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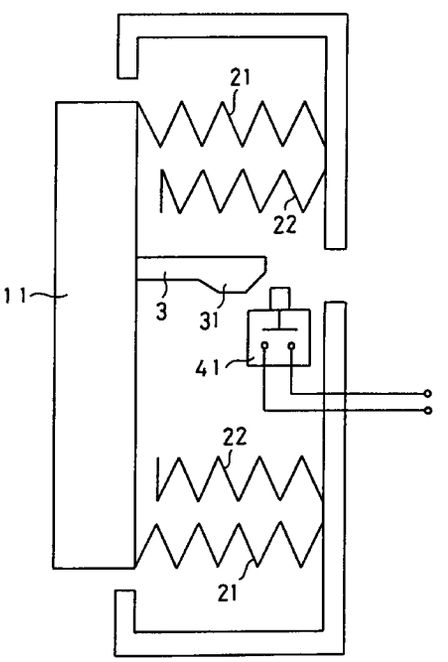
(54) THREE-POSITION SWITCH

(57) A three-position switch is provided with a push button (11) which is elastically supported by double springs (21 and 22), switch operating lever (3) which is extended inward in a direction almost perpendicular to the push button (11) and has a projection (31) projecting in the lateral direction at its front end, normally-on switch (41) which is wiped in a direction almost perpendicular to the direction of the movement of the lever (3), turned on by being pressed by the projection (31) only when the switch (41) is pressed, and turned off when the button (11) is in a free state and the button (11) is strongly depressed and largely wiped.

Fig. 1



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Description

FIELD OF THE INVENTION

This invention relates to a three-position switch. More specifically, this invention relates to a three-position switch which is employable for a double purpose including preparation for operation of a robot and emergency stop of a robot and which is mounted on an operation board employable for teaching a robot.

BACKGROUND OF THE INVENTION

A three-position switch is defined as a switch which is in an open or off position, when the push button thereof is not pressed or is in the free position, turns to a closed or on position, when the push button thereof is pressed with a moderate degree of pressure, and turns to an open or off position again, when the push button thereof is pressed with a large degree of pressure. Although plural three-position switches are available in the prior art, none of them can be practically employed for an operation board for teaching a robot, because the external dimension thereof is too large.

An operation board employable for teaching a robot is usually designed to be held in the palm of a hand (usually a left hand) of an operater and the push buttons thereof are designed to be pressed with a finger of the other hand (usually a right hand) of the operater. A switch for preparation for operation of a robot is arranged on an operation board for teaching a robot at a location at which a finger of a hand (usually a left hand) which holds the operation board, automatically closes the switch, when the operation board is held in the palm of a hand. Therefore, a switch for preparation for operation of a robot is automatically brought to a ready position, when an operation board for teaching a robot is held with a hand of an operater. This means that an operation board for teaching a robot is operable exclusively during a period in which the operation board is held with a hand (usually a left hand) and the switch for preparation for operation of a robot is automatically closed by a finger of the hand. In other words, an operation board for teaching a robot is not operable, during a period in which the operation board is not held with a hand (usually a left hand) and the switch for preparation for operation of a robot is open.

When an emergency happened, the switch for preparation for operation of a robot must be opened to stop the operation. To fulfill this requirement, the grip of the operation board for teaching a robot must be loosened, when an emergency happened. This requirement is, however, contrary to the principle of the human engineering. This is because any body is inclined to close his palm with his fingers, when he is surpsised by an emergency, during a period in which he is teaching a robot by using an operation board which is held in his hand.

In this sense, a three-position switch is suitable for a switch which is employable for a double purpose including preparation for operation of a robot and emergency stop of a robot and which is mounted on an operation board employable for teaching a robot. This is because a three-position switch is in an open position, while it is not held with a hand, turns to a closed position, when it is held with a hand and resultantly its switch for preparation for operation of a robot is pressed with a moderate degree of pressure, and turns to an open position again, when the holder thereof is surprised by an emergency and he grips the three-position switch with a large degree of pressure.

As was described above, however, the three-position switches available in the prior art are large in size and none of them can be employed as a switch which is employable for a double purpose including preparation for operation of a robot and emergency stop of a robot and which is mounted on an operation board employable for teaching a robot. This is because a switch which is employable for a double purpose including preparation for operation of a robot and emergency stop of a robot and which is mounted on an operation board employable for teaching a robot is desired to be small enough to be held in the palm of a hand of an operater. Therefore, it is required to develope a three-position switch which is small enough to be employed as a switch which is employable for a double purpose including preparation for operation of a robot and emergency stop of a robot and which is mounted on an operation board employable for teaching a robot.

The object of this invention is to provide a three-position switch which has a function to be in an open position, while the push button thereof is not pressed and the switch is in the free position, turns to a closed position, when the push button thereof is pressed with a moderate degree of pressure, and turns to an open position again, when the push button thereof is pressed with a large degree of pressure and which is small in size.

SUMMARY OF THE INVENTION

A three-position switch in accordance with the first embodiment of this invention is provided a push button 11 elastically supported by a double spring 21 and 22, a switch operating rod 3 inwardly extending from the push button 11 in the direction approximately perpendicular to the push button 11 and having a lateral projection 31 projecting at the front end thereof, a normally-off switch 41 which operates in the direction approximately perpendicular to the direction in which the push button 11 moves and which turns to a closed position by a pressing action with a moderate degree of pressure of the push button 11, which pressing action causes the projection 31 to press the button of the normally-off switch 41 and which is in an open position, during the period in which the push button 11 is not pressed or is in the free position and during the period in which the push button 11 is pressed with a large degree of pressure.

The foot of the projection 31 is preferably made large to make the operation of the normally-off switch 41 smooth.

A three-position switch in accordance with the second embodiment of this invention is provided a push button 12 elastically supported by a spring 23, a combination of a normally-off switch 42 and a normally-on switch 43 which are connected in series to each other and which are arranged to face the push button 12, a normally-off switch operating means 5 which turns the normally-off switch 42 to a closed position, when the push button 12 is pressed with a moderate degree of pressure and when the push button 12 is pressed with a large degree of pressure, and a normally-on switch operating means 6 which turns the normally-on switch 43 to an open position, when the push button 12 is pressed with a large degree of pressure.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic drawing illustrating the free position of a three-position switch in accordance with the first embodiment of this invention,

Fig. 2 is a schematic drawing of a three-position switch in accordance with the first embodiment of this invention, illustrating the position at which the push button thereof is pressed with a moderate degree of pressure,

Fig. 3 is a schematic drawing of a three-position switch in accordance with the first embodiment of this invention, illustrating the position at which the push button thereof is pressed with a large degree of pressure,

Fig. 4 is a schematic drawing illustrating the free position of a three-position switch in accordance with the second embodiment of this invention,

Fig. 5 is a schematic drawing of a three-position switch in accordance with the second embodiment of this invention, illustrating the position at which the push button thereof is pressed with a moderate degree of pressure, and

Fig. 6 is a schematic drawing of a three-position switch in accordance with the second embodiment of this invention, illustrating the position at which the push button thereof is pressed with a large degree of pressure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings, a detailed description will be presented below for three-position switches in accordance with two embodiments of this invention.

FIRST EMBODIMENT

Referring to Fig. 1, a push button 11 is a bar. The reason why the push button 11 is a bar is to enable one hand of an operater to hold the three-position switch in the palm of his hand, when the three-position switch is employed as a switch for preparation for operation of a robot and for emergency stop of a robot and which is mounted on an operation board for teaching a robot. The push button of a bar 11 is elastically supported by a double spring, so that it is suspended in the free position. The double spring consists of a weak spring 21 and a strong spring 22 both of which are wound on a single bobbin. When the double spring is pressed with a moderate degree of pressure, the weak spring 21 deforms, and when the double spring is pressed with a large degree of pressure, the both springs 21 and 22 deform.

A switching rod 3 inwardly extends from the push button 11 in the direction approximately perpendicular to the push button 11 and has a projection 31 which laterally projects at the front end thereof. The projection 31 has a shape of trapezoid, so that the move of a normally-off switch 41 to be referred to later is made smooth.

The normally-off switch 41 turns to a closed position exclusively when the push button 11 is pressed with a moderate degree of pressure to cause the projection 31 to press a button of the normally-off switch 31. The button of the normally-off switch 41 preferably has a shape of trapezoid for the purpose to make the move of the normally-off switch 41 smooth.

Fig. 1 illustrates the free position in which the push button 11 is not pressed. In this position, the normally-off switch 41 is in an open position.

Referring to Fig. 2, the normally-off switch 41 turns to a closed position, when the push button 11 is pressed with a moderate degree of pressure.

Referring to Fig. 3, the normally-off switch 41 turns to an open position again, when the push button 11 is pressed with a large degree of pressure.

The foregoing description has clarified that a three-position switch in accordance with the first embodiment of this invention has a function to be in an open position, when the push button thereof is not pressed, to be in a closed position, when the push button thereof is pressed with a moderate degree of pressure, and to be in an open position again, when the push button thereof is pressed with a large degree of pressure, and is small in size. Therefore, the three-position switch in accordance with the first embodiment of this invention can be employed as a switch employable for a double purpose including preparation for operation of a robot and emergency stop of a robot and which is mounted on an operation board for teaching a robot.

SECOND EMBODIMENT

Referring to Fig. 4, a push button 12 is a bar. The reason why the push button 12 is a bar is to enable one hand of an operater to hold the three-position switch in the palm of his hand, when the three-position switch is employed as a switch which is employable for preparation for operation of a robot and for emergency stop of a robot and which is mounted on an operation board for teaching a robot and to make it possible to operate two independent switches with one push button. The push button 12 is elastically supported by a spring 23.

A normally-off switch 42 and a normally-on switch 43 are connected in series to each other. This series circuit is in an open position, while the push button 12 is not pressed.

One example of a normally-off switch operating means 5 is a spring having a long operating span. The normally-off switch operating means 5 keeps the normally-off switch 42 in a closed position, during the period in which the push button 12 is pressed with a moderate degree of pressure and during the period in which the push button 12 is pressed with a large degree of pressure.

One example of a normally-on switch operating means 6 is a projection projected from the push button 12. The normally-on switch operating means 6 turns the normally-on switch 43 to an open position, when the push button 12 is pressed with a large degree of pressure.

Referring to Fig. 5, when the push button 12 is pressed with a moderate degree of pressure, the normally-off switch 42 turns to a closed position, and the normally-on switch 43 remains in a closed position. In this position, the series circuit of the normally-off switch 42 and the normally-on switch 43 is in a closed position.

Referring to Fig. 6, when the push button 12 is pressed with a large degree of pressure, the normally-on switch 43 turns to an open position and the normally-off switch 42 remains in a closed position. In this position, the series circuit of the normally-off switch 42 and the normally-on switch 43 is in an open position.

The foregoing description has clarified that a three-position switch in accordance with the second embodiment of this invention has a function to be in an open position, when the push button thereof is not pressed, to be in a closed position, when the push button thereof is pressed with a moderate degree of pressure, and to be in an open position again, when the push button thereof is pressed with a large degree of pressure, and is small in size. Therefore, the three-position switch in accordance with the second embodiment of this invention can be employed as a switch employable for a double purpose including preparation for operation of a robot and emergency stop of a robot and which is mounted on an operation board employable for teaching a robot.

In conclusion, the foregoing description has clarified that either of the three-position switches in accordance with this invention has a function to be in an open position, when the push button thereof is not pressed, to be in a closed position, when the push button thereof is pressed with a moderate degree of pressure, and to be in an open position again, when the push button thereof is pressed with a large degree of pressure, and is small in size. Therefore, either of the three-position switches in accordance with this invention can be employed as a switch employable for a double purpose including preparation for operation of a robot and emergency stop of a robot and which is mounted on an operation board employable for teaching a robot.

Claims

1. A three-position switch comprising :
a push button 11 elastically supported by a double spring 21 and 22,
a switch operating rod 3 inwardly extending from said push button 11 in the direction approximately perpendicular to said push button 11 and having a lateral projection 31 projecting at the front end thereof, and
a normally-off switch 41 which operates in the direction approximately perpendicular to the direction in which said push button 11 moves and which turns to a closed position by a pressing action with a moderate degree of pressure of said push button 11, which pressing action causes said projection 31 to press the button of said normally-off switch 41 and which is in an open position, during the period in which said push button 11 is not pressed and during the period in which said push button 11 is pressed with a large degree of pressure.

2. A three-position switch in accordance with claim 1, wherein said projection 31 is a trapezoid.

3. A three-position switch comprising :
a push button 12 elastically supported by a spring 23,
a combination of a normally-off switch 42 and a normally-on switch 43 which are connected in series to each other and which are arranged to face said push button 12,
a normally-off switch operating means 5 which turns said normally-off switch 42 to a closed position, when said push button 12 is pressed with a moderate degree of pressure and when said push button 12 is pressed with a large degree of pressure, and
a normally-on switch operating means 6 which turns said normally-on switch 43 to an open position, when said push button 12 is pressed with a large degree of pressure.

Fig. 1

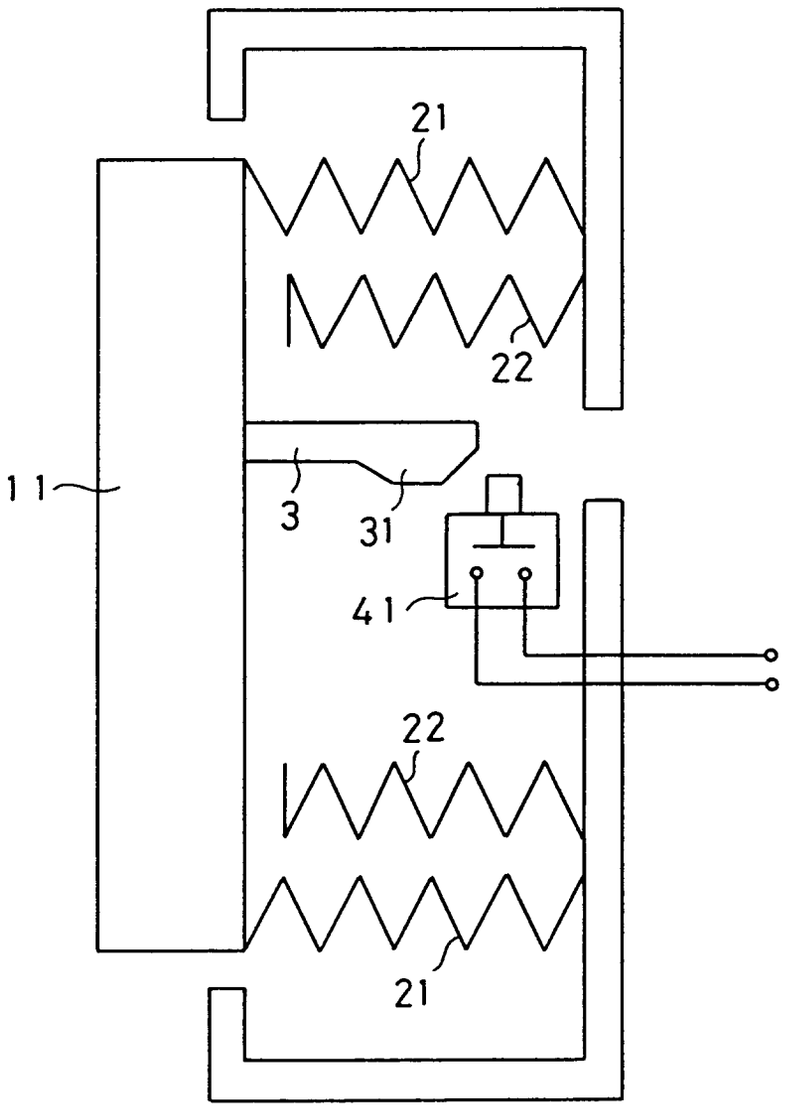


Fig. 2

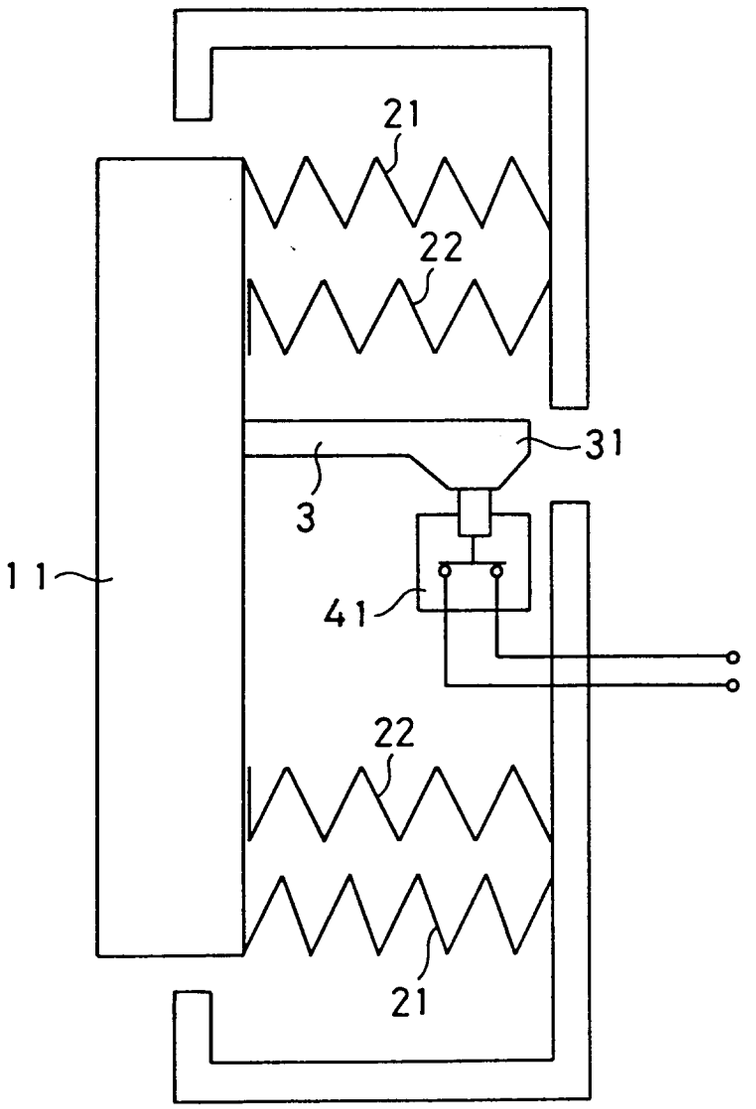


Fig. 3

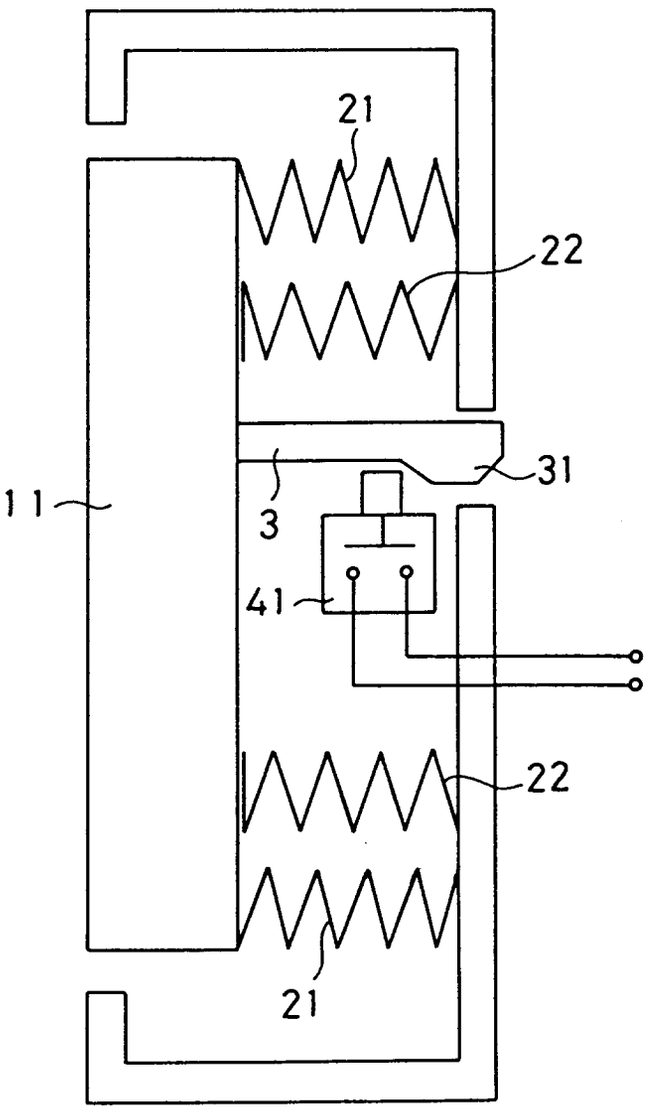


Fig. 4

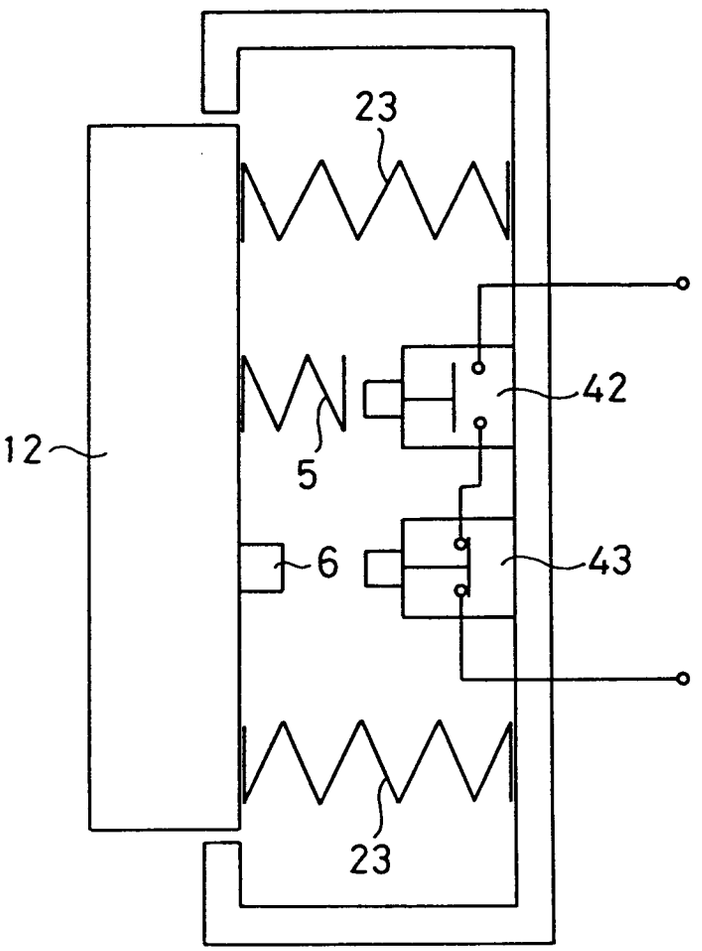


Fig. 5

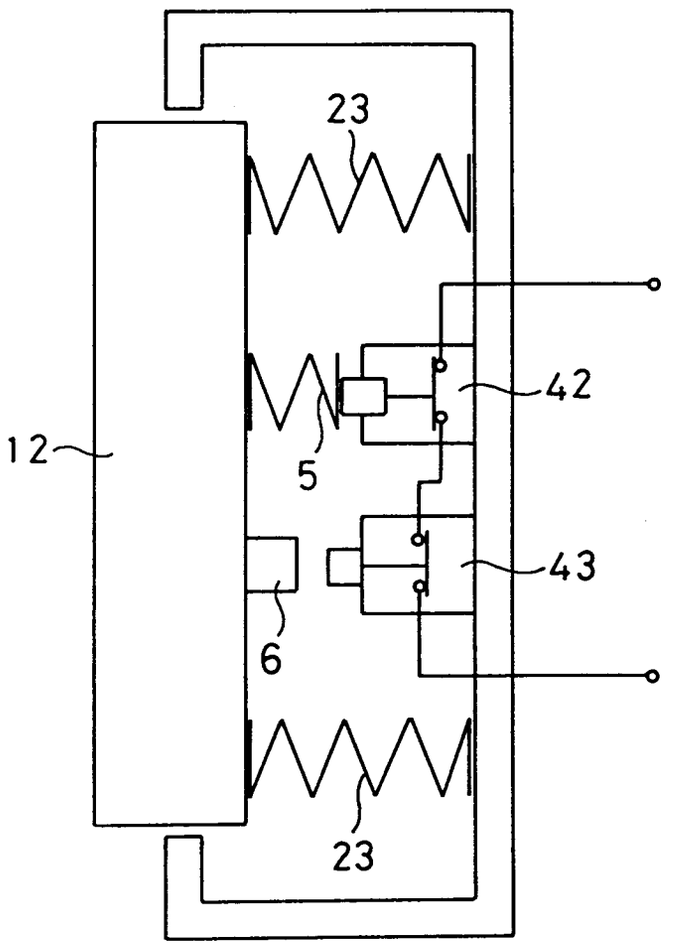
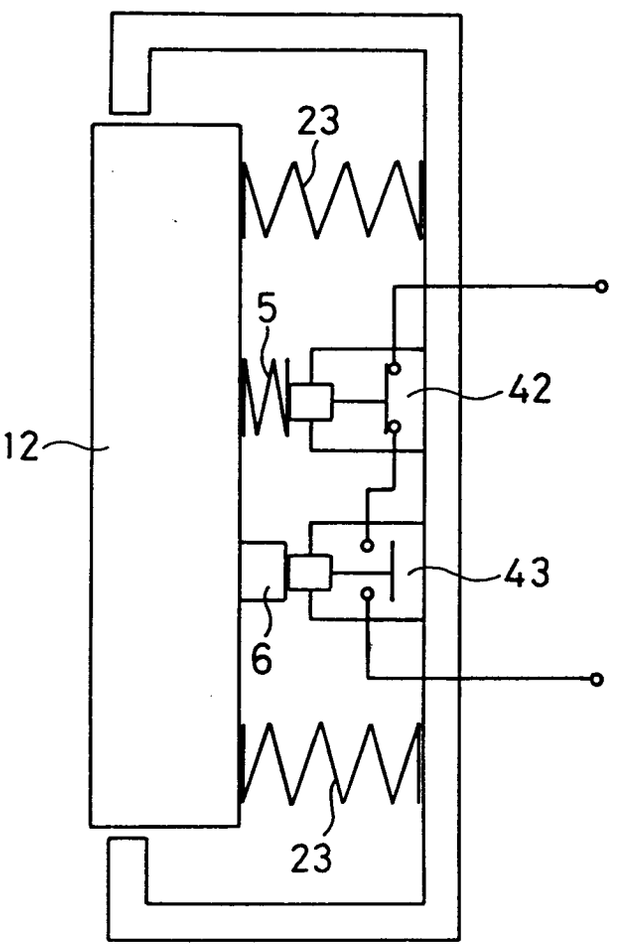


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP95/00053

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl^6 H01H13/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl^6 H01H13/00-13/66

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1926 - 1995
Kokai Jitsuyo Shinan Koho 1971 - 1995

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, U, 63-87735 (Sharp Corp.), June 8, 1988 (08. 06. 88)	1 - 2
Y	JP, U, 59-194235 (Showa Electric Wire & Cable Co., Ltd.), December 24, 1984 (24, 12, 84)	1
Y	JP, U, 63-41824 (Omron Corp.), March 18, 1988 (18. 03. 88)	1
Y	JP, U, 3-116628 (NEC Corp.), December 3, 1991 (03. 12. 91)	3
Y	JP, U, 63-83333 (Teikoku Tsushin Kogyo K.K.), June 1, 1988 (01. 06. 88)	3

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
April 10, 1995 (10. 04. 95)	May 2, 1995 (02. 05. 95)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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