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(71) Applicant: **MITSUBISHI DENKI KABUSHIKI KAISHA**
2-3, Marunouchi 2-chome Chiyoda-ku
Tokyo 100(JP)

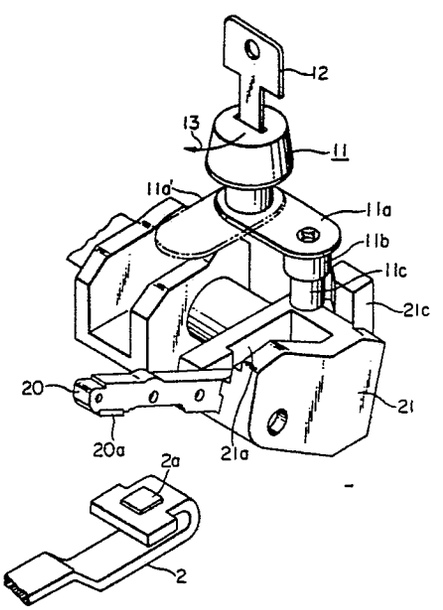
(72) Inventor: **Okuda, Kiyotaka c/o Fukuyama Seisakusho**
Mitsubishi Denki Kabushiki Kaisha 1-8 Midori-machi
Fukuyama City Hiroshima Prefecture(JP)
Inventor: **Mishima, Masayoshi c/o Fukuyama Seisakusho**
Mitsubishi Denki Kabushiki Kaisha 1-8 Midori-machi
Fukuyama City Hiroshima Prefecture(JP)

(74) Representative: **Lawson, David Glynne et al**
MARKS & CLERK 57-60 Lincoln's Inn Fields
London WC2A 3LS(GB)

(54) Circuit breaker equipped with a lock.

(57) A circuit breaker equipped with a key-operated lock 11 has a movable element 20 on which is secured a moving contact 20a. The movable element 20 is directly pivoted on a crossbar 21 by a pin 22. The crossbar 21 is made of a molded thermosetting resin and has an engaging portion 21c in the form of a protruding arm integrally formed thereon. The engaging portion 21c engages with a movable portion 11c of a lock 11. The engagement between the engaging portion 21c of the crossbar 21 and the movable portion 11c of the lock prevents the movement of the crossbar 21 and locks the circuit breaker.

FIG. 4



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CIRCUIT BREAKER EQUIPPED WITH A LOCK

BACKGROUND OF THE INVENTION

This invention relates to a circuit breaker which is equipped with a lock for locking the circuit breaker in an open or closed state.

A conventional circuit breaker of the type to which the present invention relates is illustrated in Figures 1 and 2 of the accompanying drawings, which are respectively a vertical cross-sectional view and a phantom perspective view of the essential portions of a circuit breaker disclosed in Japanese Laid-Open Utility Model Application No. 56-1063. As shown in Figure 1, the moving portions of the circuit breaker are contained within a housing 1 which comprises a base 1a and a cover 1b. A stator 2 having a fixed contact 2 mounted thereon is secured to the base 1a. A movable element 3 having a moving contact 3a mounted on one end thereof is supported by a contact arm 4 which is secured to a rotating crossbar 5. The movable element 3 is pivotably mounted on a pin 6 which passes through holes formed in two sides plates 4a of the contact arm 4 which are located on either side of the movable element 3. The other end of the movable element 3 is elastically supported by a spring 7 which is connected to the end of the contact arm 4. A C-shaped support member 8 is secured to the upper surface of the contact arm 4 by screws 9. The support member 8 supports an electrically-insulating rod 10 which extends perpendicularly upwards from the support member 8 and is secured thereto by a screw 9. A cylinder lock 11 for locking the circuit breaker is secured to the cover 1b of the housing 11. The lock 11 has a movable portion comprising a plate 11a which is secured to the cylinder of the lock 11 by a screw 9. The plate 11a can be rotated about the axis of the lock 11 so as to engage with the electrically-insulating rod 10 by turning a key 12 in the lock 11. For simplicity, the operating and trip mechanisms of the circuit breaker have been omitted from the drawings.

Figures 1 and 2 show the circuit breaker in an off state in which the contacts 2a and 3a are open. The plate 11a of the lock 11 is positioned in the path of movement of the electrically-insulating rod 10. Accordingly, the circuit breaker is prevented from operating and is locked in the off state. If the key 12 is rotated 90 degrees in the lock 11 in the direction shown by the arrow 13 in Figure 2, the plate 11a will pivot to the position shown by the dashed lines 11a' in the figures, out of the path of movement of the electrically-insulating rod 10. In this state, the crossbar 5 is free to pivot, the rod 10 can swing to the position shown by the dashed lines 10', and the circuit breaker can perform its normal switching operation.

In this type of conventional circuit breaker, the support member 8, the electrically-insulating rod 10, and the contact arm 4 are secured to one another by screws 9. Therefore, during manufacture, it is necessary to cut screw holes in these parts and to install the corresponding screws, processes which are troublesome and increase manufacturing costs.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a circuit breaker equipped with a lock which requires fewer parts than a conventional circuit breaker.

It is another object of the present invention to provide a circuit breaker equipped with a lock which can be more easily and cheaply manufactured than a conventional circuit breaker.

In a circuit breaker according to the present invention, a movable element on which a moving contact is secured is directly pivoted on a crossbar, making a contact arm unnecessary. The crossbar has an engaging portion in the form of a protruding arm which is integrally formed thereon. A lock for locking the circuit breaker has a movable portion which can engage with the engaging portion of the crossbar. In a preferred embodiment, the crossbar is molded from a thermosetting resin, and the portion of the movable portion of the lock which engages with the engaging portion of the crossbar is an electrically-insulating rod.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a vertical cross-sectional view of the main portions of a conventional circuit breaker equipped with a lock.

Figure 2 is a phantom perspective view of the main portions of the conventional circuit breaker of Figure 1.

Figure 3 is a vertical cross-sectional view of the essential features of an embodiment of a circuit breaker according to the present invention.

Figure 4 is a phantom perspective view of the essential features of the embodiment of Figure 3.

Figure 5 is an exploded perspective view of the crossbar and movable element of the embodiment of Figure 3.

In the drawings, the same reference numerals indicate the same or corresponding parts.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinbelow, a preferred embodiment of the present invention will be described while referring to Figures 3 through 5 of the accompanying drawings. Like the conventional circuit breaker of Figure 1, this circuit breaker is contained inside a housing 1 comprising a base 1a and a cover 1b. As shown in Figure 4, a stator 2 having a fixed contact 2a mounted thereon is secured to the base 1a. A movable element 20 having a moving contact 20a mounted on the end thereof is pivotably supported by a rotating crossbar 21. The crossbar 21 can be rotated between the open position shown in the drawings in which the contacts 2a and 20a are open, and a closed position in which the contacts are closed. The crossbar 21 is molded from a thermosetting resin and has three square holes 21a formed therein in each of which a movable element 20 can be mounted, although for simplicity, only a single movable element 20 is shown in the drawings. The illustrated crossbar 21 is able to support three movable elements 20, but there is no restriction on the number of holes 21a or movable elements 20. Each of the movable elements 20 is pivotably mounted on a pin 22 which fits into a pair of grooves 21b formed in the inner walls of one of the square holes 21a. A biasing torque is exerted on the movable elements 20 by biasing springs 23 which are mounted on the pins 22 and engage with notches 20b formed in the rear ends of the movable elements 20. The biasing springs 23 force the movable elements 20 to pivot about the pins 22 until they contact the bottom surfaces of the square holes 21a. The movable elements 20 are mounted on the crossbar 21 by being inserted into the square holes 21a from the back side, as shown in Figure 5. The crossbar 21 has a protruding arm 21c which is integrally formed on its upper portion. This arm 21c serves as an engaging member.

A cylinder lock 11 is mounted on the cover 1b of the housing 1. It has a movable portion comprising a horizontal plate 11a which is secured to the cylinder of the lock 11 by a screw 9, a cylindrical portion 11b which is secured to the underside of the plate 11a at is outer end by another screw 9, and an electrically-insulating rod 11c which is secured to the underside of the cylindrical portion 11b by the same screw 9 which connects the plate 11a and the cylindrical portion 11b. The entire movable portion can be pivoted 90 degrees about the axis of the lock 11 between a locked position, shown by the solid lines in Figure 4, and an unlocked position, shown by the dashed lines 11a' in Figure 4, when a key 12 is turned in the lock 11. When the movable portion is in the locked position, the electrically-insulating rod 11c engages with the engaging portion, i.e., the protruding arm 21c of the crossbar 21 and prevents the movement of the arm 21c. For better engagement between the rod 11c and the protruding arm 21c, a recess 11d having a flat surface which confronts the front surface of the protruding arm 21c is formed in the bottom end of the rod 11c. Since both the rod 11c and the protruding arm 21c are made of electrically-insulating materials, extremely high reliability is obtained. The position of the cylindrical portion 11b and the rod 11c along the plate 11a of the movable portion can be freely adjusted so as to minimize play between the rod 11c and the protruding arm 21c of the crossbar 21.

For simplicity, the operating and trip mechanisms of the circuit breaker have been omitted from the drawings, but the same type can be used as in a conventional circuit breaker.

In the state shown in Figure 3, the movable portion of the lock 11 is in a position such that the rod 11c engages with the protruding arm 21c of the crossbar 21, thus preventing the crossbar 21 from rotating. As the moving contact 20a can be made to contact the fixed contact 2a only by the rotation of the crossbar 21, the lock 11 effectively locks the circuit breaker in the off state. If a key 12 is turned in the lock 11 in the direction of the arrow 13 in Figure 4, the movable portion will rotate by 90 degrees until the plate 11a reaches the position shown by the dashed lines 11a'. In this position, the rod 11c is out of the path of movement of the protruding arm 21c and no longer prevents the crossbar 21c from rotating, and the circuit breaker is free to perform normal switching movement.

In the illustrated embodiment, the lock 11 is positioned so as to lock the circuit breaker in an off state in which the contacts 2a and 20a are open. However, by merely altering the location of the lock 11, it can be made to lock the circuit breaker in the on state with the contacts 2a and 3a closed.

In accordance with the present invention, a movable element 20 is directly pivoted on a crossbar 21 so that a contact arm 4 for supporting the movable element 20 is unnecessary. Furthermore, as a protruding arm 21c which engages with the movable portion of a lock is an integral portion of a molded crossbar 21, a separate support member 8 and connecting screws 9 therefor are unnecessary, resulting in a decrease in the number of parts.

Also, as it is not necessary to form screw holes in a contact arm 4 or a support member 8, the ease of manufacture is increased and manufacturing costs can be decreased.

In addition, as a circuit breaker according to the present invention uses the same operating mechanism, trip mechanism, and cylinder lock as a convention circuit breaker, it is simple to retrofit an existing circuit breaker to obtain one according to the present invention.

Claims

1. A circuit breaker equipped with a lock comprising:
a fixed contact
a movable element having a moving contact secured thereto;
a crossbar which has an engaging portion formed thereon, said movable element being pivotably supported by said crossbar, said crossbar being rotatable between an open position in which said moving contact is separated from said fixed contact and a closed position in which said moving contact is in contact with said fixed contact; and
a lock which can be operated from the outside of said circuit breaker and which has a movable portion which can rotate between a locked position in which it engages with said engaging portion of said crossbar and prevents the rotation of said crossbar, and an unlocked position in which it is out of the path of movement of said engaging portion.

2. A circuit breaker as claimed in Claim 1, wherein:
the portion of said movable portion of said lock which engages with said engaging portion is an electrically-insulating rod.

3. A circuit breaker as claimed in Claim 1, wherein:
said crossbar is a molded item, and said engaging portion is a protruding arm which is integrally formed on said crossbar.

4. A circuit breaker as claimed in Claim 3, wherein said crossbar is made of a thermosetting resin.

5. A circuit breaker as claimed in Claim 1, wherein said lock is a cylinder lock.

FIG. 1

PRIOR ART

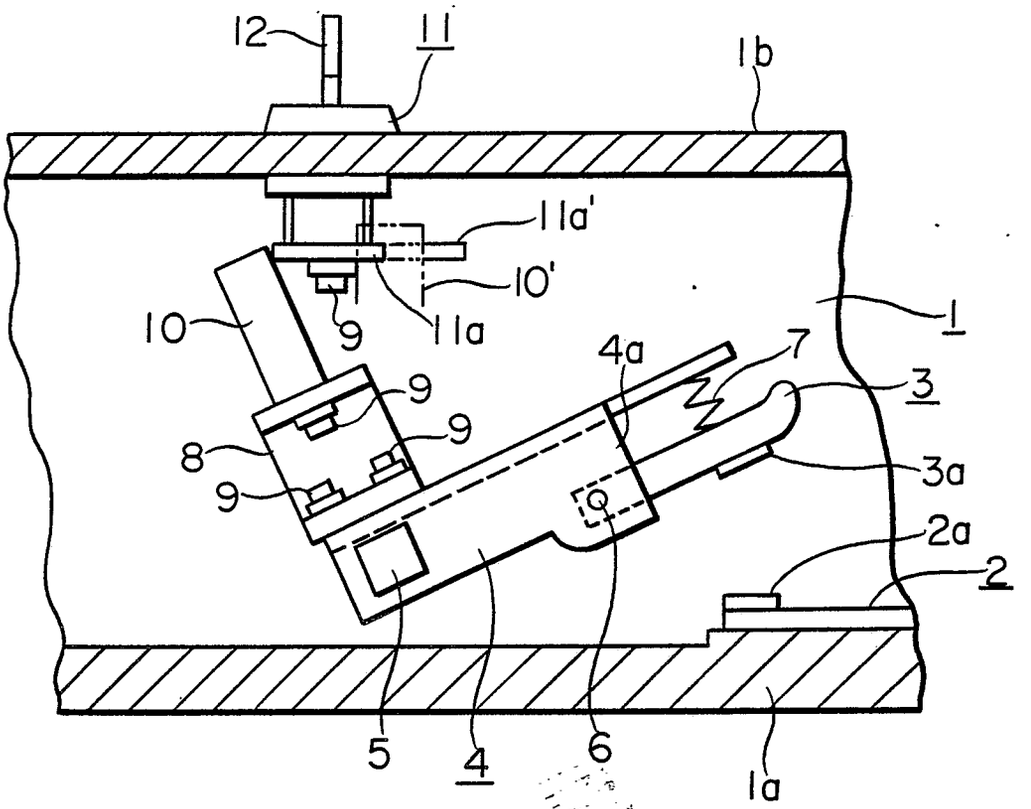

FIG. 2
PRIOR ART

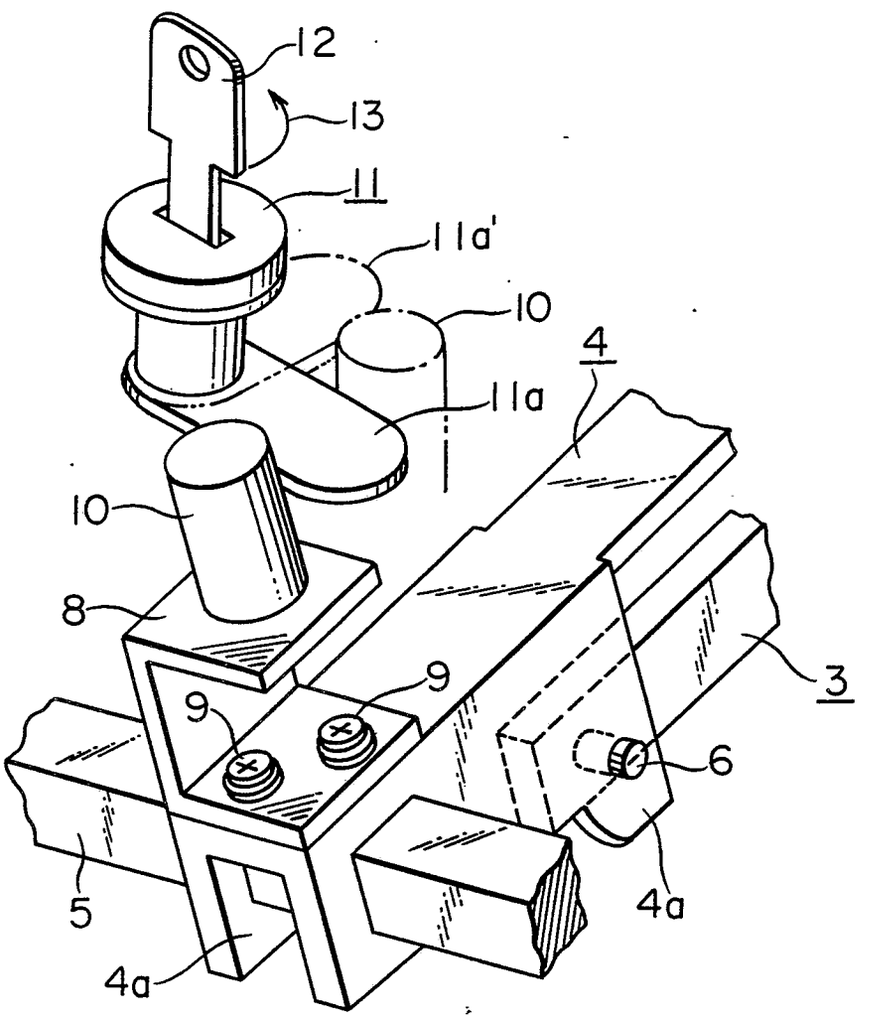

FIG. 3

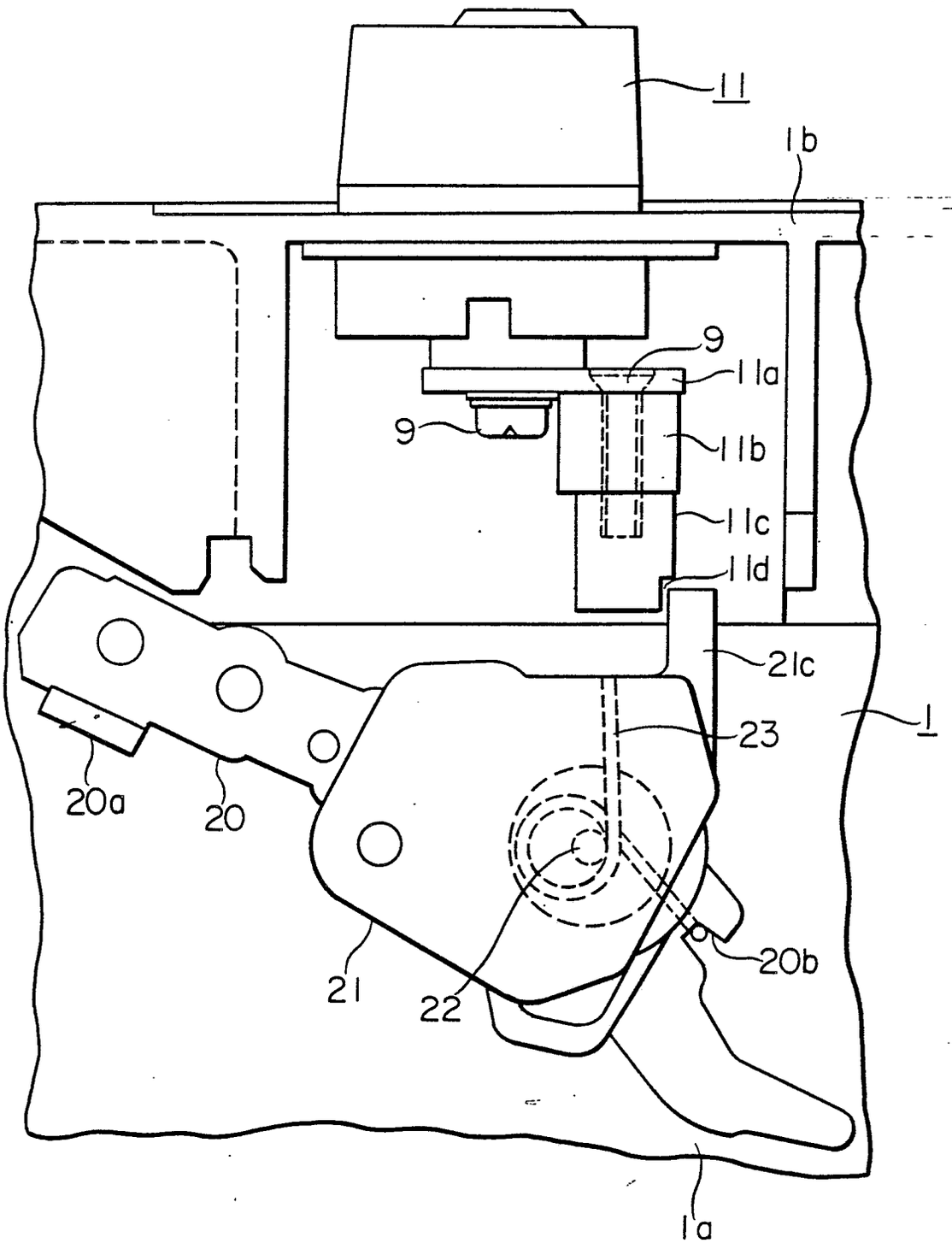

FIG. 4

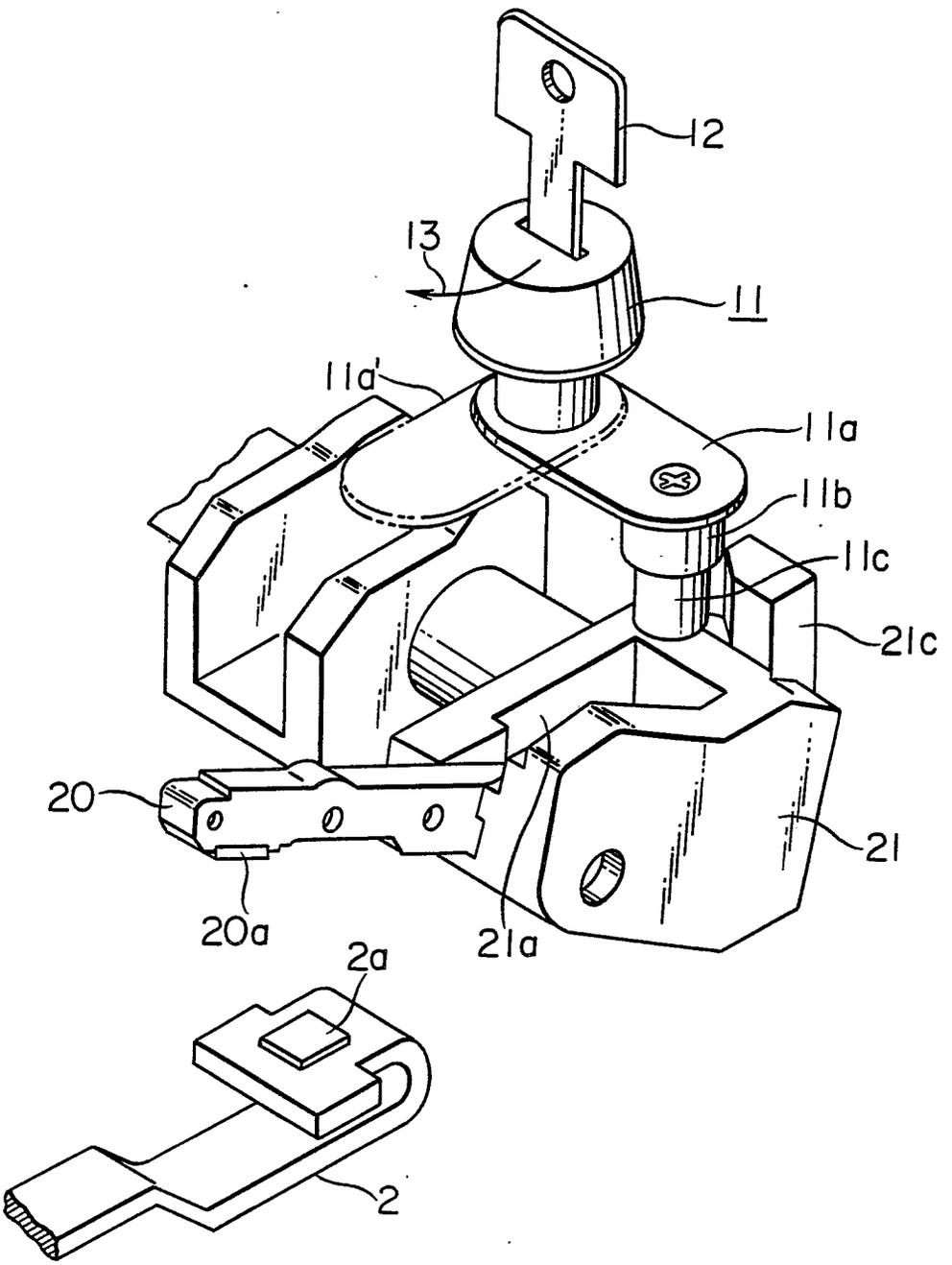

FIG. 5