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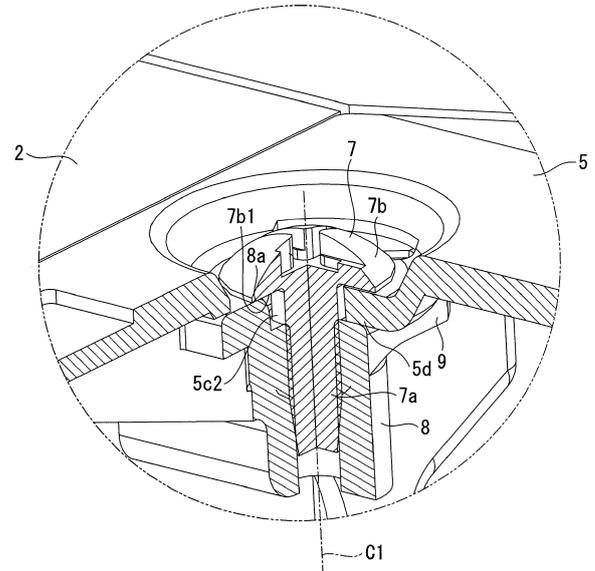
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(54) **INDOOR UNIT OF AIR-CONDITIONING APPARATUS**

(57) Provided is an indoor unit of an air-conditioning apparatus that, when mounting a cover member forming a part of an exterior of the indoor unit, allows for easy alignment of lines on a design surface of the cover member. The indoor unit includes: a lid 5 forming a part of an exterior of the indoor unit of the air-conditioning apparatus and including a fixing hole; and a screw 7 inserted into the fixing hole and fastened to a boss 8 of a panel 2. The screw 7 includes: a tip part detachably fixed to the boss 8; and a head 7b located on a front surface side of the lid 5 that is an opposite side of the lid 5 from the tip part. A gap is formed between the front surface of the lid 5 and a seating surface 7bl of the head 7b of the screw 7 facing the front surface, and the seating surface 7b1 is in contact with a contacting distal end 8a of the boss 8.

FIG. 4



**Description**

[Technical Field]

**[0001]** The present invention relates to an indoor unit of an air-conditioning apparatus, more particularly to fixing a cover member that forms a part of an exterior of the indoor unit.

[Background Art]

**[0002]** Screws are often used as a fastening member for fixing components of an air-conditioning apparatus such as a compressor or a heat exchanger. In this case, the fastening is typically made by bringing a seating surface of a head of the screw into contact with a counterpart member so as to press the seating surface against the counterpart member (for example, see Patent Literature 1).

[Citation List]

[Patent Literature]

**[0003]**

[PTL 1]

Japanese Unexamined Utility Model Application, Publication No. S60-73029

[Summary of Invention]

[Technical Problem]

**[0004]** In the above fastening method, however, as shown in Fig. 7, the counterpart member 10, which is brought into contact with the seating surface 7b1 of the head 7b of the screw 7, may directly be affected by a fastening torque of the screw. In particular, when the fastening torque is excessively large, the counterpart member 10 is affected by a shearing force of the screw, so that the counterpart member 10 rotates along with the screw in a rotational direction of the screw.

**[0005]** In the case where the counterpart member 10 is a cover member that forms a part of an exterior of an indoor unit of an air-conditioning apparatus, rotation of the cover member causes mating portions around the cover member to be displaced, which results in a surface level difference. This leads to misalignment of lines on the design surface, degrading the aesthetics of the exterior. To avoid this, an extra control is required such as controlling torques at the plant. However, this requires more drivers by the number of torques to be controlled, and is thus not efficient.

**[0006]** An object of the present invention, which has been made in view of the above circumstances, is to provide an indoor unit of an air-conditioning apparatus that, when fixing a cover member forming a part of an exterior

of the indoor unit, allows for easy alignment of lines on the design surface of the cover member.

[Solution to Problem]

**[0007]** According to an aspect of the present invention, there is provided an indoor unit of an air-conditioning apparatus, the indoor unit including: a cover member forming a part of an exterior of the indoor unit, the cover member including a fixing hole; and a fastening member inserted into the fixing hole and fastened to a main body-side fastening part of an indoor unit main body, wherein the fastening member includes: a tip part detachably fixed to the main body-side fastening part; and a head located on a front surface side of the cover member, the front surface side being an opposite side of the cover member from the tip part, the main body-side fastening part includes a boss into which the fastening member is inserted, and a gap is formed between the front surface of the cover member and a seating surface of the head of the fastening member facing the front surface, and the seating surface is in contact with a distal end of the boss.

**[0008]** The cover member is a part of an exterior of an indoor unit of an air-conditioning apparatus, and forms a design surface of the indoor unit. The fastening member is fastened to the main body-side fastening part of the indoor unit main body by being inserted into the fixing hole formed in the cover member. The tip part of the fastening member is detachably fixed to the main body-side fastening part, so that the cover member can be removed during various operations.

**[0009]** The seating surface of the fastening member is brought into contact with the distal end of the boss, whereby the fastening member is restricted from moving relative to the main body-side fastening part. On the other hand, a gap is formed between the front surface of the cover member and the seating surface of the head of the fastening member. By virtue of the gap, the fastening torque of the fastening member for fixing the cover member to the indoor unit main body is only transmitted to the boss and not directly transmitted to the cover member. This prevents the cover member from rotating along with the fastening member, and allows for easy alignment of lines on the design surface, so as to fix the cover member without any displacement.

**[0010]** Further, in the indoor unit of an air-conditioning apparatus according to the above aspect, the gap formed between the front surface of the cover member and the seating surface of the fastening member is not less than 0.05 mm and not more than 0.3 mm.

**[0011]** The gap of not less than 0.05 mm and not more than 0.3 mm, which is kept as small as possible, is formed between the front surface of the cover member and the seating surface of the fastening member. Thus, no large noise is produced even when vibration generated inside the indoor unit causes the cover member to hit against the fastening member or the main body-side fastening part.

**[0012]** Further, in the indoor unit of an air-conditioning apparatus according to the above aspect, the cover member is held between the head of the fastening member and the main body-side fastening part.

**[0013]** Since the cover member is held between the head of the fastening member and the main body-side fastening part, the cover member does not fall off from the indoor unit main body.

[Advantageous Effects of Invention]

**[0014]** The fastening torque of the fastening member is not transmitted to the cover member. This allows for easy alignment of lines on the design surface of the cover member when fixing the cover member.

[Brief Description of Drawings]

**[0015]**

Fig. 1 is a perspective view of an indoor unit of an air-conditioning apparatus according to an embodiment of the present invention.

Fig. 2 is an enlarged, exploded perspective view of a cover member and neighboring parts of Fig. 1.

Fig. 3 is an enlarged perspective view of a fixing hole of Fig. 2.

Fig. 4 is an enlarged, partial cross-sectional perspective view of a screw and neighboring parts.

Fig. 5 is a vertical cross-sectional view of the screw and neighboring parts.

Fig. 6 is a partially enlarged, vertical cross-sectional view of Fig. 5

Fig. 7 is a vertical cross-sectional view illustrating a state where a seating surface of a head of the screw contacts a counterpart member.

[Description of Embodiments]

**[0016]** Hereinafter, an embodiment of the present invention will be explained with reference to the drawings.

**[0017]** An air-conditioning apparatus includes an indoor unit and an outdoor unit. The indoor unit and the outdoor unit are connected with a refrigerant pipe, communication wires and the like. The outdoor unit is provided with a compressor for compressing refrigerant and an outdoor heat exchanger.

**[0018]** Fig. 1 illustrates an indoor unit 1 of an air-conditioning apparatus. An indoor heat exchanger, an indoor fan and the like are provided inside the indoor unit 1. The indoor unit 1 includes a panel (indoor unit main body) 2. The panel 2 is made of plastic and forms an exterior of the indoor unit 1. A flap 3 is provided at a lower part of the panel 2. When the flap 3 opens, air-conditioned air whose temperature has been adjusted by the indoor heat exchanger blows out into the room.

**[0019]** A lid (cover member) 5 made of plastic is provided at a lower corner (right-side corner in Fig. 1) of the

panel 2. Together with the panel 2, the lid 5 forms a design surface of the indoor unit 1. Thus, lines formed on the mating surfaces around the lid 5 are required to be in alignment with the panel 2. The lid 5 is provided at a position covering a terminal block to which the communication wires connected with the outdoor unit are attached. Accordingly, an operator removes or fixes the lid 5 for installation or maintenance of the indoor unit 1.

**[0020]** Fig. 2 illustrates a state where the lid 5 and neighboring parts are removed from the panel 2. The lid 5 is bent into a substantially L-shape to form a corner portion of the indoor unit 1. One end 5a of the lid 5 is provided with a claw (not shown in the figure), which is inserted into and engaged with a receiving part (not shown in the figure) at a corresponding position on the panel 2 and fixed in this manner. The other end 5b of the lid 5 is provided with a fixing hole 5c into which a screw (fastening member) 7 is inserted.

**[0021]** The panel 2 is provided with a boss 8 at a position corresponding to the fixing hole 5c. A shank (tip part) 7a of the screw 7 is screwed into the boss 8. The screw 7 includes the shank 7a having male threads, and a head 7b with a larger diameter than that of the shank 7a.

**[0022]** As shown in Fig. 3, the fixing hole 5c is provided with tongues 5d each protruding from an outer edge 5c1 of the fixing hole 5c toward the center. Two tongues 5d are provided so as to face each other. However, three or more tongues 5d may be provided. A diameter B, which is a distance between distal ends of the facing tongues 5d, is sized to match the diameter of the shank 7a of the screw 7. The shank 7a of the screw 7 is inserted between the distal ends of the tongues 5d. A boss-insertion space 5c2 is formed between these adjacent tongues 5d. As shown in Fig. 4, a contacting distal end (distal end) 8a of the boss 8 is inserted into this boss-insertion space 5c2.

**[0023]** Fig. 4 illustrates a state where the lid 5 is fixed with the screw 7. The left side of a center axis C1 of the screw 7 represents a cross-section (hereinafter simply referred to as a "left cross-section") of a position corresponding to the boss-insertion space 5c2 shown in Fig. 3. The right side of the center axis C1 of the screw 7 represents a cross-section (hereinafter simply referred to as a "right cross-section") of a position corresponding to the tongue 5d shown in Fig. 3. The left cross-section and the right cross-section form an angle of 90° around the center axis C1.

**[0024]** As shown in the left cross-section, the contacting distal end 8a of the boss 8 abuts on a seating surface (lower surface in Fig. 4) 7bl of the head 7b of the screw 7. The contacting distal end 8a is formed to protrude from a base 9 supporting the boss 8 toward the head 7b of the screw 7 (see Fig. 5). This allows a fastening torque of the screw 7 to be directly transmitted to the boss 8.

**[0025]** The contacting distal end 8a is partially provided at a distal end of the boss 8 along a circumferential direction of the boss 8. That is, the contacting distal end 8a is provided at a position corresponding to the boss-insertion space 5c2 shown in Fig. 3, and the contacting

distal end 8a is not provided at a position corresponding to each tongue 5d. Thus, at a cross-sectional position shown in the right cross-section, the boss 8 is not provided with the contacting distal end 8a protruding from the base 9. This allows the tongues 5d to be inserted into the space between the head 7b of the screw 7 and the boss 8.

**[0026]** As shown in Fig. 5, the diameter B (specifically, see Fig. 3) of the distance between the distal ends of the tongues 5d is smaller than the diameter A of the head 7b of the screw 7. This allows the tongues 5d to be held between the head 7b and the boss 8. However, the seating surface 7b1 of the screw 7 is not in contact with the surface of each tongue 5d, and accordingly a predetermined gap X is formed. Fig. 6 illustrates the gap X, which is preferably not less than 0.05 mm and not more than 0.3 mm. The gap X consists of gaps X1, X2 respectively on front and back surfaces of each tongue 5d. The sum of these gaps (X1 + X2) amounts to the gap X.

**[0027]** The present embodiment provides the following functions and effects.

**[0028]** The seating surface 7b1 of the head 7b of the screw 7 is in contact with the contacting distal end 8a of the boss 8, whereby the screw 7 is restricted from moving relative to the boss 8. On the other hand, the gap X is formed between the seating surface 7b1 of the head 7b of the screw 7 and the surface of each tongue 5d of the lid 5. By virtue of the gap X, the fastening torque of the screw 7 for mounting the lid 5 to the panel 2 is only transmitted to the boss 8 and not directly transmitted to the lid 5. This prevents the lid 5 from rotating along with the screw 7, and allows for easy alignment of the lines on the design surface, so as to mount the lid 5 without any displacement.

**[0029]** The gap of not less than 0.05 mm and not more than 0.3 mm, which is kept as small as possible, is formed between the surface of the lid 5 and the seating surface 7b1 of the head 7b of the screw 7. Thus, no large noise is produced even when vibration generated inside the indoor unit 1 causes the tongue 5d of the lid 5 to hit against the screw 7 or the boss 8.

**[0030]** Since the tongues 5d of the lid 5 are held between the head 7b of the screw 7 and the boss 8, the lid 5 does not fall off from the panel 2.

**[0031]** The above embodiment exemplarily describes the configuration where the lid 5 is fixed to the panel 2. However, the present invention is not limited to this. The present invention may be applied to any other applications as long as such applications involve fixing a cover member that forms a part of the panel 2 of the indoor unit 1.

[Reference Signs List]

**[0032]**

- 1 Indoor unit
- 2 Panel (indoor unit main body)

- 3 Flap
- 5 Lid (cover member)
- 5a One end
- 5b Other end
- 5c Fixing hole
- 5c1 Outer edge
- 5c2 Boss-insertion space
- 5d Tongue
- 7 Screw (fastening member)
- 7a Shank (tip part)
- 7b Head
- 7b1 Seating surface
- 8 Boss
- 8a Contacting distal end (distal end)
- 9 Base
- C1 Center axis (of the screw)

### Claims

1. An indoor unit of an air-conditioning apparatus, the indoor unit comprising:

a cover member forming a part of an exterior of the indoor unit, the cover member including a fixing hole; and

a fastening member inserted into the fixing hole and fastened to a main body-side fastening part of an indoor unit main body, wherein the fastening member includes:

a tip part detachably fixed to the main body-side fastening part; and

a head located on a front surface side of the cover member, the front surface side being an opposite side of the cover member from the tip part,

the main body-side fastening part includes a boss into which the fastening member is inserted, and

a gap is formed between the front surface of the cover member and a seating surface of the head of the fastening member facing the front surface, and the seating surface is in contact with a distal end of the boss.

2. The indoor unit of an air-conditioning apparatus according to claim 1, wherein the gap formed between the front surface of the cover member and the seating surface of the fastening member is not less than 0.05 mm and not more than 0.3 mm.

3. The indoor unit of an air-conditioning apparatus according to claim 1 or 2, wherein the cover member is held between the head of the fastening member and the main body-side fastening part.

FIG. 1

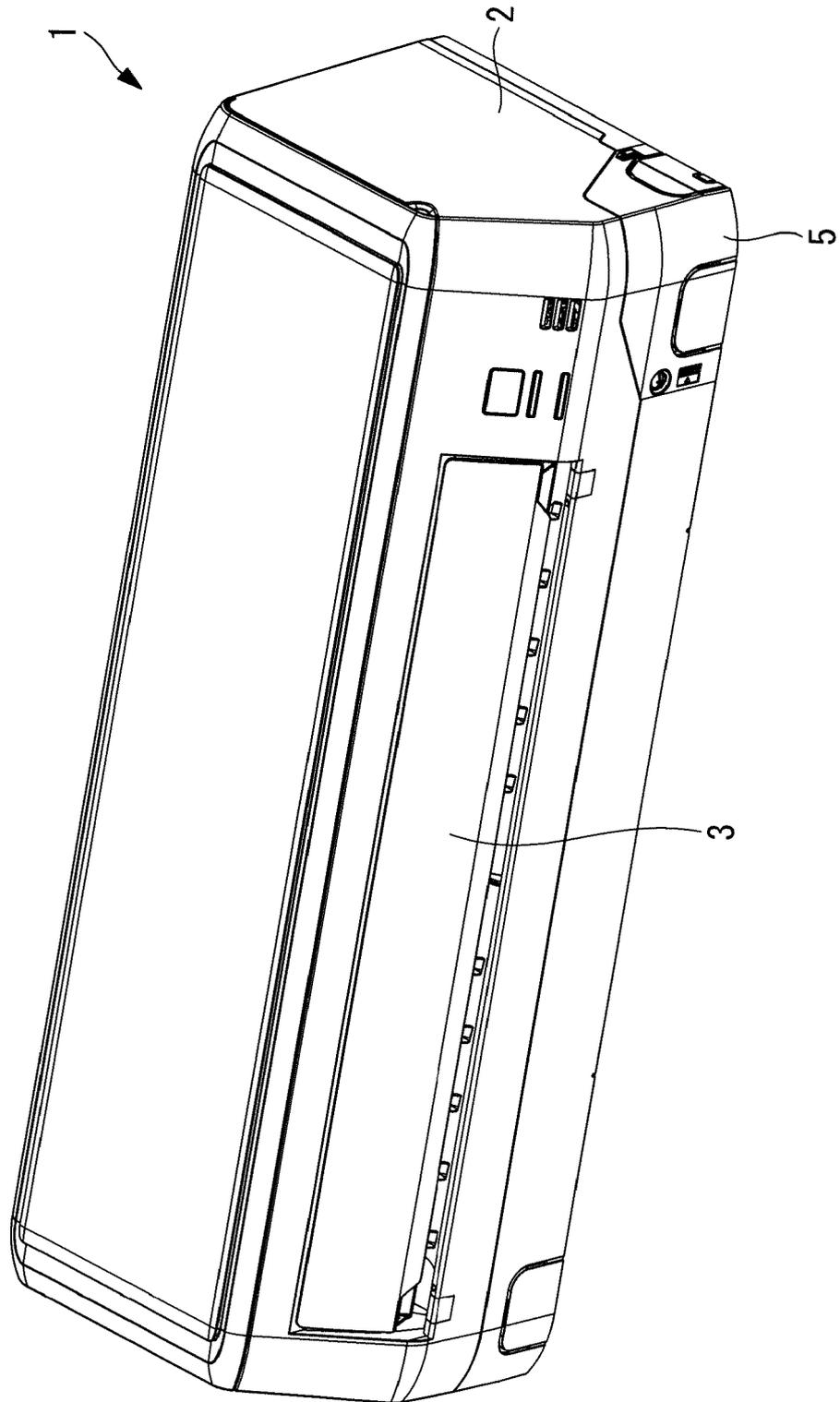


FIG. 2

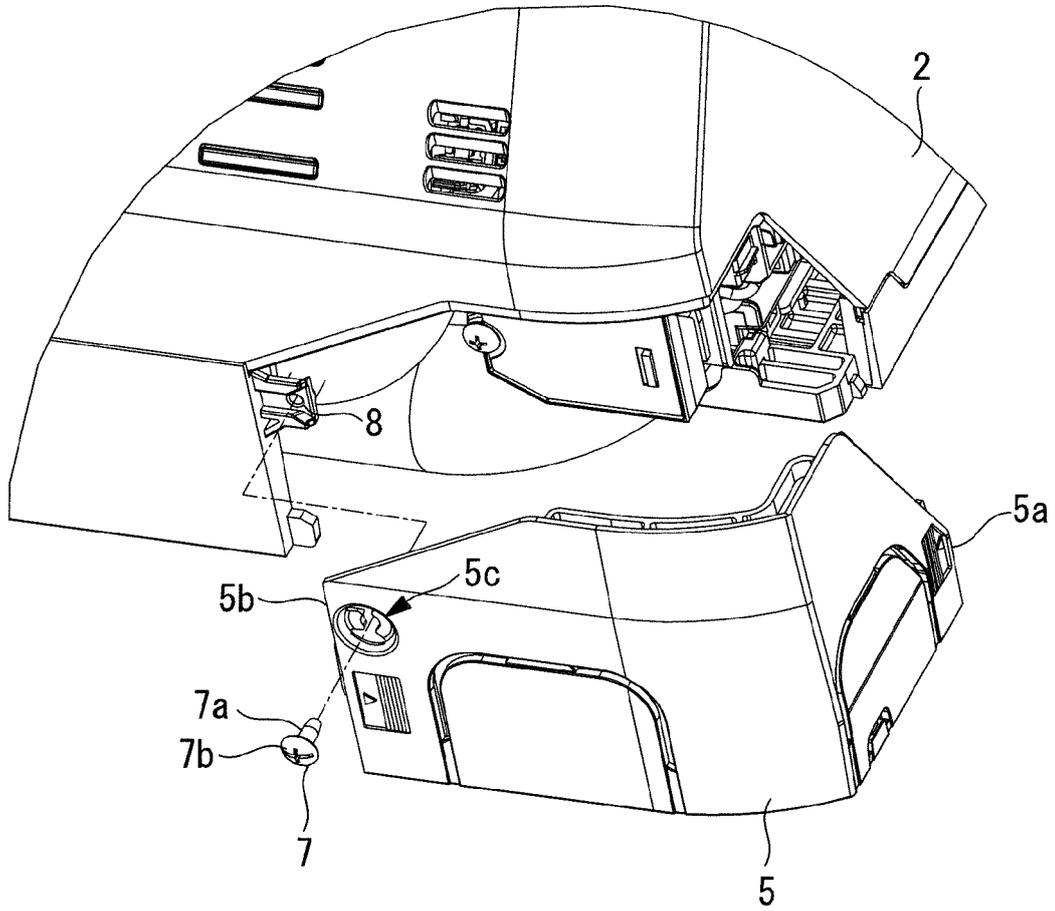


FIG. 3

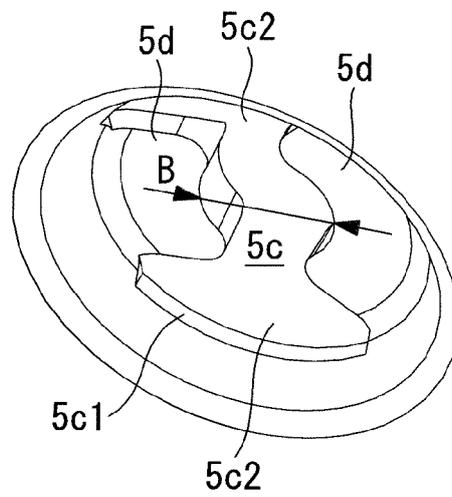


FIG. 4

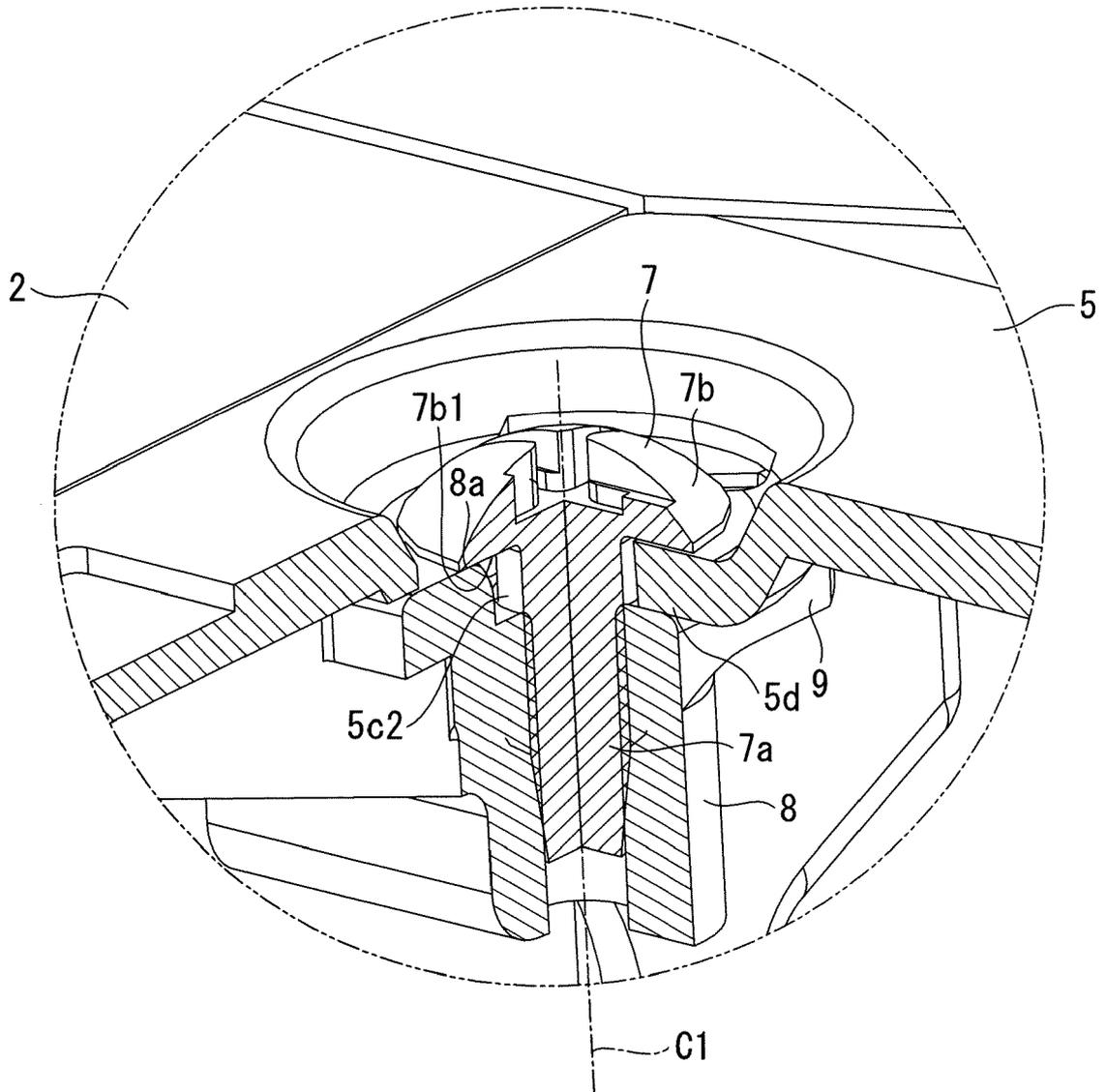


FIG. 5

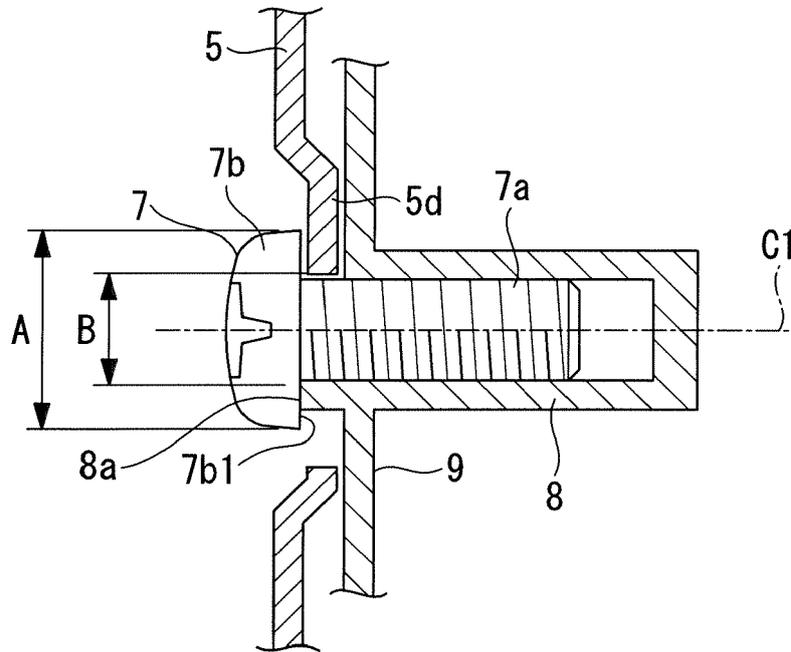
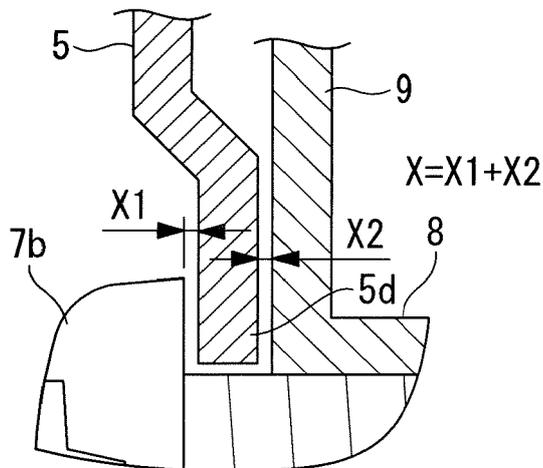


FIG. 6







EUROPEAN SEARCH REPORT

Application Number  
EP 18 21 4886

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		6 May 2019	Djemour, Anna
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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