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(54) Automotive switching device, particularly for controlling stop lights

(57) A switching device (1) presenting a movable contact (22) cooperating with two fixed contacts (15a, 15b) to close an electric circuit (44) of the device. The movable contact (22) is subjected on one side to the action of a spring (25) for maintaining the movable contact (22) against the fixed contacts, and on the other side to the action of a push-rod (4) moved by an external control element and which, in the withdrawn position, keeps the movable contact detached from the fixed contacts (15a, 15b). The movable contact (22) is in the form of a blade (22), the face of which facing the push-rod (4) presents a projection (30), which is engaged by the push-rod at the start of the opening stroke of the movable contact (22) to generate on the movable contact a force (B) eccentric in relation to the force (C) generated by the spring (25) and so rotate and slide the movable contact (22) in relation to the fixed contacts (15a, 15b) to automatically clean the contacts.

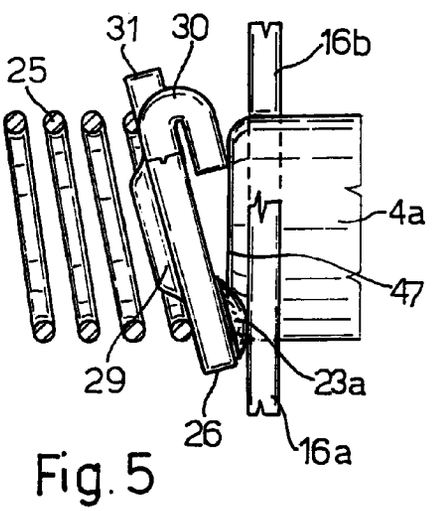

Fig. 5

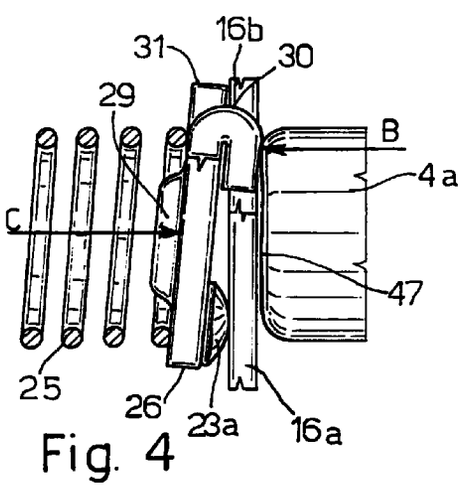

Fig. 4

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Description

The present invention relates to an automotive switching device, particularly for controlling stop lights.

As is known, pushbutton switches are used on vehicles to detect the position of a vehicle member, e.g. the brake pedal, and generate a corresponding signal or command by closing an electric circuit comprising the switch. Such switches normally comprise a tubular casing housing a contact carrier and a so-called push-rod, which is movable between an extracted and a withdrawn position, depending on the position of the member being monitored. The contact carrier houses at least a fixed contact secured to the carrier itself, and a movable contact which is subjected to the contrary action of a spring and the push-rod. When the push-rod is withdrawn by the member being monitored, it moves the movable contact away from the fixed contact to open the relative electric circuit; whereas, when the push-rod is no longer activated by the member being monitored, the unopposed spring pushes the movable contact against the fixed contact to close the electric circuit.

For detecting the position of the brake pedal, the tubular casing is fitted to the vehicle body, the push-rod is extracted when the pedal is pressed and withdrawn when the pedal is released, and the pressure on the pedal and consequent closing of the circuit provide for supplying and so turning on the stop light connected to the electric circuit.

In known switches of the above type, the contact portions of the movable contact mating with the fixed contacts are made of noble material to obtain a low-resistivity connection and so reduce the resulting voltage drop. On the other hand, opening and closing of the contacts are normally accompanied by a voltaic arc, which results in combustion of minute portions of the contact portion material and also of powder on the contacts themselves, and in the formation and deposit of carbon residue between the contacts. Such residue increases the voltage drop between the contacts, even to the extent of preventing passage of the current when this is relatively low, say, about 100-200 mA, so that self-cleaning contacts capable of eliminating the carbon residue are desirable to ensure reliable closing of the electric circuit of the switch at all times and in all conditions.

It is an object of the present invention to provide an automotive switching device, particularly for controlling stop lights, designed to overcome the aforementioned drawbacks, i.e. featuring self-cleaning contacts.

According to the present invention, there is provided an automotive switching device, particularly for controlling stop lights, the device comprising at least a first fixed contact and a movable contact; and first actuating means for activating said movable contact and controlling a first away and approach movement of said movable contact in relation to said fixed contact; characterized by comprising second actuating means for controlling a second movement of said movable contact in relation to said fixed contact prior to said away movement and/or after said approach movement.

A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a longitudinal section of the switching device according to the invention;
Figure 2 shows a side view in perspective of the movable contact of the Figure 1 switching device;
Figure 3 shows a side view in perspective of the movable contact from the opposite side to that in Figure 2;
Figure 4 shows a detail of Figure 1 in the direction of arrow A and in the contact closing position;
Figures 5 and 6 show the same view as in Figure 4 in two different operating positions of the contacts.

Number 1 in Figure 1 indicates the push-button switching device according to the present invention. Device 1 comprises a casing 2 presenting a tubular portion 2a, and a cup-shaped portion 2b larger in diameter than tubular portion 2a and defining an end wall 7. Tubular portion 2a is surrounded coaxially by a cylindrical body 3, and houses in sliding manner a push-rod 4; cup-shaped portion 2b houses a cup-shaped contact carrier 5 presenting an end wall 8 and a small-diameter shank portion 9; and end wall 8 of contact carrier 5 faces end wall 7 of cup-shaped portion 2b. Cylindrical body 3 presents a number of external projections 6 defining seats for the fitment of device 1 to the vehicle body 10; and a projecting inner portion 11, which clicks inside one of a number of grooves 13 formed on the outside of tubular portion 2a to adjust - in known manner not described in detail - the position of push-rod 4 in relation to a brake pedal 34 in the released position.

Contact carrier 5 presents two fixed contacts 15a, 15b, each comprising a metal blade presenting an L-shaped end facing end wall 7 and forming a respective contact portion 16a, 16b, and an end portion 17a, 17b for connecting device 1 in known manner to other components (supply, stop lamp - not shown) forming with device 1 an electric circuit 44. Fixed contacts 15a, 15b are preferably made of silver-plated brass; contact carrier 5 and casing 2 are fitted to each other by means of a snap-on connection 18; and end wall 7 presents two conical portions 20, 21 projecting from wall 7 inwards of contact carrier 5, and which are of different heights and form spacers between end wall 7 and respective contact portions 16a, 16b. More specifically, conical portion 20 of contact portion 16a is higher than conical portion 21.

A movable contact 22 is positioned facing contact portions 16a, 16b of fixed contacts 15a, 15b, and comprises a substantially rectangular metal blade presenting two convex contact pads 23a, 23b aligned perfectly with contact portions 16a, 16b of fixed contacts 15a, 15b, and preferably made of Ag Sn O2 92/8 to ensure a low voltage drop. Contact pads 23a, 23b are located close to a longer side 26 of movable contact 22 (Figure 2), and movable contact 22 is pressed against contact

portions 16a, 16b of fixed contacts 15a, 15b by a coil spring 25 compressed between movable contact 22 and end wall 8 of contact carrier 5. End wall 8 presents projections 27, 28 for ensuring correct axial positioning of a first end of spring 25; and movable contact 22 presents a projection 29 (Figure 3) for axially positioning the other end of spring 25. The longer side 31 opposite longer side 26 of movable contact 22 presents a projection 30 for the purpose described below, and which is preferably formed by turning down a portion of movable contact 22 itself.

Push-rod 4 comprises a rod presenting an enlarged first end 4a and an enlarged second end 4b; first end 4a faces cup-shaped portion 2b of casing 2, and presents a front surface 47 cooperating with projection 30 to open movable contact 22; second end 4b projects partly from the opposite end of tubular portion 2a of casing 2, and is activated in known manner by brake pedal 34 hinged at 35 to the body of the vehicle (not shown); first end 4a defines a shoulder 36, which contacts a stop shoulder 37 formed by tubular casing 2 and defining the extracted limit position of push-rod 4; and the free end of tubular portion 2a of casing 2, from which end 4b of push-rod 4 projects, presents an adjusting spacer 38.

In actual use, end portions 17a, 17b of fixed contacts 15a, 15b are connected to the other components of electric circuit 44 so that, when the circuit is closed, current flows in the direction of arrows 40.

Device 1 operates as follows. Like known switching devices, when released, brake pedal 34 acts on end 4b of push-rod 4 to keep push-rod 4 in the withdrawn position with end 4a projecting partly inside cup-shaped portion 2b; in which case, push-rod 4 detaches movable contact 22 from contact portions 16a, 16b of fixed contacts 15a, 15b, thus opening electric circuit 44.

When brake pedal 34 is pressed, the thrust exerted by the pedal on push-rod 4 is removed, and spring 25 pushes movable contact 22 against contact portions 16a, 16b of fixed contacts 15a, 15b, thus closing electric circuit 44 and moving device 1 into the Figure 1 position, wherein push-rod 4 is pushed by movable contact 22 into the extracted position, with end 4b projecting from tubular portion 2a of casing 2. When brake pedal 34 is again released, push-rod 4 is again withdrawn and movable contact 22 opened.

According to the invention, when closing and opening movable contact 22, in addition to moving towards and away from fixed contacts 15a, 15b, movable contact 22 also performs a rocking movement to clean contact portions 16a, 16b, 23a, 23b as described in detail below with reference to Figures 4, 5, 6 showing the opening movement of movable contact 22.

More specifically, when brake pedal 34 is released to withdraw push-rod 4, initial contact between push-rod 4 and movable contact 22 occurs at projection 30, which projects axially in relation to the surface of the blade defining movable contact 22. As push-rod 4 continues moving, front surface 47 exerts on movable contact 22 a force B, which is offset in relation to the resultant of the force of spring 25 on movable contact 22 (substantially along the axis of spring 25, as shown by arrow C in Figure 4) due to the eccentricity of projection 30 in relation to the point at which force C is applied. As such, movable contact 22 is subjected to a torque by which it is rotated into the Figure 5 position, in the course of which rotation, contact pads 23a, 23b rotate and slide on contact portions 16a, 16b of fixed contacts 15a, 15b, thus removing any carbon residue between contact pads 23a, 23b and contact portions 16a, 16b of fixed contacts 15a, 15b and so automatically cleaning the contacts.

Subsequently, push-rod 4 pushes movable contact 22 in the axial direction of push-rod 4 itself to open movable contact 22 as described above and as shown in Figure 6.

Conversely, when brake pedal 34 is pressed to close movable contact 22 on fixed contacts 15a, 15b, a reverse movement, and hence a similar self-cleaning operation, is produced by spring 25 and the reaction of contact portions 16a, 16b of fixed contacts 15a, 15b.

Conical portions 20, 21 of device 1 ensure a high degree of reliability and a long working life of the device by solving the problem of electromigration, i.e. the passage of material between the facing contacts as they are opened, and which results in the material of the fixed contact detaching and depositing on the movable contact when current flows from the fixed to the movable contact, and in the material of the movable contact detaching and depositing on the fixed contact when current flows in the opposite direction. As the movable contact is normally made of more noble material than the fixed contact to ensure effective current flow and a low voltage drop between the contacts, is it preferable that electromigration should occur from the movable to the fixed contact. In known switching devices, however, there is no guarantee that the movable contact will be opened, always and for all switching devices, at contact portions 16b-23b in which current flows from the movable to the fixed contact.

Conversely, the difference in height of conical portions 20, 21 of device 1 according to the present invention ensures that electromigration occurs precisely in the desired direction, by ensuring contact portions 16a, 16b of fixed contacts 15a, 15b are located at different distances from end wall 7 of portion 2b and hence from the surface of end 4a of push-rod 4, as described previously. As such, following the self-cleaning rotational movement of movable contact 22, as described above, when brake pedal 34 is released to push push-rod 4 into the withdrawn position, push-rod 4 first detaches contact pad 23b facing contact portion 16b to open electric circuit 44, so that, since the current flows, as stated, in the direction of arrows 40, electromigration occurs as desired from contact pad 23b towards contact portion 16b. When push-rod 4 subsequently detaches contact pad 23a from contact portion 16a, no electromigration occurs by virtue of the current flow being cut off.

The advantages of the device according to the present invention are as follows. In particular, it provides

for straightforward, effective, automatic cleaning of the contacts each time the brake pedal is pressed, and for reducing the effects of electromigration; both of which characteristics are achieved by means of straightforward design features involving substantially no additional fabrication cost. The mechanism for automatically cleaning the contacts and eliminating the effects of electromigration also provides for considerably extending the working life of the device, thus reducing vehicle maintenance costs.

Clearly, changes may be made to the device as described and illustrated herein without, however, departing from the scope of the present invention. In particular, projection 30 may be formed in any manner, e.g. by welding or pressing; self-cleaning may be effected by means of a different movement of the movable contact in relation to the fixed contact, e.g. by translating or rotating the movable contact in relation to the fixed contact in the plane defined by the movable contact; and self-cleaning may be effected when either closing or opening the movable contact, as opposed to both, as described.

Claims

1. An automotive switching device (1), particularly for controlling stop lights, the device (1) comprising at least a first fixed contact (15a) and a movable contact (22); and first actuating means (4) for activating said movable contact (22) and controlling a first away and approach movement of said movable contact (22) in relation to said first fixed contact (15a); characterized by comprising second actuating means (4, 30) for controlling a second movement of said movable contact (22) in relation to said first fixed contact (15a) prior to said away movement and/or after said approach movement.

2. A switching device as claimed in Claim 1, characterized in that said second actuating means comprise control means (4, 30) for controlling a rotational and/or sliding movement of said movable contact (22) on said first fixed contact (15a).

3. A switching device as claimed in Claim 2, characterized in that said movable contact (22) comprises a contact body (22) having a first and opposite second face, and a projection (30) projecting from said first face; and by comprising an actuating element (4) sliding inside said switching device (1), and having an actuating surface (47) facing said first face of said contact body (22) and cooperating with said projection (30) to generate a first force (B) on said first face and move said contact body (22) into a first limit position; and elastic means (25) acting on said second face of said contact body (22) and for exerting a second force (C) on said second face to move said contact body (22) into a second limit position; said first and second forces (B, C) generating a torque for rotating said contact body (22) in relation to said first fixed contact (15a).

4. A switching device as claimed in Claim 3, characterized in that said contact body comprises a rectangular blade (22); in that said blade (22) presents at least a first contact portion (23a) located on said first face and cooperating with said first fixed contact (15a) to close an electric circuit (44); and in that said projection (30) and said first contact portion (23a) are respectively located close to a first side (31) and an opposite second side (26) of said rectangular blade (22).

5. A switching device as claimed in Claim 4, characterized in that said projection (30) comprises a downfolded portion of said blade (22).

6. A switching device as claimed in Claim 4 or 5, characterized by comprising a second fixed contact (15b); in that said blade (22) presents a second contact portion (23b) facing said second fixed contact (15b), said second contact portion (23b) being located close to said second side (26) of said blade (22); and in that, in said second limit position, said first and second sides (31, 26) of said blade (22) are inclined in relation to said actuating surface (47) of said actuating element (4).

7. A switching device as claimed in Claim 6, characterized in that said first (15a) and second (15b) fixed contacts present contact ends (16a, 16b) facing said contact portions (23a) (23b) of said movable contact (22); said contact ends (16a, 16b) being located in mutually spaced parallel planes.

8. A switching device as claimed in Claim 7, characterized in that said contact ends (16a, 16b) are parts of projections (20, 21) formed by said switching device and presenting different heights.

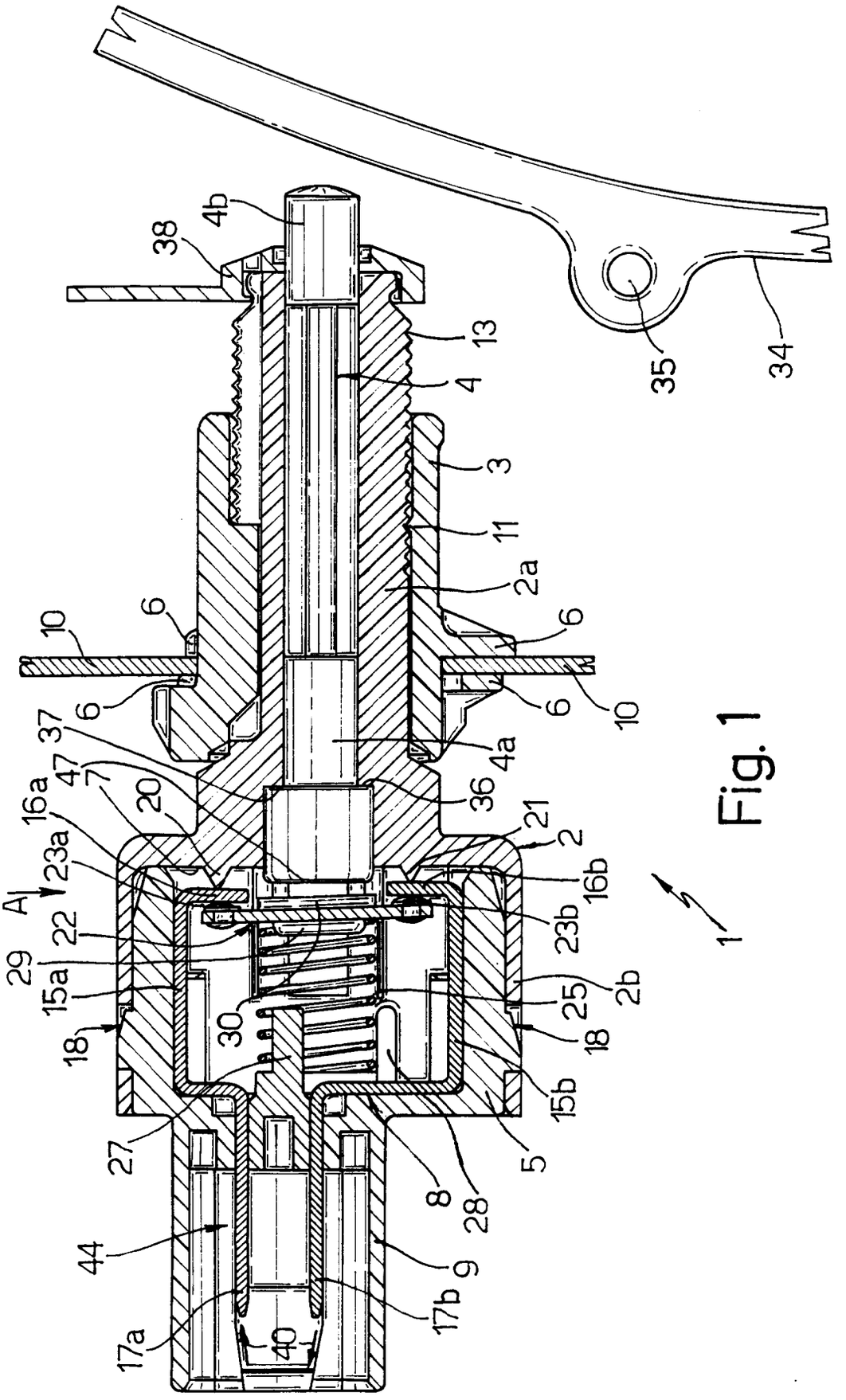

4b
38
13
4
3
11
2a
6
10
37
47
7
20
16a
23a
A
22
29
15a
18
30
27
44
17a
40
17b
9
8
28
5
15b
25
2b
23b
16b
21
2
36
4a
35
34
1

Fig. 1

Fig. 2

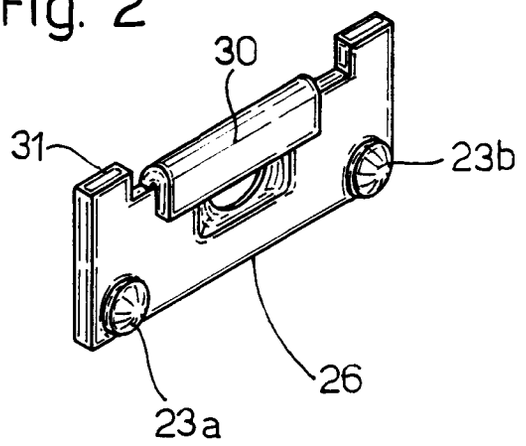
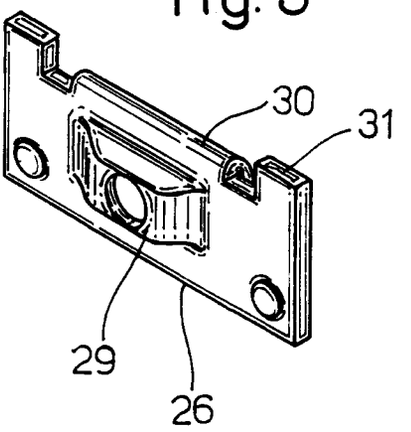


Fig. 3



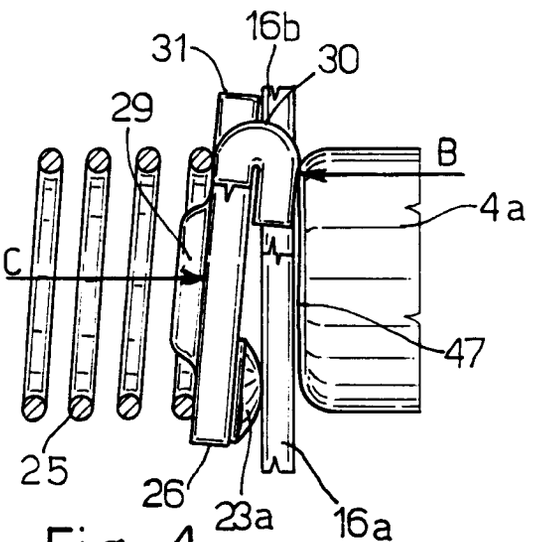


Fig. 4

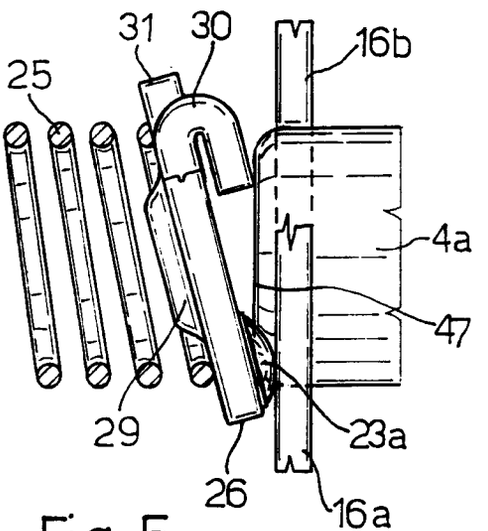
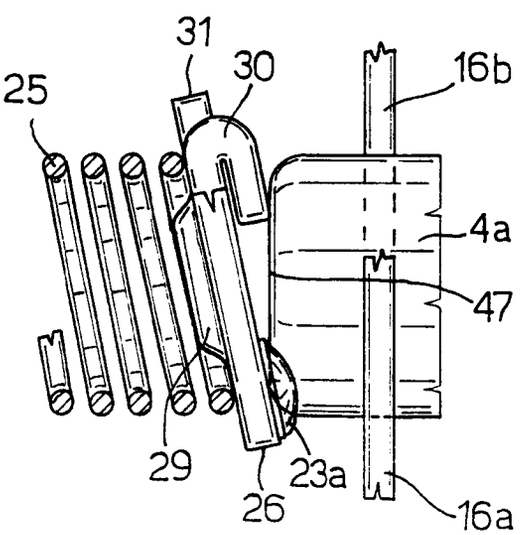


Fig. 5

Fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 96 10 9891

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-4 501 940 (SUZUKI MASARU) 26 February 1985 * abstract; figures *	1,2	H01H1/18
X	FR-A-2 520 926 (MARIO TURATTI) 5 August 1983 * claim 1; figures *	1,2	
A	FR-A-2 332 606 (PREH ELEKTRO FEINMECHANIK) 17 June 1977 * page 4, line 1 - line 8; figures 1-4 *	1,2,5	
A	GB-A-2 169 143 (MITSUBISHI ELECTRIC CORP) 2 July 1986 * abstract; figures 1-10 *	1	
A	BE-A-565 734 (J.B. FERMOR-HESKETH) 29 July 1960 * page 4, last paragraph - page 5, paragraph 1; figures 1,3 *	1,2	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 October 1996	Janssens De Vroom, P

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