure amount "d" at the limit to the shape of the original placing glass **6** which keeps the original placing glass **6** from damage thereto, the original placing glass **6** is supported by the support member **41** before the original placing glass **6** is damaged.

Accordingly, as illustrated in FIGS. **31**A, **31**B, and **32**A, the image sensor section **7** is fixed in the state of being moved to the position of substantially the center portion of the original placing glass **6**. The image reading apparatus **2** is transported under a state in which the support member **41** integrally fixed to the image sensor section **7** can support the lower surface **6***a* of the original placing glass **6** at substantially the center portion of the original placing glass **6**. Accordingly, the original placing glass **6** is brought into a state of being supported from the inner side of the casing **3**, and the original placing glass **6** is not distorted inward due to the vibration and shock at the time of transportation, resulting in a satisfactory holding state.

In this embodiment, the support member **41** is integrally fixed to the image sensor section **7**. Accordingly, even when the original placing glass **6** is distorted inward of the casing **3**, the separation distance "a" between the upper surface **7***b* of the image sensor section **7** and the lower surface **6***a* of the original placing glass **6** is larger than the separation distance "b" between the upper surface **41***a***1** of the elastic member **41***a* of the support member **41** and the lower surface **6***a* of the original placing glass **6**. Accordingly, the lower surface **6***a* of the original placing glass **6** abuts against the upper surface **41***a***1** of the elastic member **41***a* of the support member **41** and is supported by the upper surface **41***a***1** before the lower surface **6***a* of the original placing glass **6** comes into contact with the image sensor section **7**. Thus, even when the original placing glass **6** is distorted inward of the casing **3**, the original

placing glass **6** does not come into contact with the image sensor section **7**. A lower surface **41***b* of the support member **41** functions as an abutment surface of the support member **41** which is supported by the casing **3**.

The separation distance "a" between the upper surface **7***b* of the image sensor section **7** and the lower surface **6***a* of the original placing glass **6**, and the separation distance "b" between the upper surface **41***a***1** of the elastic member **41***a* of the support member **41** and the lower surface **6***a* of the original placing glass **6** are set so as to satisfy a relationship of {a>b>0}. Accordingly, when the image sensor section **7** moves in the arrow "e" direction of FIG. **31**B in the reading operation, the lower surface **6***a* of the original placing glass **6** and the upper surface **41***a***1** of the elastic member **41***a* of the support member **41** are not damaged by friction.

The lower surface **7***a* of the image sensor section **7** and the lower surface **41***b* of the support member **41** may be movable at the predetermined separation distance "c" from the bottom surface **3***b* of the casing **3** instead of being held in contact with the bottom surface **3***b* of the casing **3** at a distance of 0 mm. At this time, there is a condition that the separation distance "a" between the upper surface **7***b* of the image sensor section **7** and the lower surface **6***a* of the original placing glass **6**, the separation distance between the upper surface **41***a***1** of the elastic member **41***a* of the support member **41** and the lower surface **6***a* of the original placing glass **6**, and the separation distance "c" between the lower surface **41***b* of the support member **41** and the bottom surface **3***b* of the casing **3** satisfy a relationship of {a>b+c>0}. In this condition, under a state in which the original placing glass **6** is distorted inward of the casing **3** and the support member **41** supports the lower surface **6***a* of the original placing glass **6**, the lower surface **6***a* of the original placing glass **6** abuts against the upper surface **41***a***1** of the elastic member **41***a* of the support member **41**. When the image sensor section **7** is distorted, the support member **41** is lowered and the lower surface **41***b* of the support member **41** abuts against the bottom surface **3***b* of the casing **3**. When the above-mentioned separation distances and the maximum flexure amount "d" of the original placing glass **6** satisfy a relationship of b+c<d at the position of the support member **41**, it is possible to prevent the damage to the original placing glass **6**. In the case described in this embodiment, "c" is zero, but "c" may be larger than zero.

The original placing glass **6** is distorted inward of the casing **3**, and the lower surface **6***a* of the original placing glass **6** abuts against the elastic member **41***a* provided at the upper portion of the support member **41**. Accordingly, a shock at the time when the lower surface **6***a* of the original placing glass **6** comes into contact with the support member **41** can be absorbed by the elasticity of the elastic member **41***a*, which is more effective in the protection of the original placing glass **6**.

When the image reading apparatus **2** receives a shock in a period in which the image reading apparatus **2** is transported, or when the original placing glass **6** receives an external force and is distorted inward of the casing **3** at the time of the image reading operation, the support member **41** supports the lower surface **6***a* of the original placing glass **6**. That is, a force for distorting the original placing glass **6** is transferred to the bottom surface **3***b* of the casing **3** via the support member **41**. Accordingly, it is possible to protect the original placing glass **6** and the image sensor section **7**.

The number of the support members **41** and the abutment area of the support member **41** abutting against the lower surface **6***a* of the original placing glass **6** may be set as appropriate depending on the area and thickness of the original placing glass **6**.

When the image reading apparatus **2** is transported (when the image reading apparatus **2** does not perform the reading operation), as illustrated in FIGS. **31**A, **31**B, and **32**A, the image sensor section **7** is moved to a position in the vicinity of substantially the center portion of the original placing glass **6**.

Accordingly, the image sensor section **7** automatically performs a sequence of returning to the position of the left end portion of the original placing glass **6** illustrated in FIGS. **31**A, **31**B, **32**A, and **32**B at, for example, a timing at which the user turns ON the power of the image reading apparatus **2** or the image forming apparatus **1**. The image sensor section **7** moves by the drive unit (not shown) such as a motor. The position of the left end portion of the original placing glass **6** illustrated in FIGS. **31**A, **31**B, **32**A, and **32**B corresponds to the home position of the image sensor section **7**. Accordingly, the convenience of the user can be enhanced.

As described above, in this embodiment, the support member **41** is provided so as to move in association with the image sensor section **7**. The support member **41** receives the force for distorting the original placing glass **6**, and directly transfers the force to the casing **3**. Accordingly, there is no need to move the support member **41** so as to operate (move) the image sensor **7**, and the configuration for supporting the original placing glass **6** can be simplified and less complex. The support member **41** receives the force for distorting the original placing glass **6**, and directly transfers the force to the casing **3**. Accordingly, it is possible to reduce a ratio of the force for distorting the original placing glass **6**, which is transferred to the image sensor section **7**.

(Ninth Embodiment)

Next, referring to FIGS. **33**A, **33**B, **34**A, and **34**B, a configuration of an image reading apparatus according to a ninth embodiment of the present invention is described. In the eighth embodiment, the support member **41** serves as the support unit for supporting the original placing glass **6** by abutting against the lower surface **6***a* of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3**, and the support member **41** is provided integrally with the image sensor section **7**. In this embodiment, the support member **41** is provided separately from the image sensor section **7** so as to be independently movable in the normal direction to the lower surface **6***a* of the original placing glass **6**. The support member **41** moves in association with the movement of the image sensor section **7** in a direction parallel to the lower surface **6***a* of the original placing glass **6**. Components similar to those in the first to eighth embodiments are represented by the same reference symbols, and description thereof is therefore omitted herein.

The support member **41** is fixed to a tip end portion of an arm **42** provided so as to be pivotable about a pivot shaft **43**, which is provided at a corner portion of the bottom surface **3***b* of the casing **3**. A torsion coil spring **44** is fitted onto the pivot shaft **43**. One end of the torsion coil spring **44** abuts against an inner wall surface of the side surface **3***a* of the casing **3**, and another end of the torsion coil spring **44** is locked at the arm **42**.

The arm **42** is constantly biased about the pivot shaft **43** in a clockwise direction of FIG. **33**B by an elastic force of the torsion coil spring **44**. Under a state in which the support member **41** abuts against a side surface **7***d* of the image sensor section **7** on the left side of FIG. **33**B, the arm **42** moves in the direction parallel to the lower surface **6***a* of the original placing glass **6** in association with the movement of the image sensor section **7**. When the support member **41** moves to a position in the vicinity of substantially the center portion of the original placing glass **6**, the torsion coil spring **44** transi-

tions to a free state of FIG. **33**B, in which the spring is fully expanded and the elastic force thereof does not act, and the support member **41** does not further move and comes into a stationary state.

The image sensor section **7** moves from the position in the vicinity of the center portion in a leftward direction of FIG. **33**B. Then, the side surface **7***d* of the image sensor section **7** on the left side of FIG. **33**B abuts against the support member **41**. Then, the arm **42** is pivoted about the pivot shaft **43** in a counterclockwise direction of FIG. **33**B against the biasing force of the torsion coil spring **44**. The support member **41** slides in abutment against the side surface **7***d* of the image sensor section **7** on the left side of FIG. **33**B, and in this state, moves in a manner of drawing an arc with the arm **42** defining its radius. Then, the image sensor section **7** returns to the position of the left end portion of the original placing glass **6** illustrated in FIG. **33**B, which corresponds to the home position. Then, the support member **41** returns to the position in the vicinity of the side surface **3***a* of the casing **3** in association with the movement of the image sensor section **7**.

As illustrated in FIG. **33**B, the image sensor section **7** is fixed in a state of being moved to the position of substantially the center portion of the original placing glass **6**. The image reading apparatus **2** is transported under a state in which the support member **41** following the image sensor section **7** can support the lower surface **6***a* of the original placing glass **6** at substantially the center portion of the original placing glass **6**. Accordingly, the original placing glass **6** is brought into a state of being supported from the inner side of the casing **3**. Accordingly, the original placing glass **6** is brought into a state in which the inward flexure due to the vibration and shock at the time of transportation is suppressed, resulting in a satisfactory holding state. That is, the force for distorting the original placing glass **6** is transferred to the bottom surface **3***b* of the casing **3** via the support member **41**. At this time, the support member **41** is movable independently of the image sensor section **7** in the normal direction to the lower surface **6***a* of the original placing glass **6**. Accordingly, it is possible to protect the original placing glass **6** and the image sensor section **7**.

In this embodiment, the biasing force is constantly applied to the arm **42** with use of the torsion coil spring **44**, but the torsion coil spring **44** may be replaced with a different elastic member such as a coil spring, and the elastic member may be arranged at a different position.

The number of the arms **42** and support members **41** may be increased as appropriate depending on the area and thickness of the original placing glass **6**. Further, the method of moving the arm **42** and the support member **41** is not limited to the method in this embodiment, and various other methods may be employed instead. Other components are similar to those in the eighth embodiment. The support member **41** is provided so as to move in association with the image sensor section **7**. The support member **41** receives the force for distorting the original placing glass **6**, and directly transfers the force to the casing **3**. Accordingly, there is no need to move the support member **41** so as to operate (move) the image sensor **7**, and the configuration for supporting the original placing glass **6** can be simplified and less complex. The support member **41**, which is movable independently of the image sensor section **7** in the normal direction to the lower surface **6***a* of the original placing glass **6**, receives the force for distorting the original placing glass **6**, and directly transfers the force to the casing **3**. Accordingly, it is possible to reduce the ratio of the force for distorting the original placing glass **6**, which is transferred to the image sensor section **7**.

(Tenth Embodiment)

Next, referring to FIGS. **35**, **36**A, and **36**B, a configuration of an image reading apparatus according to a tenth embodiment of the present invention is described. In this embodiment, a plate-like support member **52** serves as the support unit for supporting the original placing glass **6** by abutting against the lower surface **6***a* of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3**.

The support member **52** is provided at substantially a center portion of a signal line bundle **51** in its longitudinal direction. The signal line bundle **51** is freely foldable between the bottom surface **3***b* of the casing **3** and the lower surface **6***a* of the original placing glass **6**. The signal line bundle **51** connects the image sensor section **7** to a control section (not shown) of the image reading apparatus **2** so as to transmit an input/output signal. The support member **52** moves together with the signal line bundle **51**, which expands and contracts in association with the movement of the image sensor section **7**.

In FIGS. **35**, **36**A, and **36**B, the signal line bundle **51** transmits the input/output signal of the image sensor section **7**. The plate-like support member **52** supports the lower surface **6***a* of the original placing glass **6**. An elastic member **52***a* is provided at an upper portion of the support member **52**. The signal line bundle **51** is freely foldable (bendable) into an accordion shape, and is connected to the support member **52** at a position in the vicinity of the center in a folding direction. One end of the signal line bundle **51** is connected to the image sensor section **7**, and another end of the signal line bundle **51** is connected to the control section (not shown) provided inside the casing **3**.

As illustrated in FIG. **36**B, the separation distance "a" between the upper surface **7***b* of the image sensor section **7** and the lower surface **6***a* of the original placing glass **6**, and the separation distance "b" between an upper surface **52***a***1** of the elastic member **52***a* of the support member **52** and the lower surface **6***a* of the original placing glass **6** satisfy a relationship of a>b.

The support member **52** moves between the bottom surface **3***b* of the casing **3** and the lower surface **6***a* of the original placing glass **6** in a floating manner under a state in which the support member **52** is held upright, together with the signal line bundle **51**, which expands and contracts in association with the movement of the image sensor section **7**. The support member **52** is movable at the predetermined separation distance "b" between the support member **52** and the lower surface **6***a* of the original placing glass **6**.

Only when the original placing glass **6** receives a force in the arrow "F" direction of FIG. **36**B, the lower surface **6***a* of the original placing glass **6** abuts against the elastic member **52***a* of the support member **52**, and the support member **52** is lowered. Then, a lower surface **52***b* of the support member **52** abuts against the bottom surface **3***b* of the casing **3**, and the lower surface **6***a* of the original placing glass **6** is supported by the support member **52**.

Therefore, when the force in the arrow direction of FIG. **36**B is applied to the original placing glass **6**, the original placing glass **6** is supported by the support member **52** abutting against the bottom surface **3***b* of the casing **3**, and the original placing glass **6** does not come into contact with the image sensor section **7**. That is, the force for distorting the original placing glass **6** is transferred to the bottom surface **3***b* of the casing **3** via the support member **52**. At this time, the support member **52** is movable independently of the image sensor section **7** in the normal direction to the lower surface **6***a* of the original placing glass **6**. Accordingly, it is possible to protect the original placing glass **6** and the image sensor section **7**.

In this embodiment, there has been described an example in which only the single plate-like support member **52** is connected to the signal line bundle **51**, but a plurality of support members **52** may be arranged. Other components are similar to those in the first to ninth embodiments, and similar effects can be obtained.

Further, the support member **52** is provided so as to move in association with the image sensor section **7**. The support member **52** receives the force for distorting the original placing glass **6**, and directly transfers the force to the casing **3**. Accordingly, there is no need to move the support member **52** separately so as to operate (move) the image sensor **7**, and the configuration for supporting the original placing glass **6** can be simplified and less complex. The support member **52**, which is movable independently of the image sensor section **7** in the normal direction to the lower surface **6***a* of the original placing glass **6**, receives the force for distorting the original placing glass **6**, and directly transfers the force to the casing **3**. Accordingly, it is possible to further suppress the transfer of the force for distorting the original placing glass **6** to the image sensor section **7** as compared to the ninth embodiment.

(Eleventh Embodiment)

Next, referring to FIGS. **37**A and **37**B, a configuration of an image reading apparatus according to an eleventh embodiment of the present invention is described. Also in this embodiment, a support member **61** serves as the support unit for supporting the original placing glass **6** by abutting against the lower surface **6***a* of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3**, and the support member **61** moves in association with the movement of the image sensor section **7**. The support member **61** is movable at a predetermined separation distance between the support member **61** and the lower surface **6***a* of the original placing glass **6**.

The support member **61** is formed by connecting a plurality of plate-like members into an accordion shape, and is freely foldable (bendable) between the bottom surface **3***b* of the casing **3** and the lower surface **6***a* of the original placing glass **6**. Each of the plurality of plate-like members is arranged in a state of being held upright in a direction perpendicular to the original placing glass **6**. One end portion of the support member **61** is coupled to the image sensor section **7**, and another end portion of the support member **61** is coupled to an inner wall surface of a side surface **3***d* of the casing **3** on the right side of FIG. **37**B. Through the movement of the image sensor section **7**, the support member **61** expands and contracts. The support member **61** moves between the bottom surface **3***b* of the casing **3** and the lower surface **6***a* of the original placing glass **6** in a floating manner under a state in which the support member **61** is held upright. The support member **61** is movable at the predetermined separation distance between the support member **61** and the lower surface **6***a* of the original placing glass **6**.

In this embodiment, when the image reading apparatus **2** receives a shock in a period in which the image reading apparatus **2** is transported, or when the original placing glass **6** receives an external force and is distorted inward of the casing **3** at the time of the image reading operation, the lower surface **6***a* of the original placing glass **6** abuts against an elastic member **61***a* provided at an upper portion of the support member **61**, and the support member **61** is lowered.

Then, a lower surface of the support member **61** abuts against the bottom surface **3***b* of the casing **3**, and the lower surface **6***a* of the original placing glass **6** is supported by the support member **61**.

Therefore, when the original placing glass **6** receives an external force and is distorted inward of the casing **3**, the original placing glass **6** is supported by the support member **61** abutting against the bottom surface **3***b* of the casing **3**, and the original placing glass **6** does not come into contact with the image sensor section **7**. The support member **61** of this embodiment is structurally hard to buckle. Thus, the signal line bundle connected to the image sensor section **7** may serve also as the support member **61** that is freely foldable.

One end of the support member **61** formed of the signal line bundle is connected to the image sensor section **7**, and another end of the support member **61** is connected to the control section (not shown) provided inside the casing **3**. The signal line bundle forming the support member **61** connects the image sensor section **7** to the control section (not shown) of the image reading apparatus **2** so as to transmit the input/output signal.

The support member **61** for supporting the lower surface **6***a* of the original placing glass **6** only needs to expand and contract in a freely foldable manner in association with the image sensor section **7**, and may be arranged so as to draw any trajectory of expansion and contraction such as a fan shape or the like.

As described above, in this embodiment, the support member **61** is provided so as to move in association with the image sensor section **7**. The support member **61** receives the force for distorting the original placing glass **6**, and directly transfers the force to the casing **3**. Accordingly, there is no need to move the support member **61** separately so as to operate (move) the image sensor **7**, and the configuration for supporting the original placing glass **6** can be simplified and less complex. The support member **61** receives the force for distorting the original placing glass **6**, and directly transfers the force to the casing **3**. Accordingly, it is possible to reduce the ratio of the force for distorting the original placing glass **6**, which is transferred to the image sensor section **7**.

(Twelfth Embodiment)

Next, referring to FIGS. **38**, **39**A, and **39**B, a configuration of an image reading apparatus according to a twelfth embodiment of the present invention is described. In this embodiment, the image reading apparatus includes rollers **71***a* and **71***b* as rotary members, which serve as the support unit capable of supporting the original placing glass **6** by abutting against the lower surface **6***a* of the original placing glass **6** at a portion other than the portion of the original placing glass **6** which is supported by the casing **3**.

The rollers **71***a* and **71***b* move in association with the movement of the image sensor section **7** while rolling on the bottom surface **3***b* of the casing **3**. The rollers **71***a* and **71***b* are rotary members which are freely rotatable and movable in the moving direction of the image sensor section **7** at the predetermined separation distance "b" between the rollers **71***a* and **71***b* and the lower surface **6***a* of the original placing glass **6**. At least a surface layer of each of the rollers **71***a* and **71***b* is an elastic member.

The rollers **71***a* and **71***b* maintain the predetermined separation distance "b" from the lower surface **6***a* of the original placing glass **6**, and also maintain a constant separation distance from the image sensor section **7**. In this state, the rollers **71***a* and **71***b* travel in the arrow "e" direction of FIG. **39**A by a drive source (not shown) such as a motor. Each of the rollers **71***a* and **71***b* is an elastic member. Therefore, even when the separation distance "b" between the rollers **71***a* and **71***b* and the lower surface **6***a* of the original placing glass **6** is set to zero, there is no risk of damaging the lower surface **6***a* of the original placing glass **6** when the surfaces of the rollers **71***a* and **71***b* slide on the lower surface **6***a* of the original placing glass **6**.

The rollers **71***a* and **71***b* are capable of traveling in association with the image sensor section **7** while constantly and actively supporting the lower surface **6***a* of the original placing glass **6**. Further, a lower portion of each of the rollers **71***a* and **71***b* functions as an abutment surface abutting against the bottom surface **3***b* of the casing **3**, to thereby transfer the force from the original placing glass **6** to the casing **3**. Therefore, the lower surface **6***a* of the original placing glass **6** can be supported more actively. When the image reading apparatus **2** is transported, the position in the vicinity of the line E of FIG. **39**A is set as the home position of the image sensor section **7**, with the result that the vicinity of the center portion of the lower surface **6***a* of the original placing glass **6** can be supported reliably. Other components are similar to those in the first to eleventh embodiments, and similar effects can be obtained.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Applications No. 2011-191221, filed Sep. 2, 2011, and 2012-178122, filed Aug. 10, 2012 which are hereby incorporated by reference herein in their entirety.

What is claimed is:

1. An image reading apparatus, comprising:

a placing member on which an original is to be placed, the placing member including an opposite surface which is opposite to a surface of the placing member that contacts the original;

a reading unit movable to a position opposed to the original across the placing member and constructed to read an image of the original placed on the placing member by receiving light reflected off the original via the placing member;

a casing constructed to support an outer peripheral edge portion of the placing member;

the opposite surface of the placing member includes a portion through which a light to be received by the reading unit passes when the reading unit reads the image of the original; and

a support member that supports a portion of the opposite surface other than the outer peripheral edge portion of the placing member,

the support member is further constructed to include an abutment portion abutting against the casing, such that the support member supports the placing member when the abutment portion abuts against the casing.

2. An image reading apparatus according to claim **1**, wherein the reading unit has an abutment portion abutting against the casing so that the reading unit is supported by the casing, the abutment portion of the reading unit being different from the abutment portion of the support member.

3. An image reading apparatus according to claim **1**, wherein the support member is movable between a support position capable of supporting the placing member and a retracted position retracted from the placing member relative to the support position.

4. An image reading apparatus according to claim **3**, wherein

the reading unit is configured to read the image of the original while moving, and

when the support member is situated in the support position, the support member restricts movement of the reading unit, and when the support member is situated in the retracted position, the support member avoids restricting the movement of the reading unit.

5. An image reading apparatus according to claim **3**, further comprising a restricting member movable between a restricting position for restricting movement of the reading unit and a restriction canceling position for canceling the restriction, the restricting member moving from the restricting position to the restriction canceling position in association with movement of the support member from the support position to the retracted position.

6. An image reading apparatus according to claim **5**, wherein the support member and the restricting member are configured to move integrally.

7. An image reading apparatus according to claim **1**, wherein the support member is configured to move in a direction parallel to a placing surface of the placing member, on which the original is to be placed, in association with movement of the reading unit.

8. An image reading apparatus according to claim **7**, wherein the support member is movable relative to the reading unit in a normal direction to the placing surface.

9. An image reading apparatus according to claim **7**, wherein the support member is separated from the placing member under a state in which the placing member is not distorted.

10. An image reading apparatus according to claim **7**, wherein the support member is separated from the casing under a state in which the placing member is not distorted.

11. An image reading apparatus according to claim **1**, wherein the reading unit is separated from the placing member under a state in which the support member supports the placing member.

12. An image reading apparatus according to claim **7**, wherein the support member has a bending portion which is freely bendable, the bending portion having one end coupled to the reading unit, and having another end coupled to the casing, the bending portion being bendable in association with the movement of the reading unit.

13. An image reading apparatus according to claim **12**, wherein the bending portion has a signal line bundle connected to the reading unit.

14. An image reading apparatus according to claim **1**, wherein the support member is a rotary member which is rotatable and movable in a moving direction of the reading unit.

15. An image reading apparatus according to claim **3**, wherein when the support member moves from the retracted position to the support position, a part of the support member which abuts against the placing member moves in a normal direction to a placing surface of the placing member, on which the original is to be placed.

16. An image reading apparatus according to claim **3**, wherein when a power of the image reading apparatus is turned ON under a state in which the support member is situated at the support position, the support member moves to the retracted position.

17. An image reading apparatus according to claim **3**, wherein the support member moves from the support position to the retracted position in association with an operation in which a protective member placed on a main body of the image reading apparatus and protecting the image reading apparatus is removed from the main body.

18. An image reading apparatus according to claim **1**, wherein the support member supports a center portion of the opposite surface of the placing member in a moving direction of the reading unit and a direction orthogonal to the moving direction.

19. An image reading apparatus according to claim **1**, wherein a part of the support member which abuts against the placing member is an elastic portion.

20. An image reading apparatus according to claim **1**, further comprising an image forming unit for forming an image on a recording material based on information of an image of an original, which is read by the reading unit.

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