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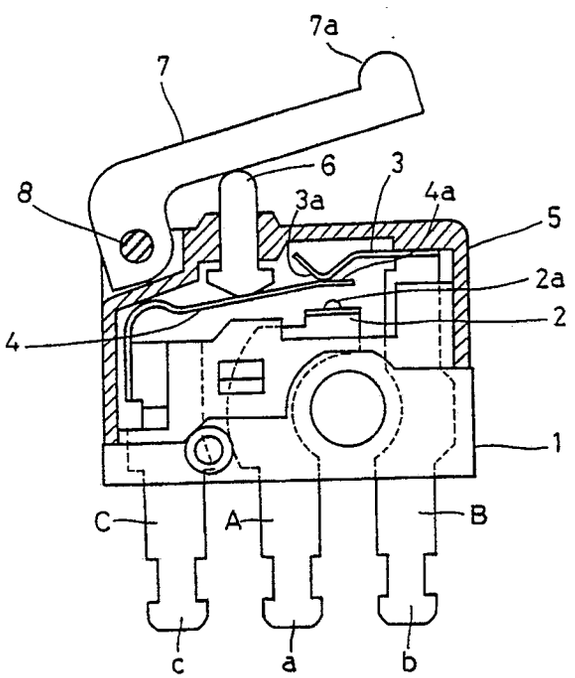
(54) Switch contact arrangement.

(57) A switch contact mechanism, comprising: a first terminal piece and a second terminal piece which are planar in shape and disposed on a common plane; a casing including a switch base made of resin material supporting the terminal pieces in spaced relationship with both ends of each of the terminal pieces exposed; a moveable contact piece cut out of an end of the first terminal piece and carrying a moveable contact at its free end; a fixed contact piece cut out of an end of the second terminal piece carrying a fixed contact opposite to the moveable contact; and an actuating member moveably supported by the casing for acting upon the moveable contact piece so as to bring the moveable contact into contact with the fixed contact. Thus, each of the terminal piece and contact piece assemblies consists of an integral member, and there is no risk of poor contact. Further, since the fixed and moveable contact pieces are cut out of end portions of the first and second terminal pieces which are disposed on a common plane, it is possible to produce them in an efficient manner with a manufacturing line which forms them out of a common strip of electroconductive plate, and to reduce the manufacturing cost.

FIG. 1



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SWITCH CONTACT MECHANISM

TECHNICAL FIELD

The present invention relates to a switch contact mechanism which may be used, for instance, in a limit switch, and in particular to such a switch contact mechanism which is reliable in operation and easy to manufacture.

BACKGROUND OF THE INVENTION

According to a certain switch contact mechanism of this type, as shown in Figure 3, fixed terminals a and b, and a common terminal c are arranged in prescribed locations of a switch base 20 with one end of each of these terminals projecting outwards, and fixed contact pieces 21 and 22 are secured to the other ends of the fixed terminals a and b, respectively, by spot welding while a moveable contact piece 23 is secured to the other end of the common terminal c by crimping a rivet 24. And, a cover 25 carrying a push-button 26 so as to be slidable along its axial direction is fitted upon the switch base 20.

According to this switch, by pressing the push-button 26 and lowering the moveable contact piece 23 against its own spring force, the contact 23a of the moveable contact piece 23 is moved out of contact with a fixed contact 22a of one of the fixed contact pieces 22, and comes into contact with a fixed contact 21a of the other fixed contact piece 21.

However, according to the switch contact mechanism of this switch, since the fixed contact piece 21 and the fixed terminal a, the fixed contact piece 22 and the fixed terminal b, and the moveable contact piece 23 and the common terminal c are connected together by crimping, spot welding or other securing means, they may generate heat when they are not properly connected together. Also, as there are a large number of component parts which are required to be fixed to each other, additional facilities are required in the manufacturing line, and the manufacturing cost tends to rise because of the difficulty to achieve a simple one-line manufacturing process.

BRIEF SUMMARY OF THE INVENTION

In view of such problems encountered in designing a switch contact mechanism, a primary object of the present invention is to provide a switch contact mechanism which eliminates the possibility of generating heat due to poor contact between mechanically joined parts, for instance between a moveable contact piece and a common terminal which are intended to be securely attached to each other, of the switch contact mechanism.

A second object of the present invention is to provide a switch contact mechanism which is reliable in operation.

A third object of the present invention is to provide a switch contact mechanism which is easy to manufacture.

These and other objects of the present invention can be accomplished by providing a switch contact mechanism, comprising: a first terminal piece and a second terminal piece which are planar in shape and disposed on a common plane; a casing including a switch base made of resin material supporting the terminal pieces in spaced relationship with both ends of each of the terminal pieces exposed; a moveable contact piece cut out of an end of the first terminal piece and carrying a moveable contact at its free end; a fixed contact piece cut out of an end of the second terminal piece and carrying a fixed contact opposite to the moveable contact at its free end; and an actuating member moveably supported by the casing for acting upon the moveable contact piece so as to bring the moveable contact into contact with the fixed contact.

According to this structure, since the moveable contact piece is cut out of an end of the first terminal piece, and the fixed contact piece is cut out of an end of the second terminal piece, each of the terminal piece and contact piece assemblies thus consists of an integral member, and there is no risk of poor contact. Further, since the fixed and moveable contact pieces are cut out of end portions of the first and second terminal pieces which are disposed on a common plane, it is possible to produce them in an efficient manner with a manufacturing line which forms them out of a common strip of electroconductive plate, and to reduce the manufacturing cost.

According to a preferred embodiment of the present invention, the first terminal piece comprises a first portion securely fixed in the switch base, a second portion bent from the first portion by approximately 90 degrees along a first folding line extending in parallel with a longitudinal line of the first terminal piece, and a third portion, projecting from the second portion and serving as the moveable contact piece, bent toward the second terminal; and the second terminal piece is provided with a first portion securely fixed in the switch base, and a second portion, serving as the fixed

contact piece, bent from the first portion by approximately 90 degrees along a second folding line extending in parallel with a major surface of the second terminal piece and perpendicular to a longitudinal line of the second terminal piece.

Such a contact mechanism can be favorably fabricated by the method comprising the steps of: cutting out a first terminal piece, a second terminal piece and a connecting piece connecting base ends of the terminal pieces together from a strip of electroconductive plate; molding a switch base around the terminal pieces so as to secure the terminal pieces therein; bending a part of the first terminal piece intermediate between the switch base and a free end of the first terminal piece along a first folding line extending in parallel with a longitudinal line of the first terminal piece by approximately 90 degrees, and then bending a free end portion of the first terminal piece toward the second terminal; bending a free end portion of the second terminal piece along a second folding line parallel with a major surface of the plate and perpendicular to a longitudinal line of the second terminal piece by approximately 90 degrees; and cutting off the connecting piece from the terminal pieces. It may further comprise the step of stamping a projection serving as a contact in a free end portion of at least one of the terminal pieces.

BRIEF DESCRIPTION OF THE DRAWINGS

Now the present invention is described in the following with reference to the appended drawings, in which:

Figure 1 is a partly broken away side view of an embodiment of the switch contact mechanism according to the present invention;

Figures 2(a) through 2(e) are manufacturing process flow diagrams showing an example of manufacturing process for the switch contact mechanism of the present invention; and

Figure 3 is a view similar to Figure 1 showing a related art switch contact mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows an example in which the switch contact mechanism of the present invention is applied to a limit switch. In this drawing, fixed terminal pieces A and B and a common terminal piece C which are planar in shape and disposed on a common plane are integrally molded with a switch base 1 made of resin material.

Numerals 2 and 3 denote fixed contact pieces which are cut out and bent from one end portions of the fixed terminal pieces A and B. Numeral 4 denotes a moveable contact piece which is cut out and bent from one end portion of the common terminal piece C, and opposes the fixed contact pieces 2 and 3 at its free end so as to selectively come into contact with either one of them. In particular, this moveable contact piece 4 is normally in contact with the fixed contact piece 3 and spaced away from the fixed contact piece 2.

Numeral 5 denotes a cover which is fitted upon the switch base 1, and carries a push-button 6 thereon so as to be slidable along its axial direction. A pivoted lever 7 pivotally supported by a mounting shaft 8 arranged at an end portion of the cover 5 can axially drive the push-button 6.

Numerals 2a and 3a denote fixed contacts, and numeral 4a denotes a moveable contact 4a. The moveable contact piece 4 may be provided with a snap action mechanism by known means.

Now the operation of the above structure is described in the following.

When a pressure is applied to the pivoted lever 7, the pivoted lever 7 is thereby pivoted around the mounting shaft 8 in clockwise direction, and the push-button 6 is depressed downwards. As a result, the moveable contact piece 4 is also pushed downwards, and the contact 4a of the moveable contact piece 4 is moved away from the contact 3a of the fixed contact piece 3 and comes into contact with the contact 2a of the fixed contact piece 2. Conversely, when the pressure is removed from the free end 7a of the pivoted lever, the contact 4a of the moveable contact piece 4 is moved away from the contact 2a of the fixed contact piece 2 under the spring force of the moveable contact piece 4 and, again, comes into contact with the contact 3a of the fixed contact piece 3.

According to the switch contact mechanism of the present embodiment, since there are no parts to be securely attached to each other between the moveable contact piece and the common terminal, and between the fixed contact pieces and the fixed terminals, and a relatively small number of component parts are required, it is possible to avoid the various troubles such as heat generation which would arise if the contact pieces and the terminals were made by securely attaching various component parts together.

The above described switch contact mechanism can be manufactured, for instance, according to the manufacturing processes indicated in Figures 2(a) through 2(e). Now, the process of manufacturing the switch contact mechanism is described in the following with reference to Figures 2-(a) through 2(e).

1 - In the first step consisting of a blanking process, planar fixed terminal pieces A and B, and a planar moveable common terminal piece

C which are disposed on a common plane are formed as shown in Figure 2(a) by carrying out a blanking process, in an intermittent manner, on a strip of electroconductive plate (not shown in the drawings) which is continuously fed in one direction. One end 12a of the fixed terminal piece A is connected, for instance, to one end 12b of the fixed terminal piece B by a connecting piece 11a, and is connected to a lead frame part 9a by a connecting piece 11b. One end 12c of the common terminal piece C is connected to the lead frame part 9a by a connecting piece 11c. The other ends 13a, 13b and 13c of these terminal pieces A through C are connected to a lead frame part 9b. The above mentioned connecting pieces 11a through 11c are removed as shown in Figure 2(b) before the work is transferred to the next step.

Engagement holes 10a and 10b formed in the lead frame parts 9a and 9b at certain interval are used for feeding the electroconductive plate in one direction by engaging them with engagement portions provided in conveyor belts (now shown in the drawings) arranged on either side.

2 - In the second step consisting of a resin molding process, the fixed terminal pieces A and B, and the common terminal piece C are integrally molded in resin base 1 with both ends of each of the terminal pieces projecting from this resin base 1. In other words, by molding the part surrounded by the imaginary line D in Figure 2(a) in resin, the switch base 1 is formed. In this way, the terminal pieces A through C are securely fixed to the switch base 1.

3 - In the third step consisting of a bending process, an end portion (which will be the fixed contact piece) 12a of the fixed terminal piece A is bent inwards by 90 degrees along the folding line X, and the fixed contact piece 2 having the fixed contact 2a is formed by a stamping process (refer to Figure 2(c)).

4 - In the fourth step, in order to form the moveable contact piece 4 having the moveable contact 4a, the one end (which will be the moveable contact piece) 12 of the common terminal piece C is bent inwards by 90 degrees along the folding line Y, and is then bent by a stamping process to a position to oppose the contact 2a of the fixed contact piece 2 as shown in Figure 2(c) (refer to Figure 2(d)).

5 - In the fifth step, in order to form the fixed contact piece 3 having the fixed contact 3a, the one end (which will be the fixed contact piece) 12b of the fixed terminal piece B is bent inwards by 90 degrees along the folding line Y, and is then bent by a stamping process to a position to oppose the contact 4a of the moveable contact piece 4 as shown in Figure 2(c) (refer to Figure 2(e)).

6 - Finally, by cutting off the remaining lead frame part 9b along the cutting line W, the one end portions of the fixed terminal pieces A and B, and the common terminal piece C on the side of the lead frame part 9b are formed into the fixed terminals a and b and the common terminal c, and a desired switch contact mechanism is obtained.

7 - By mounting the cover 5 provided with the push-button 6 and the pivoted lever 7 on the switch base 1 of the switch contact mechanism obtained by the above described steps 1 through 5, the limit switch illustrated in Figure 1 is obtained.

Thus, according to the switch contact mechanism of the present invention, since, as illustrated in the above described manufacturing process of the preferred embodiment, the contact pieces and the terminals are made of a common strip of electroconductive plate, and are formed in a continuous manufacturing process, a highly efficient manufacturing line flow can be achieved, and the manufacturing cost can be reduced.

Also, since the moveable contact piece may be integral with the terminal piece, and may not be provided with a projection made of a separate member serving as a contact point to bear upon a fixed contact piece as opposed to the prior art contact mechanism, the number of component parts is reduced, and its manufacturing process is significantly simplified.

Although the present invention has been described in terms of specific embodiments, it is possible to modify and alter details thereof without departing from the spirit of the present invention.

Claims

1. A switch contact mechanism, comprising:
a first terminal piece and a second terminal piece which are planar in shape and disposed on a common plane;
a casing including a switch base made of resin material supporting said terminal pieces in spaced relationship with both ends of each of said terminal pieces exposed;
a moveable contact piece cut out of an end of said first terminal piece and carrying a moveable contact at its free end;
a fixed contact piece cut out of an end of said second terminal piece and carrying a fixed contact opposite to said moveable contact at its free end; and
an actuating member moveably supported by said casing for acting upon said moveable contact piece so as to bring said moveable contact into contact

with said fixed contact.

2. A switch contact mechanism according to claim 1, wherein said switch base is integrally molded with said terminal pieces.

3. A switch contact mechanism according to claim 1, wherein said first terminal piece comprises a first portion securely fixed in said switch base, a second portion bent from said first portion by approximately 90 degrees along a first folding line extending in parallel with a longitudinal line of said first terminal piece, and a third portion, projecting from said second portion and serving as said moveable contact piece, bent toward said second terminal; and said second terminal piece is provided with a first portion securely fixed in said switch base, and a second portion, serving as said fixed contact piece, bent from said first portion by approximately 90 degrees along a second folding line extending in parallel with a major surface of said second terminal piece and perpendicular to a longitudinal line of said second terminal piece.

4. A switch contact mechanism according to claim 3, wherein at least one of said third portion of said first terminal piece and said second portion of said second terminal piece is formed with a projection by stamping so as to serve as a contact.

5. A method for making a switch contact mechanism, comprising the steps of:

cutting out a first terminal piece, a second terminal piece and a connecting piece connecting base ends of said terminal pieces together from a strip of electroconductive plate;

molding a switch base around said terminal pieces so as to secure said terminal pieces therein;

bending a part of said first terminal piece intermediate between said switch base and a free end of said first terminal piece along a first folding line extending in parallel with a longitudinal line of said first terminal piece by approximately 90 degrees, and then bending a free end portion of said first terminal piece toward said second terminal;

bending a free end portion of said second terminal piece along a second folding line parallel with a major surface of said plate and perpendicular to a longitudinal line of said second terminal piece by approximately 90 degrees; and

cutting off said connecting piece from said terminal pieces.

6. A method according to claim 5, further comprising the step of stamping a projection serving as a contact in a free end portion of at least one of said terminal pieces.

FIG. 1

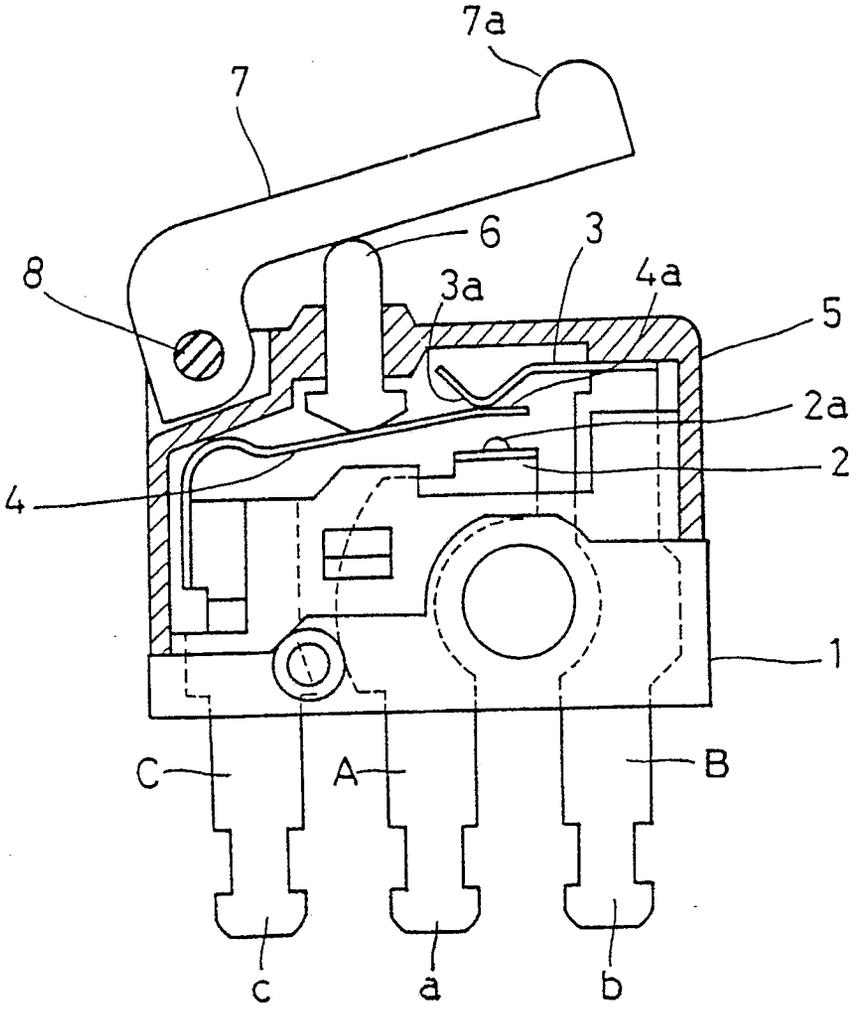

FIG. 2 (a)

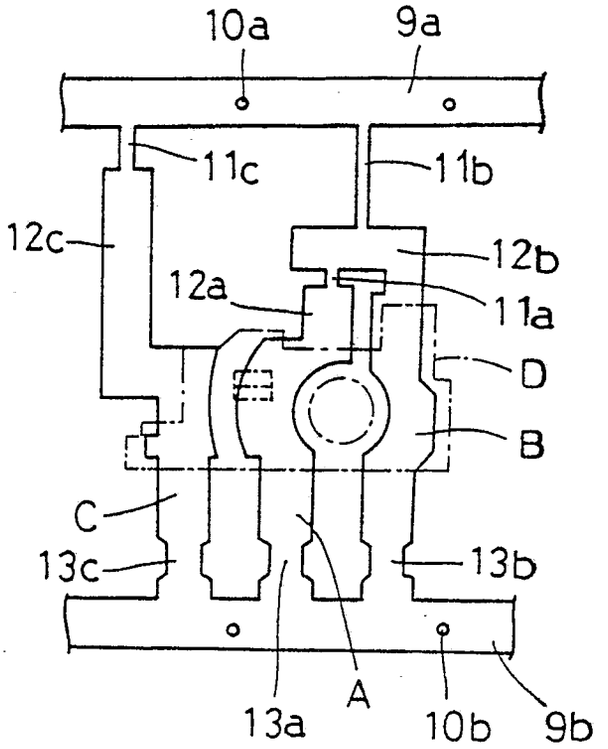
10a
9a
11c
11b
12c
12b
12a
11a
D
B
C
13c
13b
13a
A
10b
9b

FIG. 2 (b)

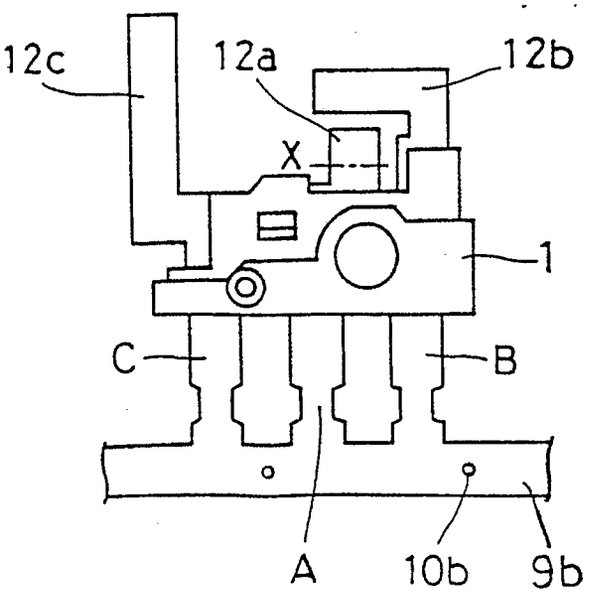
12c
12a
12b
X
1
C
B
A
10b
9b

FIG. 2 (c)

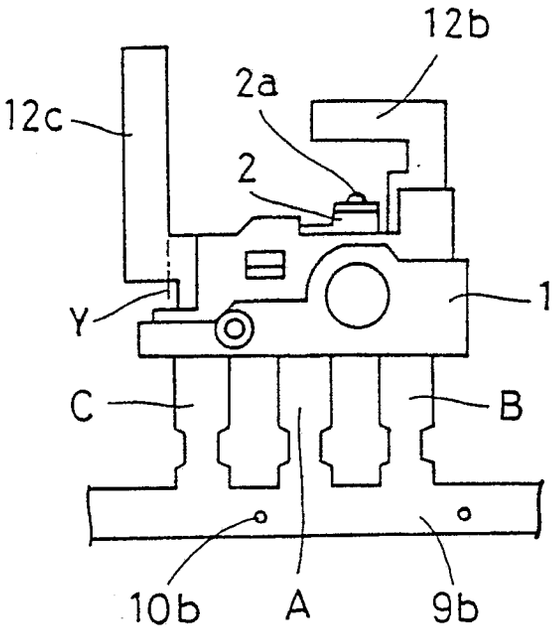

FIG. 2 (d)

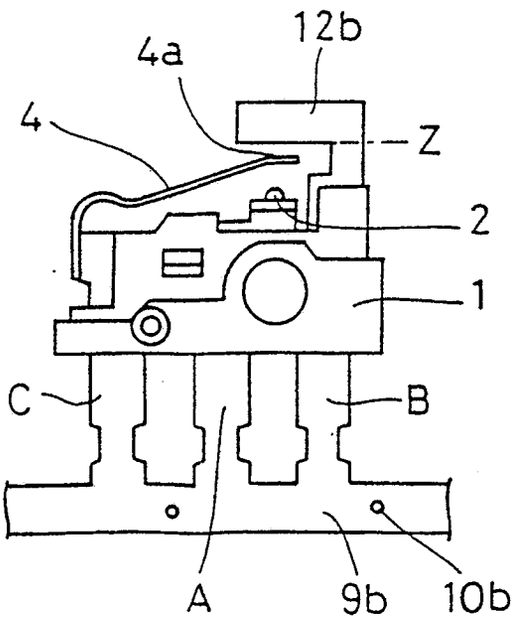

FIG. 2 (e)

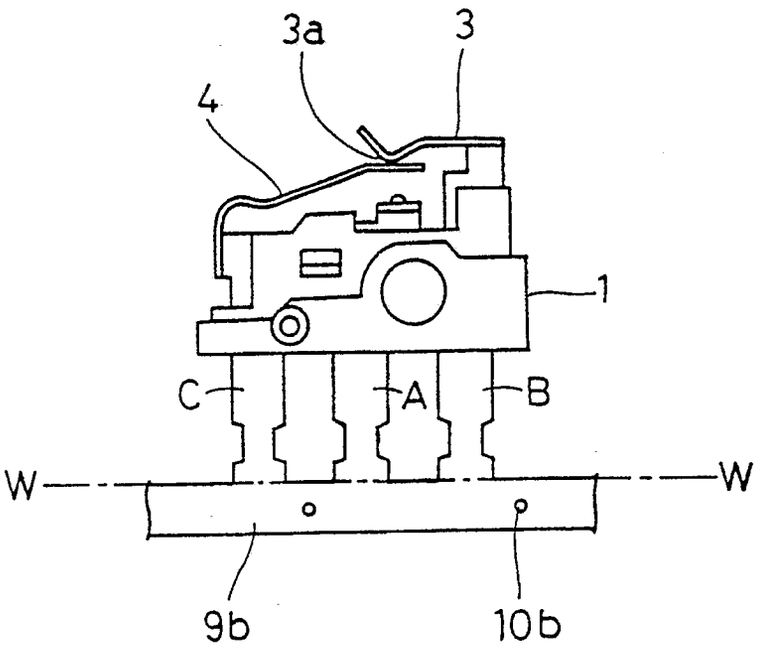

FIG. 3