



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) Publication number:

**0 314 925 B1**

(12)

## EUROPEAN PATENT SPECIFICATION

(49) Date of publication of patent specification: **27.07.94** (51) Int. Cl.<sup>5</sup>: **H01H 13/36, H01H 5/18**

(21) Application number: **88116375.2**

(22) Date of filing: **04.10.88**

(54) **Microswitch.**

(30) Priority: **08.10.87 JP 154541/87 U**

(43) Date of publication of application:  
**10.05.89 Bulletin 89/19**

(45) Publication of the grant of the patent:  
**27.07.94 Bulletin 94/30**

(84) Designated Contracting States:  
**AT BE CH DE ES FR GB GR IT LI LU NL SE**

(56) References cited:  
**EP-A- 0 118 870**  
**EP-A- 0 219 564**  
**EP-A- 0 224 402**  
**FR-A- 1 529 781**  
**FR-A- 2 530 862**

(73) Proprietor: **OMRON CORPORATION**  
**10, Tsuchido-cho**  
**Hanazono**  
**Ukyo-ku**  
**Kyoto 616(JP)**

(72) Inventor: **Nagahara, Toyohiro Izumo Omron**  
**Tateisi**  
**Electronics Co., 626-1, Nishibayashigi-cho**  
**Izumo-shi Shimane-ken(JP)**  
Inventor: **Niwa, Takashi c/o Patent Center**

**Omron Tateisi Electronics Co.**  
**20, Igadera**  
**Shimokaiinji Nagaokakyo-shi Kyoto 617(JP)**  
Inventor: **Sano, Takezo c/o Patent Center**  
**Omron Tateisi Electronics Co.**  
**20, Igadera**  
**Shimokaiinji Nagaokakyo-shi Kyoto 617(JP)**  
Inventor: **Kato, Isao c/o Patent Center**  
**Omron Tateisi Electronics Co.**  
**20, Igadera**  
**Shimokaiinji Nagaokakyo-shi Kyoto 617(JP)**

(74) Representative: **Kahler, Kurt, Dipl.-Ing. Paten-**  
**tanwälte Kahler, Käck & Fiener**  
**Maximilianstrasse 57**  
**Postfach 12 49**  
**D-87712 Mindelheim (DE)**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

**EP 0 314 925 B1**

## Description

The present invention relates to a microswitch assembling method and a microswitch obtainable thereby.

A typical microswitch is shown in Fig. 1 as one of conventional general microswitches. A switch casing 102 is constructed by a cover 101 and a switch casing main body 103. A pair of a terminal member 104 for normally closed contact and a terminal member 105 for normally open contact and a common terminal member 106 are fixed to the main body 103. Fixed contacts 107 and 108 are fixed to inner end portions 104a and 105a of the fixed terminal members 104 and 105, respectively. A movable contact member 110 is pivotally supported to the inner end portion 106a of the common terminal member 106 at the base end thereof. The movable contact member 110 has a movable contact 109 at the front end thereof, the movable contact 109 being come into contact with or removed from the fixed contacts 107 and 108, respectively. A compression leaf spring 111 is attached between the front end side of the movable contact member 110 and the inner end portion 106a of the common terminal member 106. A push button 112 is inserted into a hole 102a formed in the top plate of the switch casing 102. By depressing the push button 112, the movable contact member 110 is moved, thereby switching the contacting state of the movable contact 109 from the normally closed type fixed contact 107 to the normally open type fixed contact 108 by the snap action.

However, in such a microswitch, since the movable contact member 110 is directly operated by the push button 112, a degree of whole motion (a travelling amount of the push button 112 from its free position to the operating limit position) is small and its operating stroke amount is also limited to up to about 1 mm.

To solve this problem, means for assuring a large operating stroke is shown in Fig. 2. That is, the push button 112 is operated by an operating lever 113 which is pivotally attached to the switch casing 102. Fig. 3 shows another means for realizing a large operating stroke, in which a sub-button 115 which is pressed downwardly through a spring member 114 is inserted in the push button 112 and the movable contact member 110 is operated by the sub-button 115. However, the former means has a drawback such that a large space is needed for the operating lever 113. The latter means has a drawback such that the number of parts increases.

On the other hand, in any of the foregoing conventional microswitches, their operating characteristics are as shown in Fig. 4 and a load near the operating limit position suddenly increases, so

that the good operating feeling cannot be obtained.

Furthermore, FR-A- 2 530 862 discloses a microswitch, comprising an isolating frame on which stationary contacts are fixed. A pivotally supported movable contact for selectively contacting the stationary contacts is in connection with a vertically movable push button and a commuting mechanism. The latter comprises an entrainment lever, an intermediate lever, a leaf spring and a contact lever. The one end region of the entrainment lever is fixed to the isolating frame. The other end region of the entrainment lever is connected to the intermediate lever. The free end of the contact lever carries the movable contact. The end of the intermediate lever and the end of the leaf spring are connected to each other. The contact lever is connected to projections of the isolating frame and to the end of the leaf spring. However, such a construction is complicated and assembling work cannot be easily performed.

## SUMMARY OF THE INVENTION

The present invention is made to solve the inconveniences in the foregoing conventional microswitches and it is an object of the present invention to provide a method by which a microswitch can be easily automatically assembled and a microswitch which needs a small number of component parts.

This object is solved by the microswitch assembling method of claim 1.

According to the present invention, the swingable lever is operated by the push button and the movable member is operated through the compression spring interposed between the swingable lever and the movable member. Therefore, although the microswitch is small, the operating stroke can be enhanced by the swingable lever. The number of parts is smaller than that of the conventional microswitch in which the operating stroke is increased by a spring member assembled in a push button. Further, the fulcrum of the compression spring is moved like an arc around a pivotal supporting portion of the swingable lever as a rotational center. Therefore, a sudden increase in load at a position near the operation limit position is suppressed, a good operating feeling is derived, particularly a large operating stroke is derived, and the assembling efficiency is high. Further, the swingable lever applied with the spring force of the compression spring is deformed to the settable position of the push button by the swingable lever positioning projection, so that this microswitch can be easily assembled.

Particular embodiments of a microswitch obtainable by the method of claim 1 are set out in claims 2 to 5.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in detail below with reference to the drawings, in which:

Fig. 1 is a front view with a part cut away showing a conventional microswitch;

Figs. 2 and 3 are front views with parts cut away showing conventional microswitches having different operating stroke enhancing means;

Fig. 4 is a characteristic graph showing the relation between the operating distance and the operating force in a conventional microswitch;

Fig. 5 is an exploded perspective view showing an example of a microswitch according to the present invention;

Figs. 6a and 6b are front cross sectional views showing the microswitch in the OFF and ON states, respectively;

Figs. 7a to 7f are diagrams for explaining an assembling procedure of the microswitch;

Fig. 8 is a characteristic diagram showing the relation between the operating distance and the operating force in the microswitch; and

Fig. 9 is a front cross sectional view showing a modification of the microswitch in a state before a cover is attached.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the present invention will be described hereinbelow with reference to the drawings.

Fig. 5 is an exploded perspective view showing an example of a microswitch according to the invention. Figs. 6a and 6b are front cross sectional views showing the microswitch in the OFF and ON states, respectively.

In the diagrams, a switch casing 10 consists of a terminal base 11 and a cover 12. The terminal base 11 is made of a plate-like synthetic resin having an electrical insulating property and constructs a lower plate of the switch casing 10. Vertically projecting portions 11a and 11b are formed on both of the left and right end portions of the terminal base 11. The cover 12 is assembled onto the terminal base 11. A pair of notched portions 12a and 12b adapted to be come into engagement with the vertically projecting portions 11a and 11b are formed at both of the left and right end portions of the cover 12 made of a synthetic resin, respectively.

A common terminal member 13, a terminal member 14 for normally closed type contact, and a terminal member 15 for normally open type contact are fixed to the terminal base 11. Inner end portions 14a and 15a of the terminal members 14 and 15 are bent from lower and upper directions on

the right end side in the terminal base 11 so as to face each other. Fixed contacts 16 and 17 are fixed to the opposite surfaces of the inner end portions 14a and 15a, respectively. A movable member 18 is arranged in the lateral (right/left) direction. The movable member 18 is made of a conductive material and has a almost rectangular shape having a large opening in the central position. A movable contact 19 which faces both of the fixed contacts 16 and 17 is fixed to a free end portion 18a. A base end portion 18b is fitted into a first pivotal groove 20 formed on the left end surface of an inner end portions 13a of the common terminal member 13. The base end portion 18b is rotatably pivotally supported by this groove 20.

A rectangular hole 21 is formed in a top plate 12c of the cover 12. A push button 22 made of a synthetic resin is inserted into the hole 21 and can be vertically moved between the inner end portion 13a of the common terminal member 13 and the inner end portions 14a and 15a of the terminal members 14 and 15.

A swingable lever 23 is formed into a substantially S shape. An edge portion 24 formed on the side of a base end portion 23a of the swingable lever 23 is fitted into and rotatably pivotally supported to a second pivotal groove 25 formed on the right side surface of the inner end portion 13a of the common terminal member 13. A free end portion 23b of the lever 23 is pushed by the lower surface of the push button 22.

A compression spring 26 is made of a leaf spring and formed into an almost arc shape. A left end portion 26a of the spring 26 is fitted into a lateral groove 27 formed in the central portion of the swingable lever 23. Notched portions 28 formed in a right end portion 26b are come into engagement with engaging projections 29 formed on the free end side of the movable member 18, thereby applying a return spring force to the movable member 18.

A pair of restricting plates 30 and 31, which face each other, are formed in the lower end portions of the push button 22, thereby restricting the position of the movable member 18 in the width direction. Projecting portions 32 and 33 to vertically guide the restricting plates 30 and 31 are formed on the front and rear inner walls of the cover 12 respectively.

Engaging projections 34 are formed on both of the front and rear walls of the terminal base 11. Engaging holes 35 are formed in both of the front and rear walls of the cover 12 and are brought into engagement with the engaging projections 34 when the cover 12 is assembled onto the terminal base 11.

A swingable lever positioning projection 36 is formed by an elongated portion of the inner end of

the common terminal member 13 and is bent toward the side of the swingable lever 23. The free end portion 23b of the swingable lever 23 to which the left end portion 26a of the compression spring 26 is pivotally attached is brought to the settable position of the push button 22 by the positioning projection 36 as will be described later. A concave portion 37 to bend the projection is formed in the inner end portion 13a of the common terminal member 13.

An assembling procedure of the microswitch will now be described with reference to Figs. 7a to 7f.

First, the base end portion 18b of the movable member 18 is fitted into the first pivotal groove 20 in the common terminal member 13 as shown in Fig. 7a. Then, the swingable lever 23 is set to an almost vertical position and the edge portion 24 is pivotally fitted into the second pivotal groove 25 as shown in Fig. 7b. Further, as shown in Fig. 7c, the notched portions 28 on the right end side of the compression spring 26 are movably attached to the engaging projections 29 on the free end portion of the movable member 18. The left end portion 26a of the compression spring 26 is downwardly moved along the right side surface of the swingable lever 23 and is movably fitted into the lateral groove 27 of the swingable lever 23 as shown in Fig. 7d. After that, in the concave portion 37, the positioning projection 36 formed in the inner end portion 13a of the common terminal member 13 is bent to the right as shown in Fig. 7e. The swingable lever 23 is inclined to the right by the projection 36, thereby positioning so that the free end portion 23b of the lever 23 is brought to the settable position of the push button 22. Finally, as shown in Fig. 7f, by assembling the cover 12 having the push button 22 onto the terminal base 11, the push button 22 is set to the settable position of the swingable lever 23.

The operation of the above structure will now be described.

When the push button 22 is depressed from the position of Fig. 6a, the swingable lever 23 rotates clockwise around the pivotal supporting portion 24 (25) on the base end side as a rotational center. Therefore, the pivotal supporting portion 26a (27) on the left end side of the compression spring 26 is compressed while being deformed downwardly by the arc-like motion around the pivotal supporting portion 24 (25) as a rotational center. Further, by depressing the push button 22, when the left end portion 26a (27) of the compression spring 26 exceeds a change point corresponding to the height level position of the pivotal supporting portion 18b (20) on the base end side of the movable member 18 and is deformed downwardly, the spring force of the compression spring

26 is released. Thus, the free end portion 18a of the movable member 18 rotates counterclockwise around the pivotal supporting portion 18b (20) as a rotational center by the snap action. Consequently, as shown in Fig. 6b, the movable contact 19 is away from the normally closed type fixed contact 16 and is come into contact with the normally open type fixed contact 17, thereby electrically connecting the terminal member 15 and the common terminal member 13.

When the pushing operation of the push button 22 is released from the state of Fig. 6b, the swingable lever 23 rotates counterclockwise and the movable contact 19 is returned to the original state of Fig. 6a by the operations opposite to the above, thereby electrically connecting the terminal member 14 for normally closed type contact 16 and the common terminal member 13.

Since the operating force of the push button 22 is propagated to the movable member 18 through the swingable lever 23 and compression spring 26, the operating stroke can be enhanced by the swingable lever 23 and a long stroke of about 3 mm can be obtained. Moreover, the necessary space can be reduced as compared with the conventional structure (in the example shown in Fig. 2) in which the operating stroke is enhanced by the operating lever provided in the outside of the switch casing. On the other hand, the number of parts can be reduced as compared with the conventional structure (in the example shown in Fig. 3) in which the operating stroke is enhanced by the spring member arranged in the push button.

Further, since the pivotal supporting portion 26a (27) with the swingable lever 23 of the compression spring 26 is moved like an arc around the pivotal supporting portion 24 (25) of the lever 23 as a rotational center, an operating characteristic as shown in Fig. 8 is derived. That is, the ratio of the change in operating force to the operating distance at a position near the operation limit position decreases and the good operating feeling can be obtained.

According to the embodiment, the inner end elongated portion of the common terminal member 13 is bent to thereby form the projection 36. Therefore, the swingable lever 23 is brought to the push button settable position, so that the push button 22 faces the free end portion 23b of the swingable lever 23 by assembling the cover 12 onto the terminal base 11. In other words, the automatic assembling works can be easily performed and the productivity can be improved.

In the embodiment, the swingable lever positioning projection 36 has been constructed by the bent portion 37 of the inner end portion of the common terminal member 13. However, the projection 36 can be also formed by a boss portion 61

formed on the inner wall of the terminal base 11 as shown in Fig. 9.

On the other hand, the positions of the movable member 18 and the like are restricted in the width direction by the restricting plates 30 and 31 formed under the push button 22. Also, the restricting plates 30 and 31 are guided by the projecting portions plates 32 and 33 formed on the side of the switch casing 10. Therefore, the movable member 18 and the like are properly held without shaking.

Although the foregoing example has been described with respect to the structure having a pair of terminal members 14 and 15, the invention can be also applied to a structure having one fixed terminal member.

## Claims

### 1. A method of assembling a microswitch comprising the steps:

- fitting a base end portion (18b) of a movable member (18) into a first groove (20) formed in a common terminal member (13);
- setting a swingable lever (23) into an almost vertical position with an edge portion (24) thereof pivotally fitted into a second pivotal groove (25);
- movably attaching notched portions (28) formed on one side of a leaf-type compression spring (26) to engaging projections (29) at a free end of said movable member (18);
- moving an opposite end portion (26a) of said compression spring (26) downwardly along a front surface of said swingable lever (23) up to a central portion of said swingable lever (23);
- providing a positioning projection (36;61) for said swingable lever (23) such that a free end portion (23b) thereof is maintained projecting into an actuating path of a push button (22); and
- placing a housing onto the above structure having said push button (22) guided therein for acting on said free end portion (23b) of said swingable lever (23).

### 2. A microswitch obtainable by the method of claim 1, wherein

said positioning projection (36) is formed by a bent member on the inner end side of said common terminal member (13).

### 3. A microswitch obtainable by the method of claim 1, wherein

said positioning projection is formed by a boss portion (61) formed on an inner wall of

said terminal base (11), and adapted for engagement with that end of said swingable lever (23) pivotally supported by said inner end portion of said first common terminal member (13).

### 4. A microswitch according to claim 2 or 3, wherein

said opposite end of said compression spring (26) is engaged in a lateral groove (27) in said central portion of said swingable lever (23).

### 5. A microswitch according to claim 2,3 or 4, further comprising:

a pair of front and rear restricting members (30, 31), formed vertically downwardly at lower ends of said push button (22), for restricting the position of said movable member (18) in a width direction; and guide portions (32, 33), formed on an inner wall of said switch casing (10), for guiding the vertical motions of said restricting members (30, 31).

## Patentansprüche

### 1. Ein Verfahren zum Zusammenbauen eines Mikroschalters, aufweisend die Schritte:

- Einsetzen eines Fußendteils (18b) eines beweglichen Elements (18) in eine in einem gemeinsamen Anschlußelement (13) ausgebildete erste Nut (20);
- Verbringen eines verschwenkbaren Hebels (23) in eine nahezu vertikale Lage, wobei ein Schneidenteil (24) von diesem verschwenkbar in eine zweite, als Angel dienende Nut (25) eingesetzt wird;
- bewegliches Befestigen eingekerbter Teile (28), die an einer Seite einer blattartigen Druckfeder (26) ausgebildet sind, an Eingriffsvorsprünge (29) an einem freien Ende des beweglichen Elements (18);
- Bewegen eines gegenüberliegenden Endteils (26a) der Druckfeder (26) längs einer Vorderfläche des verschwenkbaren Hebels (23) bis zu einem Mittelteil des verschwenkbaren Hebels (23) nach unten;
- Vorsehen eines Positioniervorsprungs (36; 61) für den verschwenkbaren Hebel (23) derart, daß man ein freies Endteil (23b) von diesem in einen Betätigungsweg einer Drucktaste (22) hineinragen läßt; und
- Aufsetzen eines Gehäuses auf den vorstehenden Aufbau, wobei die Drucktaste (22) darin zum Betätigen des freien End-

teils (23b) des verschwenkbaren Hebels (23) geführt wird.

2. Ein Mikroschalter, der durch das Verfahren des Anspruchs 1 erhalten werden kann, wobei der Positioniervorsprung (36) durch ein gebogenes Element an der inneren Endseite des gemeinsamen Anschlußelements (13) ausgebildet ist. 5
3. Ein Mikroschalter, der durch das Verfahren des Anspruchs 1 erhalten werden kann, wobei der Positioniervorsprung durch ein an einer Innenwand der Anschlußgrundplatte (11) ausgebildetes vorspringendes Teil (61) ausgebildet ist und zum Eingriff mit dem Ende des verschwenkbaren Hebels (23) angepaßt ist, der durch das innere Endteil des ersten gemeinsamen Anschlußelements (13) verschwenkbar gelagert ist. 10 15 20
4. Ein Mikroschalter nach Anspruch 2 oder 3, wobei das gegenüberliegende Ende der Druckfeder (26) mit einer Quernut (27) in dem Mittelteil des verschwenkbaren Hebels (23) in Eingriff steht. 25
5. Ein Mikroschalter nach Anspruch 2, 3 oder 4, ferner aufweisend:
  - ein vorderes und ein hinteres Beschränkungselement (30, 31), die ein Paar bilden und an den unteren Enden der Drucktaste (22) zum Beschränken der Lage des beweglichen Elements (18) in Richtung der Breite vertikal nach unten ausgebildet sind; und 30
  - Führungsteile (32, 33), die an einer Innenwand des Schaltgehäuses (10) zum Führen der vertikalen Bewegungen der Beschränkungselemente (30, 31) ausgebildet sind. 35

## Revendications

1. Procédé d'assemblage d'un microrupteur comprenant les étapes consistant à :
  - adapter une partie d'extrémité de base (18b) d'un élément mobile (18) en ajustement dans une première gorge (20) formée dans un élément de borne commun (13), 45
  - placer un levier basculant (23) en une position quasi verticale, une partie de bord (24) de celui-ci étant adaptée en ajustement dans une seconde gorge de pivotement (25) avec faculté de pivotement, 50
  - fixer de manière amovible des parties en forme d'encoche (28) formées sur un premier côté d'un ressort de compres-

sion du genre à lame (26) à des saillies d'engagement (29) ménagées dans une extrémité libre dudit élément mobile (18),

- déplacer une partie d'extrémité opposée (26a) dudit ressort de compression (26) vers le bas suivant une surface avant dudit levier basculant (23) jusqu'à une partie centrale dudit levier basculant (23),
- disposer une saillie de positionnement (36 ; 61) destinée audit levier basculant (23) de façon telle qu'une partie d'extrémité libre (23b) de celui-ci soit maintenue en saillie sur un trajet d'actionnement d'un bouton poussoir (22), et
- placer un logement sur la structure précédemment décrite dans lequel est guidé ledit bouton poussoir (22) en vue d'agir sur ladite partie d'extrémité libre (23b) dudit levier basculant (23).

2. Microrupteur pouvant être obtenu par le procédé de la revendication 1, dans lequel :
  - ladite saillie de positionnement (36) est formée par un élément recourbé sur le côté d'extrémité interne dudit élément de borne commun (13).
3. Microrupteur pouvant être obtenu par le procédé de la revendication 1, dans lequel
  - ladite saillie de positionnement est constituée d'une partie de protubérance (61) formée sur une paroi interne de ladite base de maintien de bornes (11) et est prévue pour s'engager avec l'extrémité dudit levier basculant (23) qui est supportée avec faculté de pivotement par ladite partie d'extrémité interne dudit premier élément de borne commun (13).
4. Microrupteur selon la revendication 2 ou 3, dans lequel :
  - ladite extrémité opposée dudit ressort de compression (26) est engagée dans une gorge latérale (27) formée dans ladite partie centrale dudit levier basculant (23).
5. Microrupteur selon la revendication 2, 3 ou 4, comprenant en outre :
  - une paire d'éléments de restriction avant et arrière (30, 31), formés en direction du bas dans le sens vertical aux extrémités inférieures dudit bouton poussoir (22), servant à limiter la position dudit élément mobile (18) dans le sens de la largeur, et
  - des parties de guidage (32, 33), formées sur une paroi interne dudit boîtier d'interrupteur (10), en vue de guider le déplacement vertical desdits éléments de restriction (30, 31).

Fig.1

PRIOR ART

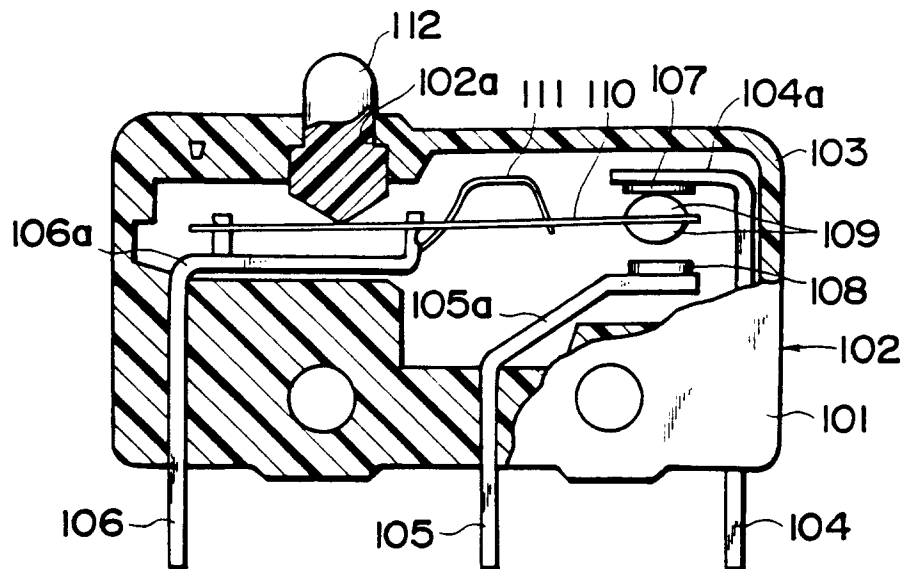


Fig.4

PRIOR ART

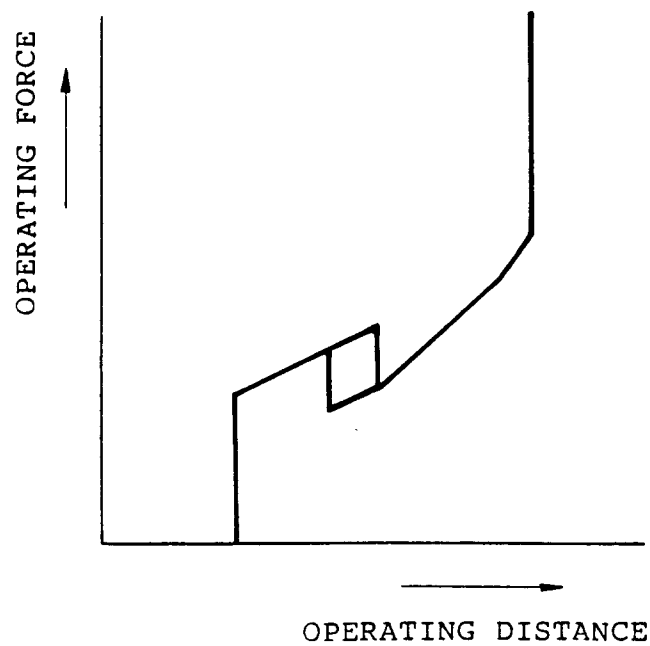


Fig.2

PRIOR ART

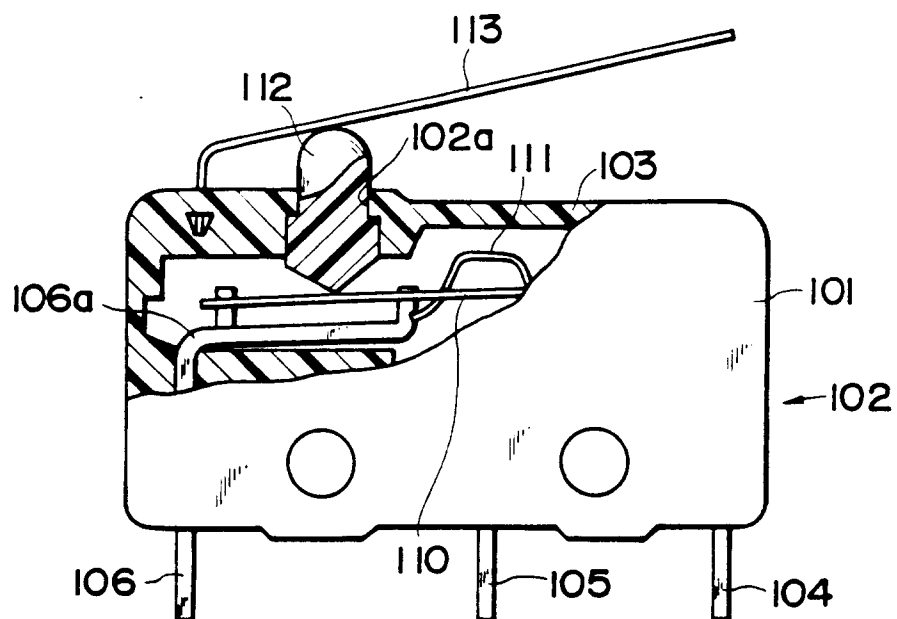
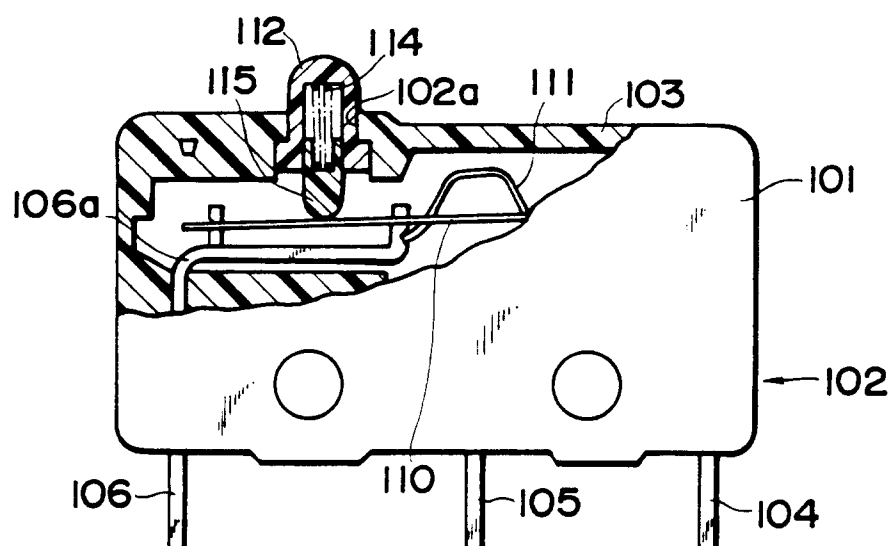


Fig.3

PRIOR ART





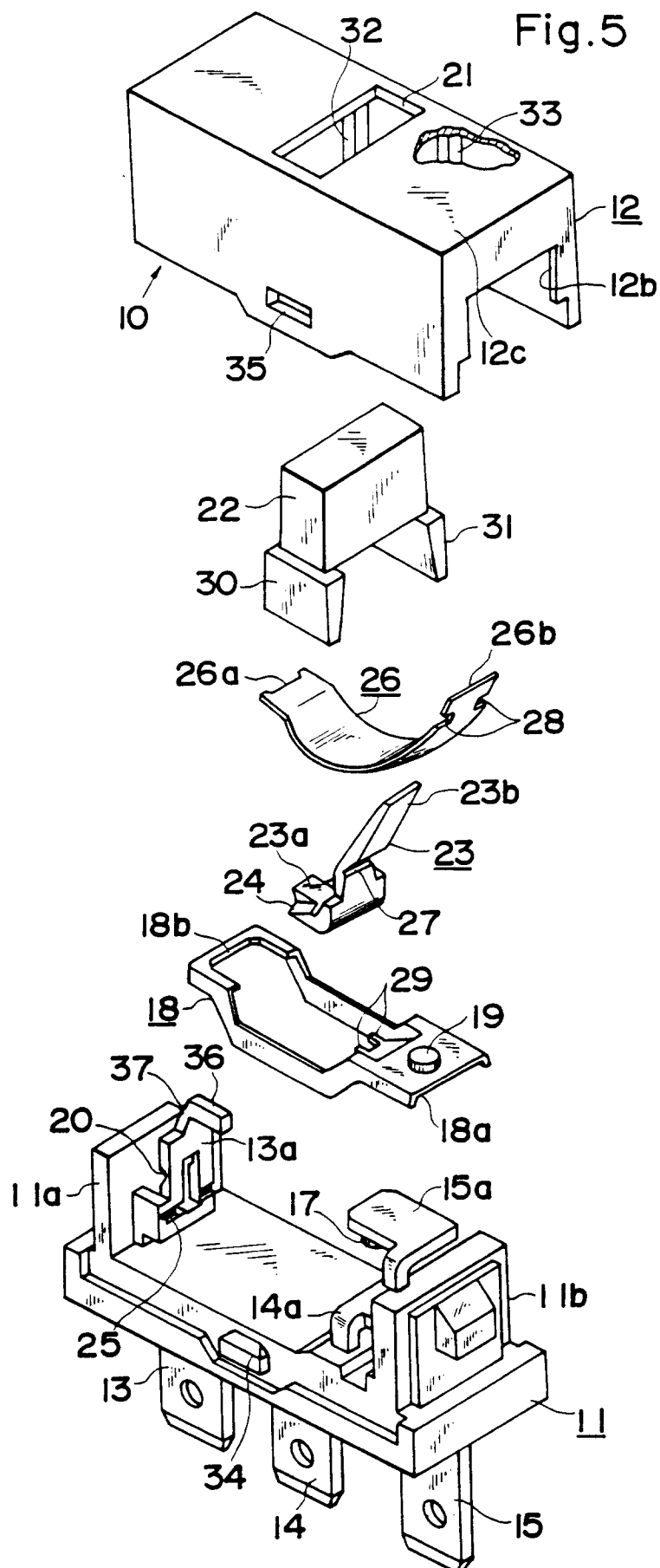


Fig.6a

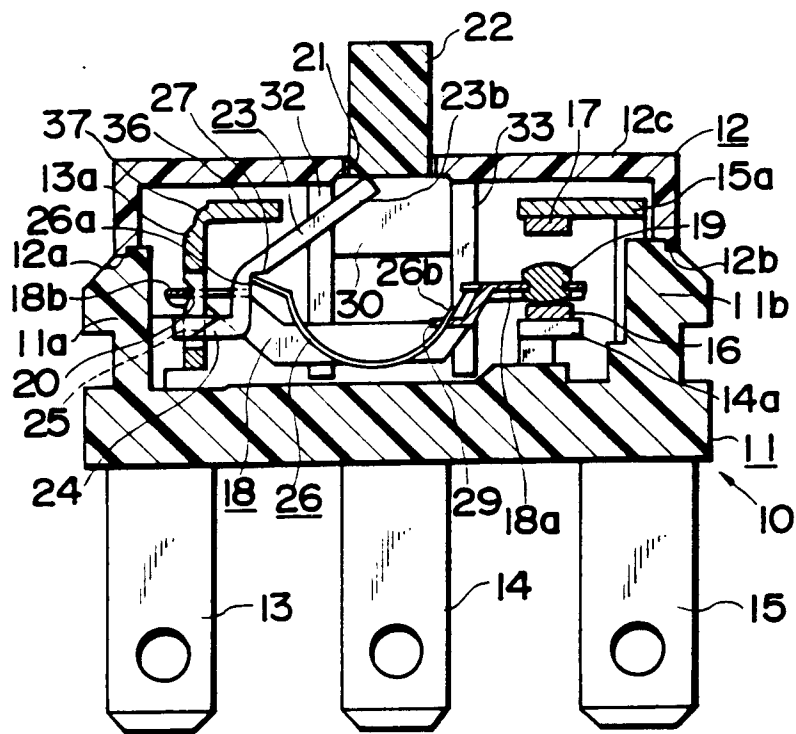


Fig.6b

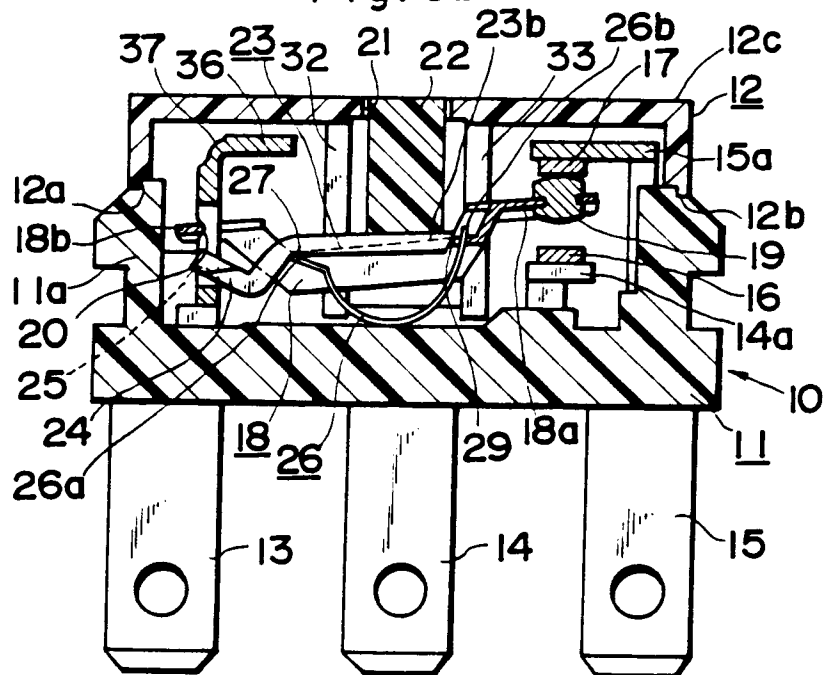


Fig.7a

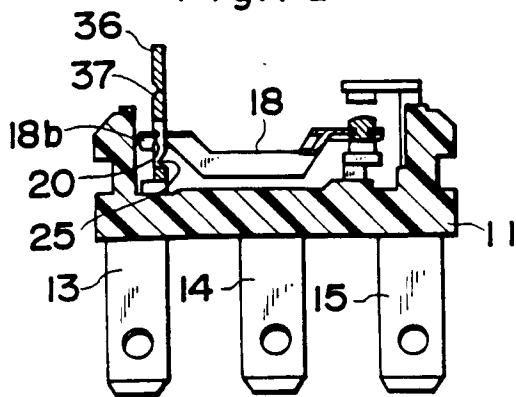


Fig.7d

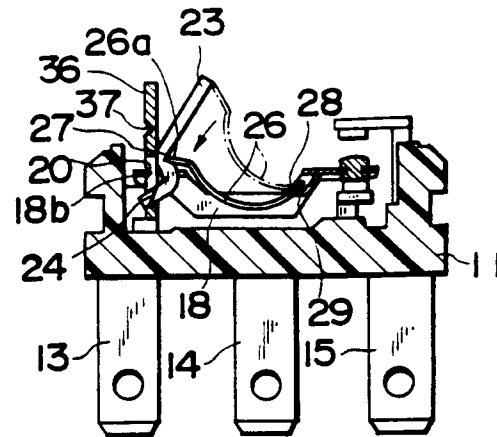


Fig.7b

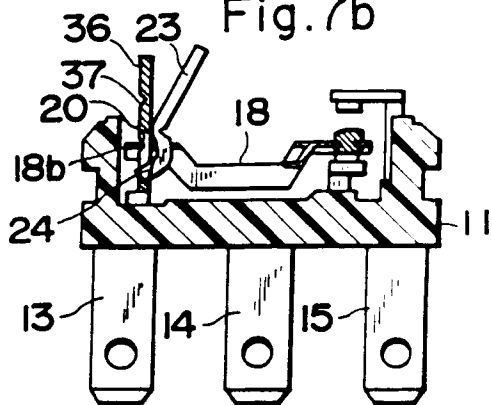


Fig.7e

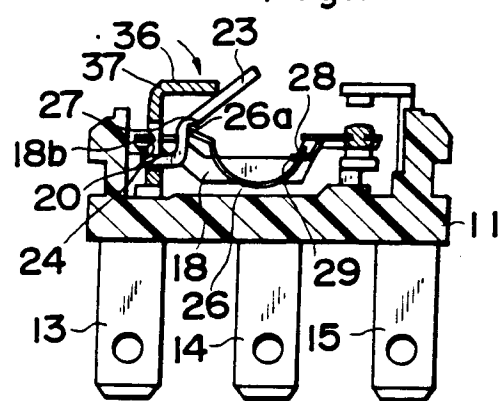


Fig.7c

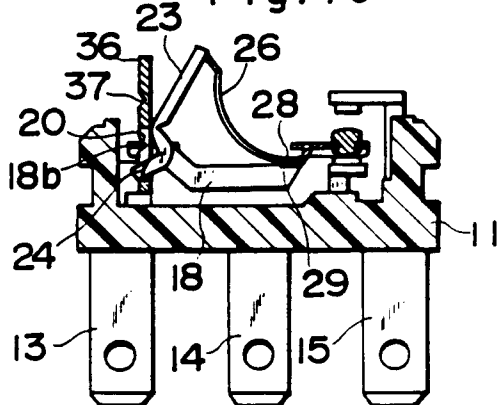


Fig.7f

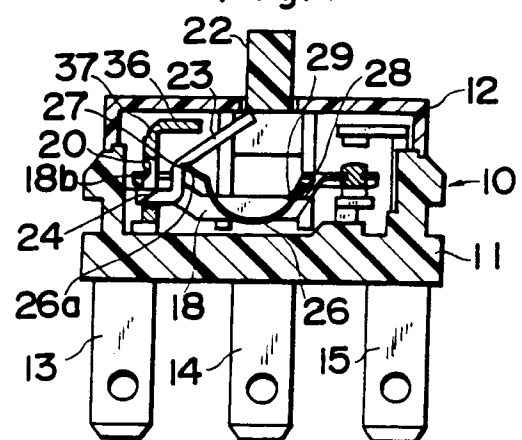


Fig.8

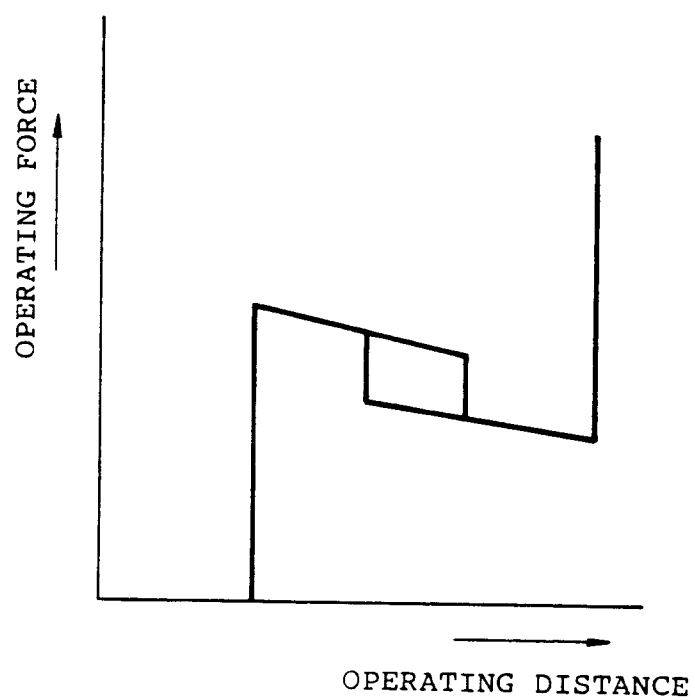


Fig.9

