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(54) POSITION DETECTOR OF ELEVATOR

(57) A position detecting apparatus for an elevator is provided with a detector disposed on a car side of an elevator traveling up and down in a hoistway and a device to be detected disposed on a hall side of the hoistway, in which the detector has lead switches, and the device to be detected has a mounting plate for securing the device to be detected on the hall side and a plurality of permanent magnets of a small shape being spaced apart from one another in the direction of a moving direction of the car and disposed on the mounting plate, whereby the device to be detected can be configured inexpensively and damages to the permanent magnets of the device to be detected can be prevented.

EP 1 426 319 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an improvement of a position detecting apparatus for an elevator, which is provided with a detector composed of lead switches on a car side and a device to be detected composed of a mounting plate made of a magnetic body such as a permanent magnet and a steel sheet on a hall side of a hoistway.

BACKGROUND ART

[0002] Conventional apparatus for detecting a position of an elevator will be described with reference to Figs. 8 and 9. Fig. 8 illustrates a configuration of the conventional position detecting apparatus for an elevator viewed from a side of a hoistway.

[0003] In Fig. 8, reference numeral 10 denotes a detector composed of a mounting plate 11 with a substantially L shaped cross section and lead switches 12 and 13 for detecting a door opening and closing possible position, and 20 denotes a device to be detected composed of a mounting plate 21 that is a steel sheet of a magnetic body with a substantially L shaped cross section and a permanent magnet 22 of a rectangular parallelepiped shape with a length identical with that of the mounting plate 21.

[0004] Fig. 9 illustrates the conventional position detecting apparatus for an elevator viewed from right above it in the hoistway.

[0005] In Fig. 9, reference numeral 3 denotes a door apparatus on a car side to which the detector 10 is mounted. In addition, reference numeral 5 denotes a door apparatus on a hall side to which the device to be detected 20 is mounted.

[0006] In the conventional position detecting apparatus for an elevator configured as described above, the detector 10 mounted on the door apparatus 3 on the car side passes the device to be detected 20 mounted on the door apparatus 5 on the hall side as an elevator moves, thereby detecting a door opening and closing possible position. A control apparatus of the elevator effects determination of a stop position of the car and opening and closing of the door using a signal representing the door opening and closing possible position.

[0007] In the above-mentioned conventional position detecting apparatus for an elevator, the permanent magnet 22 of the device to be detected 20 is configured in a form of one length. Thus, the apparatus requires the permanent magnet 22 to be exclusively used which meets a specification of a position detecting length if a plurality of devices to be detected 20 are provided to meet the specification of the position detecting length. As a result, manufacturing costs of the permanent magnet 22 is increased, which makes the device to be detected 20 expensive.

[0008] In addition, if the permanent magnet 22 has a long shape, it becomes susceptible to damages during transportation and assembling work.

[0009] Moreover, in case of an earthquake, a car swings to bring the detector 10 in interference with the permanent magnet 22 of the device to be detected 20 and the detector 10 is damaged.

DISCLOSURE OF THE INVENTION

[0010] The present invention has been devised in order to solve the above-mentioned problems, and it is an object of the present invention to provide a position detecting apparatus for an elevator which can provide an inexpensive device to be detected and with which a detector is not damaged even when the detector and the device to be detected interfere with each other.

[0011] A position detecting apparatus for an elevator in accordance with the present invention includes a detector disposed on one of a car side of an elevator travelling up and down in a hoistway and a hall side of the hoistway and a device to be detected disposed on the other of the car side and the hall side, in which the detector has lead switches, and the device to be detected has a mounting plate for securing the device to be detected on the other of the car side and the hall side and a plurality of permanent magnets of a predetermined shape which are spaced apart from each other and disposed in a moving direction of the car on the mounting plate.

[0012] In addition, in the position detecting apparatus for an elevator in accordance with the present invention, the device to be detected has a first permanent magnet disposed in both ends of the mounting plate and having strong magnetic force that brings the lead switches into an ON level and a second permanent magnet disposed in the portion excluding both the ends of the mounting plate and having weak magnetic force between the ON level and an OFF level of the lead switches.

[0013] In addition, in the position detecting apparatus for an elevator in accordance with the present invention, the first permanent magnet consists of two permanent magnets of a predetermined shape which are overlapped and disposed on the mounting plate and the second permanent magnet consists of only one permanent magnet of a predetermined shape which is disposed on the mounting plate.

[0014] In addition, in the position detecting apparatus for an elevator in accordance with the present invention, the plurality of permanent magnets of a predetermined shape have identical surfaces that face the lead switches.

[0015] In addition, in the position detecting apparatus for an elevator in accordance with the present invention, the plurality of permanent magnets of a predetermined shape are covered by a rubber body.

[0016] Moreover, in the position detecting apparatus for an elevator in accordance with the present invention,

the detector has a lead switch mounting plate on the side of which the lead switches are secured and its upper and lower ends on the side facing the device to be detected are slant cut and a mounting plate, which has a spring structure, for securing the lead switch mounting plate on one of the car side and the hall side.

[0017] Other objects and features of the present invention will be apparent from the following descriptions taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In the accompanying drawings:

Fig. 1 illustrates a position detecting apparatus for an elevator in accordance with a first embodiment of the present invention viewed from a side of a hoistway;

Fig. 2 is a side view of the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention;

Fig. 3 illustrates a configuration of the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention viewed from right above it in the hoistway;

Fig. 4 illustrates a configuration of a device to be detected of the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention;

Fig. 5 illustrates variation of magnetic force in a longitudinal direction of the device to be detected of the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention;

Fig. 6 illustrates a situation in which a detector and the device to be detected of the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention contacts with each other;

Fig. 7 illustrates a configuration of the device to be detected of the position detecting apparatus for an elevator in accordance with a second embodiment of the present invention;

Fig. 8 is a side view of a conventional position detecting apparatus for an elevator; and

Fig. 9 illustrates a configuration of the conventional position detecting apparatus for an elevator viewed right above it in a hoistway.

BEST MODE FOR CARRYING OUT THE INVENTION

Embodiment 1

[0019] A position detecting apparatus for an elevator in accordance with Embodiment 1 of the present invention will be described with reference to the accompanying drawings. Fig. 1 illustrates a configuration of the position detecting apparatus for an elevator in accordance with Embodiment 1 of the present invention as viewed from a side of a hoistway. Further, in each drawing, identical reference numerals denote identical or equivalent parts.

[0020] In Fig. 1, reference numeral 1 denotes a rope of an elevator, 2 denotes a car traveling up and down in a hoistway of a building, 3 denotes a door apparatus on the car side, 4 denotes a hall of the elevator in the building, and 5 denotes a door apparatus on the hall side. In addition, reference numeral 10A denotes a detector mounted on the door apparatus 3 on the car side and 20A denotes a device to be detected mounted on the door apparatus 5 on the hall side.

[0021] Fig. 2 illustrates a configuration of the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention viewed from a side of the hoistway.

[0022] In Fig. 2, the detector 10A is provided with lead switches (lead relays) 12 and 13, a mounting plate 14 made of a steel sheet having a substantially C shaped cross section and a lead switch mounting plate 15 on the side of which the lead switches 12 and 13 are mounted and which is composed of a steel sheet of a nonmagnetic body having slant cut parts 15a in two parts, in the upper part and the lower part.

[0023] In addition, in the figure, the device to be detected 20A is provided with a mounting plate 21 composed of a steel sheet of a magnetic body having a substantially L shaped cross section and a magnetic member 23 secured to the mounting plate 21 and having a rectangular parallelepiped shape.

[0024] This magnetic member 23 is composed of permanent magnets 24 formed in a shape of a small rectangular parallelepiped having a fixed dimension and a rubber body (resin) 25 molding the surrounding of the permanent magnets 24.

[0025] At both ends of the magnetic member 23, two permanent magnets 24 are overlapped and mounted on the mounting plate 21, in order to give strong magnetic force exceeding an ON level of the lead switches 12 and 13 such that positional accuracy of ON and OFF operating points of the lead switches 12 and 13 is realized. In addition, since magnetic force capable of holding the ON state of the lead switches 12 and 13 is sufficient for intermediate parts other than both the ends of the magnetic member 23, only one permanent magnet 24 is mounted on the mounting plate 21 for each intermediate part. Moreover, the permanent magnets 24 are spaced apart from each other when mounted on the mounting plate 21 utilizing a hysteresis property of the lead switches 12 and 13.

[0026] Fig. 3 illustrates the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention viewed from right above it in the hoistway.

[0027] In Fig. 3, the mounting plate 14 is made of a steel sheet having a spring structure with a substantially C shaped cross section so that the mounting plate 14

secures the detector 10A to the door apparatus 3 on the car side. In addition, the mounting plate 21 is made of a steel sheet with a substantially L shaped cross section so that the mounting plate 21 secures the device to be detected 20A to the door apparatus 5 on the hall side.

[0028] Fig. 4 illustrates a configuration of the device to be detected of the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention.

[0029] In Fig. 4, the upper part of the figure shows the device to be detected 20A viewed from the top and the lower part of the figure shows the device to be detected 20A viewed from the side. A plurality of small permanent magnets 24 are attached to the mounting plate 21 and are molded by the rubber body 25 such as resin to form the magnetic member 23. Further, this rubber body 25 is for protecting the permanent magnets 24 and is not always required as a function of the device to be detected.

[0030] In the position detecting apparatus for an elevator configured as described above, the device to be detected 20A of a given length can be configured by arranging a minimum number of small permanent magnets 24 that are formed in a fixed dimension as required for the given length. Since the surrounding of the permanent magnets 24 is molded by the rubber body 25, they can absorb an impact of external force.

[0031] Fig. 5 illustrates variation of magnetic force in a longitudinal direction of the device to be detected of the position detecting apparatus for an elevator in accordance with the first embodiment of the present invention.

[0032] In Fig. 5, the upper part of the figure shows the top and the side of the device to be detected 20A from which the rubber body 25 is removed. Both the ends of the device to be detected 20A where two small permanent magnets 24 are overlapped have magnetic force exceeding the ON level of the lead switches 12 and 13. The intermediate parts other than both the ends of the device to be detected 20A, where only one small permanent magnet 24 is mounted, respectively, on the mounting plate 21, have magnetic force not reaching the ON level but exceeding the OFF level of the lead switches 12 and 13. Further, polarities (NS) of all the permanent magnets 24 are identical with those of the conventional example shown in Fig. 9. That is, the polarity is N on the lead switches 12 and 13 side.

[0033] In addition, in Fig. 5, the lower part of the figure is a graph showing a hysteresis loop with a state (OFF, ON) of the lead switches on the horizontal axis and magnetic force on the vertical axis.

[0034] Fig. 6 illustrates a situation in which the detector and the device to be detected of the position detecting apparatus of an elevator in accordance with the first embodiment of the present invention contact with each other.

[0035] As shown in Fig. 6, if a car 2 is swung by an earthquake or the like and the detector 10A interferes with the device to be detected 20A, an impact exerted on the detector 10A and the device to be detected 20A can be absorbed by the lead switch mounting plate 15 made of a steel sheet with its side slant cut and the mounting plate 14 made of a steel sheet of a spring structure to be secured to the door apparatus 3 on the car side.

[0036] That is, according to this first embodiment, in the position detecting apparatus for an elevator provided with the detector 10A composed of the lead switches 12 and 13 on the car side and the device to be detected 20A composed of the permanent magnets 24 on the hall side of the hoistway as means for detecting a position of the car 2 of the elevator traveling up and down in the hoistway, the lead switches 12 and 13 being disposed vertically with respect to the permanent magnets 24, a plurality of small permanent magnets 24 of a fixed dimension are spaced apart from the one another and disposed on the mounting plate 21 in the moving direction of the lead switches 12 and 13 to configure the device to be detected 20 with a required dimension.

[0037] In addition, the device to be detected 20A is configured by overlapping two small permanent magnets 24 to dispose them on its both ends, and disposing only one small permanent_magnet 24 in the portion excluding both the ends. Further, alternatively one relatively large permanent magnet with strong magnetic force equivalent to that of two permanent magnets 24 may be disposed on both sides of the device to be detected.

[0038] In addition, the device to be detected 20A is configured by covering the permanent magnets 24 with the rubber body 25 such as resin.

[0039] Moreover, the detector 10A has the lead switch mounting plate 15 made of a steel sheet of a nonmagnetic body, which is slant cut on the side facing the permanent magnets 24 of the device to be detected 20A, on the side of the lead switches 12 and 13. In addition, the detector 10A has the mounting plate 14 made of a steel sheet having a spring structure to effectively secure the detector 10A to the door apparatus 3 on the car side.

[0040] Since the first embodiment of the present invention is configured as described above, the device to be detected 20A can be configured inexpensively. In addition, the detector 10A and the device to be detected 20A can be prevented from being damaged even when the detector 10A and the device to be detected 20A are brought into interference with each other.

Embodiment 2

[0041] A position detecting apparatus in accordance with Embodiment 2 of the present invention will be described with reference to the accompanying drawings. Fig. 7 illustrates a configuration of a device to be detected of the position detecting apparatus for an elevator in accordance with Embodiment 2 of the present invention. Further, the detector is the same as that of the above-

mentioned first Embodiment 1.

[0042] In Fig. 7, the upper part of the figure shows a device to be detected 20B viewed from the top, and the lower part of the figure shows the device to be detected 20B viewed from the front side and the device to be detected 20B viewed from the right side.

[0043] In addition, in the figure, the device to be detected 20B is provided with a mounting plate 21 having a step in the portion for attaching permanent magnets 24 with a substantially L shaped cross section in its central part and the magnet member 23 of a substantially saddle shape extending over the step. That is, the portion of the mounting plate 21 for attaching the permanent magnets 24 is receded by the thickness of the permanent magnet 24 only in both the ends of the magnet member 23 where two permanent magnets 24 are overlapped.

[0044] This magnet member 23 is composed of the permanent magnets 24 formed in a small rectangular parallelepiped shape of a fixed dimension and the rubber body (resin) molding the surrounding of the permanent magnets 24 as in the above-mentioned first embodiment.

[0045] The permanent magnets 24 are arranged such that the distance between the lead switches 12 and 13 of the detector 10A and the permanent magnet 24 of the device to be detected 20B is the same for all the permanent magnets 24. Thus, magnetic force of the permanent magnets 24 is applied to the lead switches 12 and 13 effectively.

[0046] Further, although a description was made of an example, in which the detector 10A is provided on the car side and the devices to be detected 20A and 20B are provided on the hall side, in the above-mentioned each embodiment, this may be made reverse. That is, the above-mentioned effect is not changed even if the detector 10A is provided on the hall side and the devices to be detected 20A and 20B are provided on the car side.

INDUSTRIAL APPLICABILITY

[0047] As described above, the position detecting apparatus for an elevator in accordance with the present invention includes a detector disposed on one of a car side of an elevator traveling up and down in a hoistway and a hall side of the hoistway; and a device to be detected disposed on the other of the car side and the hall side, in which the detector has lead switches; the device to be detected has a mounting plate for securing the device to be detected on the other of the car side or the hall side; and a plurality of permanent magnets of a predetermined shape which are spaced apart from one another and disposed in the direction of a moving direction of the car on the mounting plate, whereby the device to be detected can be configured inexpensively and damages to the permanent magnets of the device to be detected can be prevented.

[0048] In addition, as describe above, in the position detecting apparatus for an elevator in accordance with the present invention, the device to be detected has a first permanent magnet disposed in both ends of the mounting plate and having strong magnetic force that brings the lead switches into an ON level and a second permanent magnet disposed in other than both the ends of the mounting plate and having weak magnetic force between the ON level and an OFF level of the lead switches, whereby the device to be detected can be configured inexpensively and damage to the permanent magnets of the device to be detected can be prevented.

[0049] In addition, as described above, in the position detecting apparatus for an elevator in accordance with the present invention, the first permanent magnet consists of two permanent magnets of a predetermined shape which are overlapped and disposed on the mounting plate and the second permanent magnet consists of only one permanent magnet of a predetermined shape which is disposed on the mounting plate, whereby the device to be detected can be configured inexpensively and damage to the permanent magnets of the device to be detected can be prevented.

[0050] In addition, in the position detecting apparatus for an elevator in accordance with the present invention, the plurality of permanent magnets of a predetermined shape have identical surfaces opposing the lead switches, whereby magnetic force of the permanent magnets is applied to the lead switches effectively.

[0051] In addition, in the position detecting apparatus for an elevator in accordance with the present invention, the plurality of permanent magnets of a predetermined shape are covered by a rubber body, whereby the rubber body can protect the permanent magnets by absorbing an impact of external force exerted thereon.

[0052] Moreover, in the position detecting apparatus for an elevator in accordance with the present invention, the detector has a lead switch mounting plate on the side of which the lead switches are secured and its upper and lower ends on the side facing the device to be detected are slant cut, and a mounting plate, having a spring structure for securing the lead switch mounting plate on one of the car side and the hall side. therefore, damages to the detector and the device to be detected can be prevented even when the detector and the device to be detected are brought into interference with each other.

Claims

1. A position detecting apparatus for an elevator comprising;

   a detector disposed on one of a car side of an elevator travelling up and down in a hoistway and a hall side of said hoistway; and

   a device to be detected disposed on the other of said car side and said hall side,

   wherein said detector has lead switches, and

said device to be detected has a mounting plate for securing said device to be detected on the other of said car side and said hall side and a plurality of permanent magnets of a predetermined shape which are spaced apart from each other and disposed in a moving direction of the car on the mounting plate.

2. A position detecting apparatus for an elevator according to claim 1, wherein said device to be detected has a first permanent magnet disposed in both ends of said mounting plate and having strong magnetic force that brings said lead switches into an ON level and a second permanent magnet disposed in other than both the ends of said mounting plate and having weak magnetic force between the ON level and an OFF level of said lead switches.

3. A position detecting apparatus for an elevator according to claim 2, wherein said first permanent magnet is two permanent magnets of a predetermined shape which are overlapped and disposed on said mounting plate, and said second permanent magnet is only one permanent magnet of a predetermined shape which is disposed on said mounting plate.

4. A position detecting apparatus for an elevator according to claim 1, wherein said plurality of permanent magnets of a predetermined shape have identical surfaces opposing said lead switches.

5. A position detecting apparatus for an elevator according to claim 2, wherein said plurality of permanent magnets of a predetermined shape are covered by a rubber body.

6. A position detecting apparatus for an elevator according to claim 2, wherein said detector has a lead switch mounting plate on the side of which said lead switches are secured and its upper and lower ends on the side facing said device to be detected are slant cut and a mounting plate, which has a spring structure, for securing said lead switch mounting plate on one of said car side and said hall side.

FIG. 1

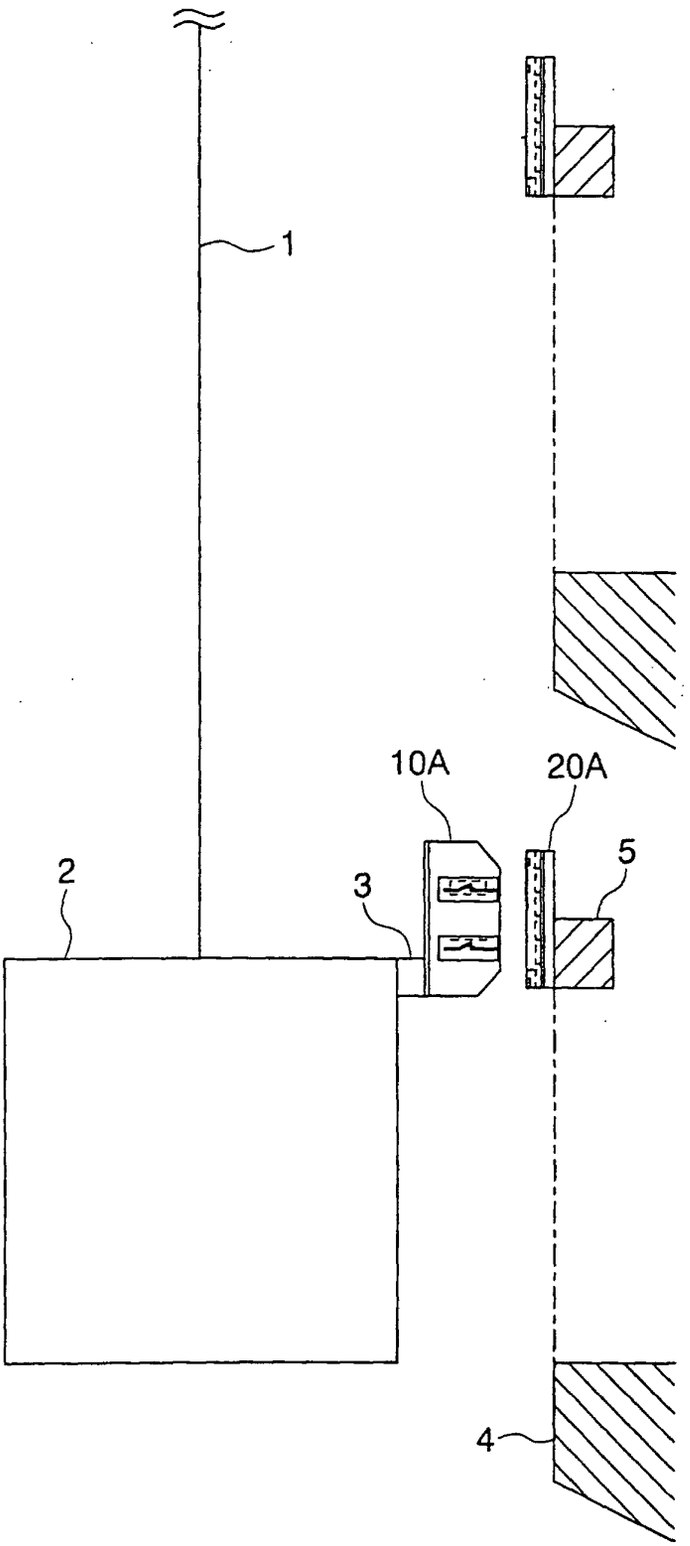


FIG. 2

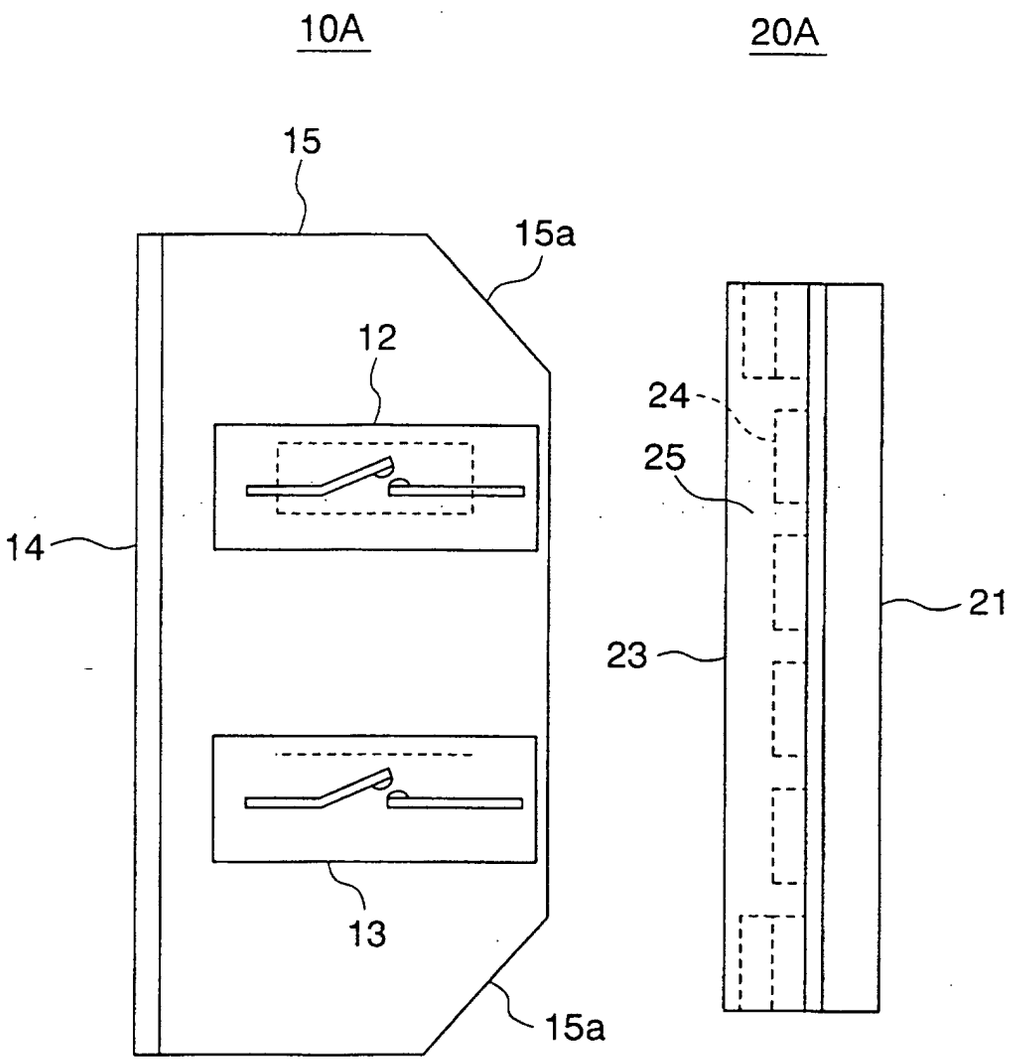


FIG. 3

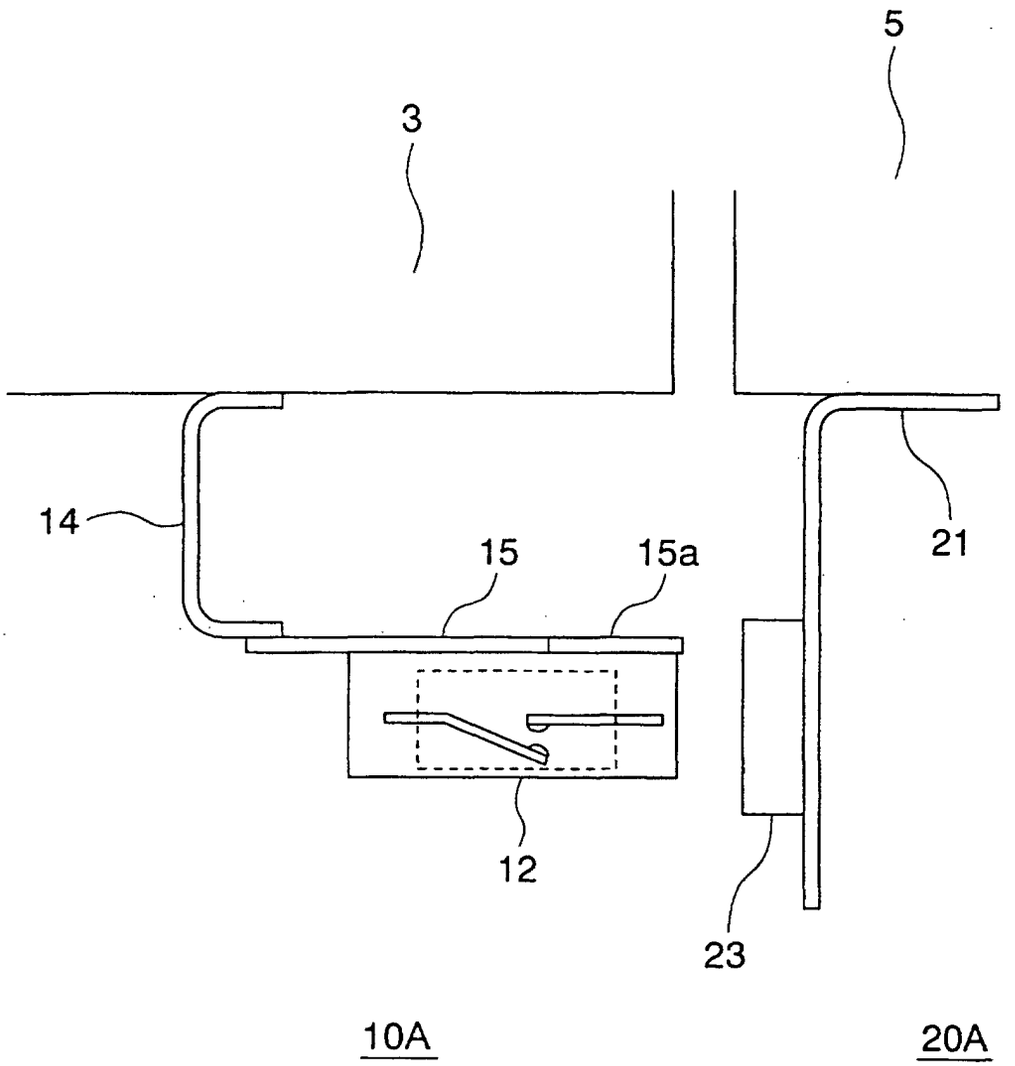


FIG. 4

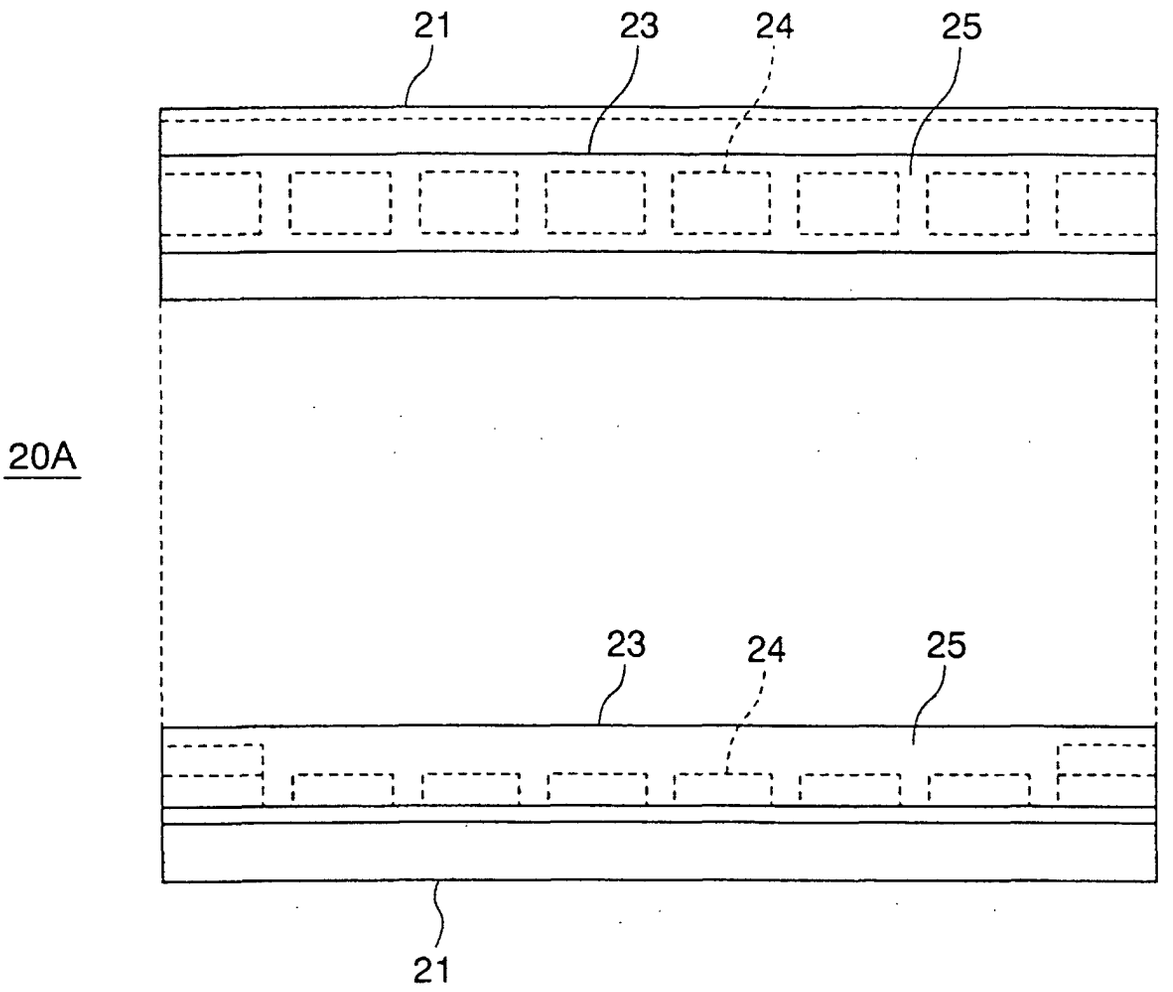
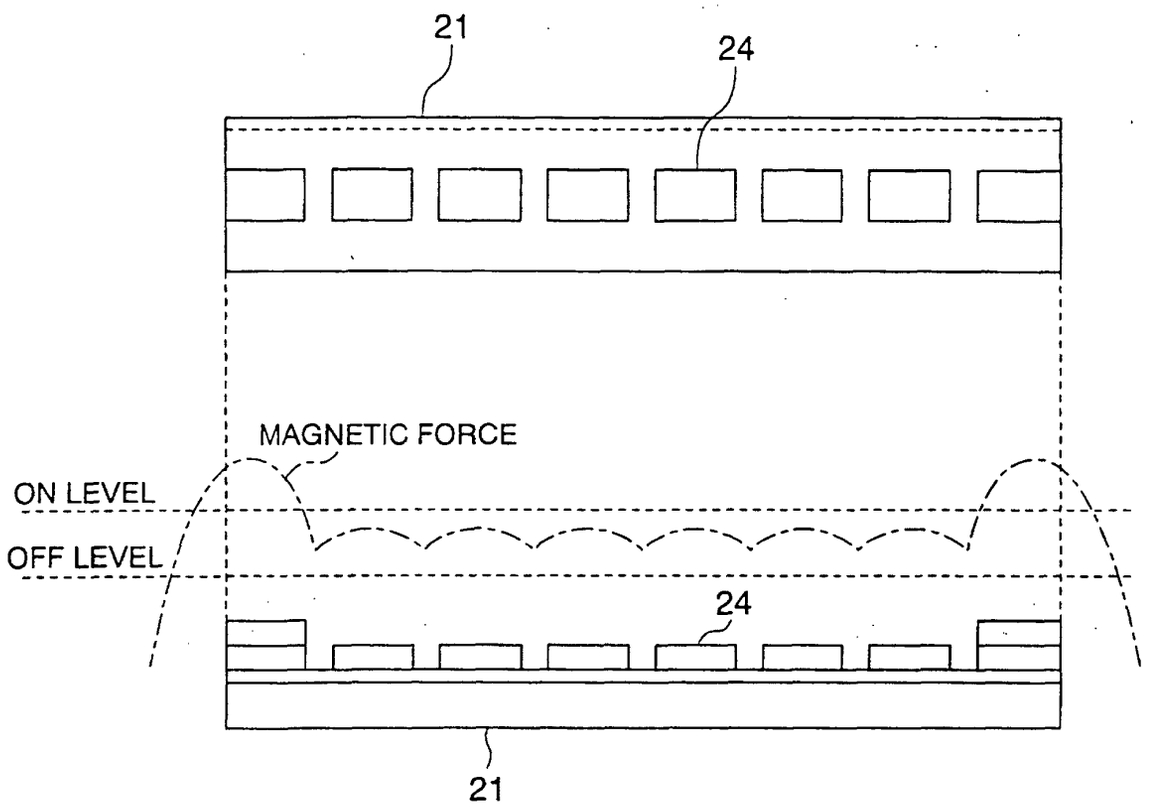


FIG. 5


21
24
MAGNETIC FORCE
ON LEVEL
OFF LEVEL
24
21

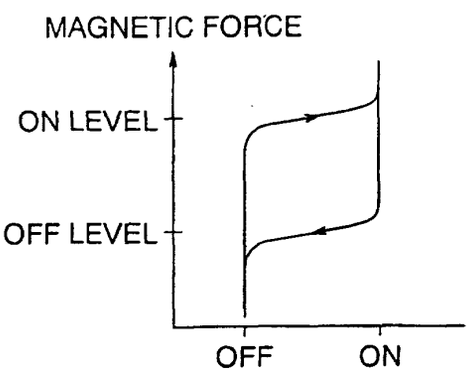

MAGNETIC FORCE
ON LEVEL
OFF LEVEL
OFF
ON

FIG. 6

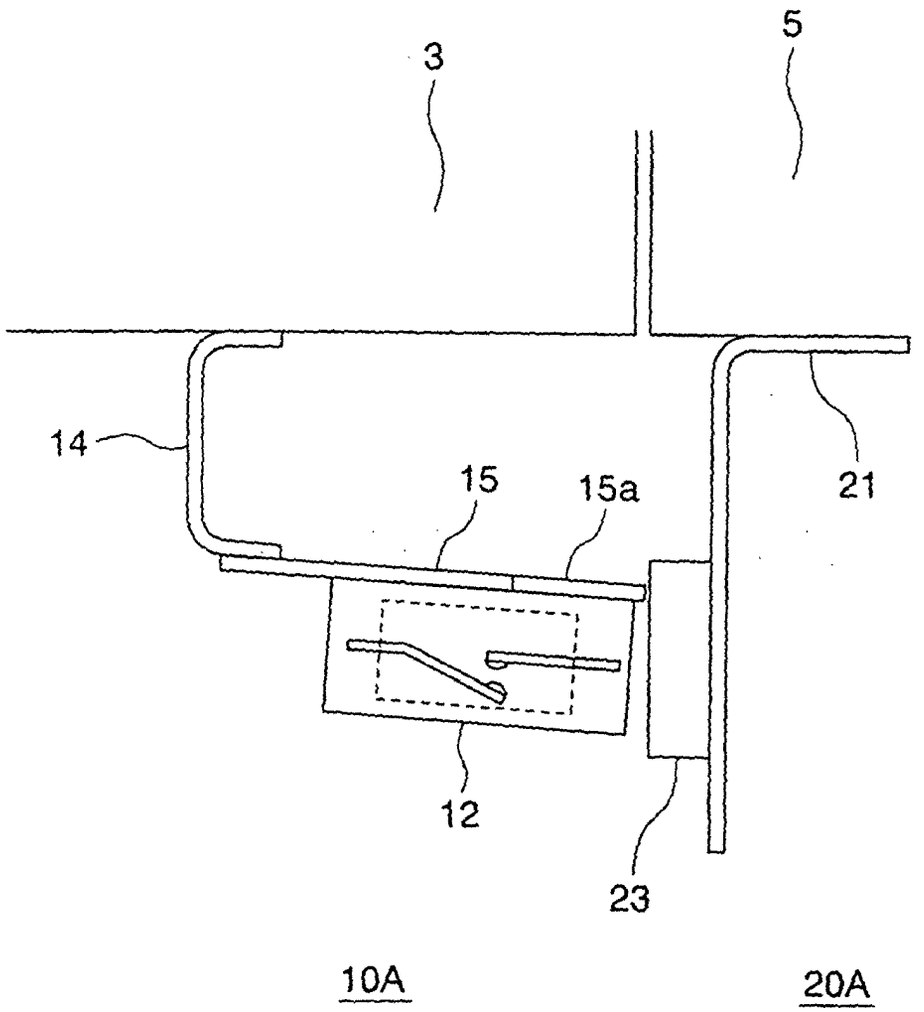


FIG. 7

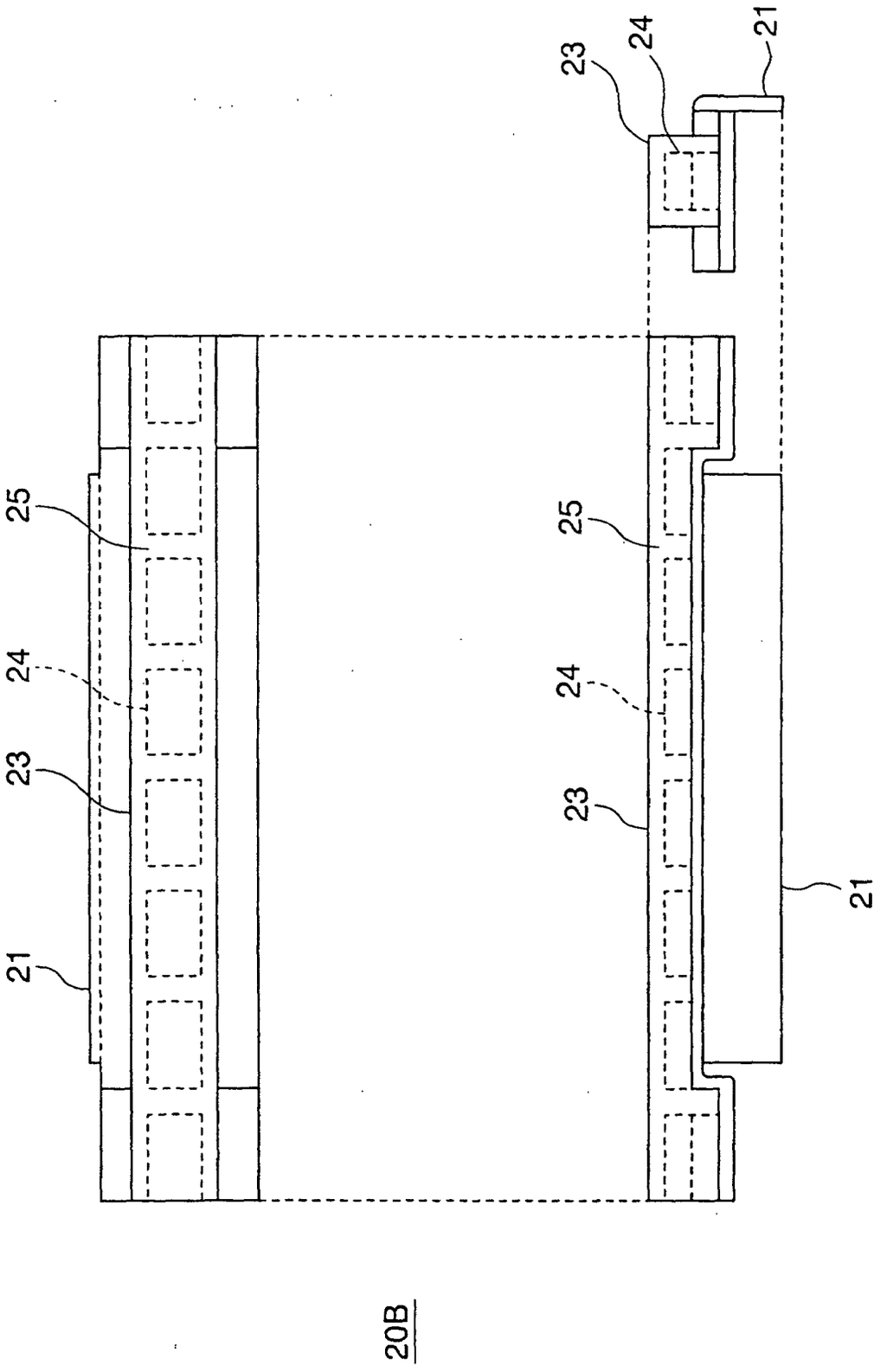


FIG. 8
PRIOR ART

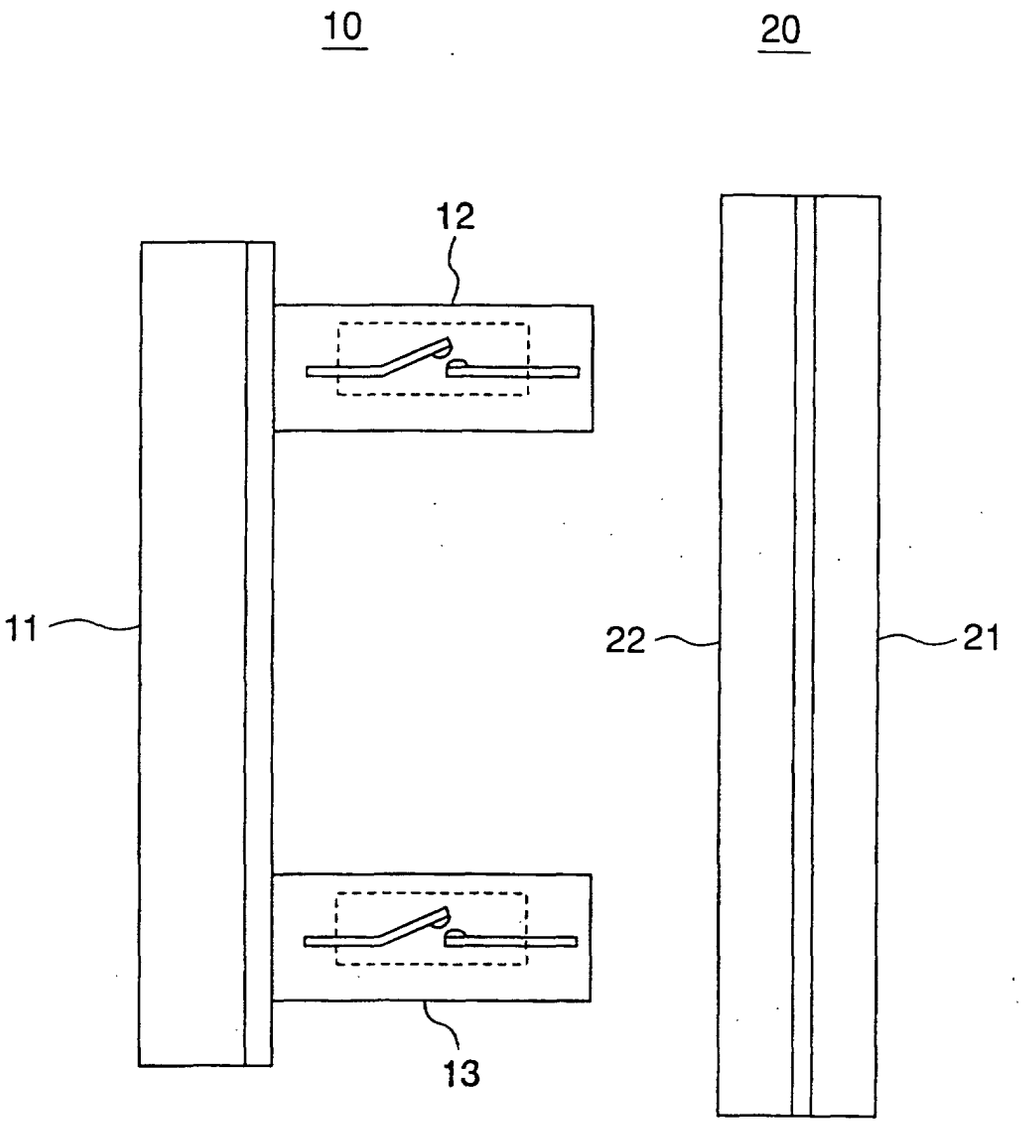
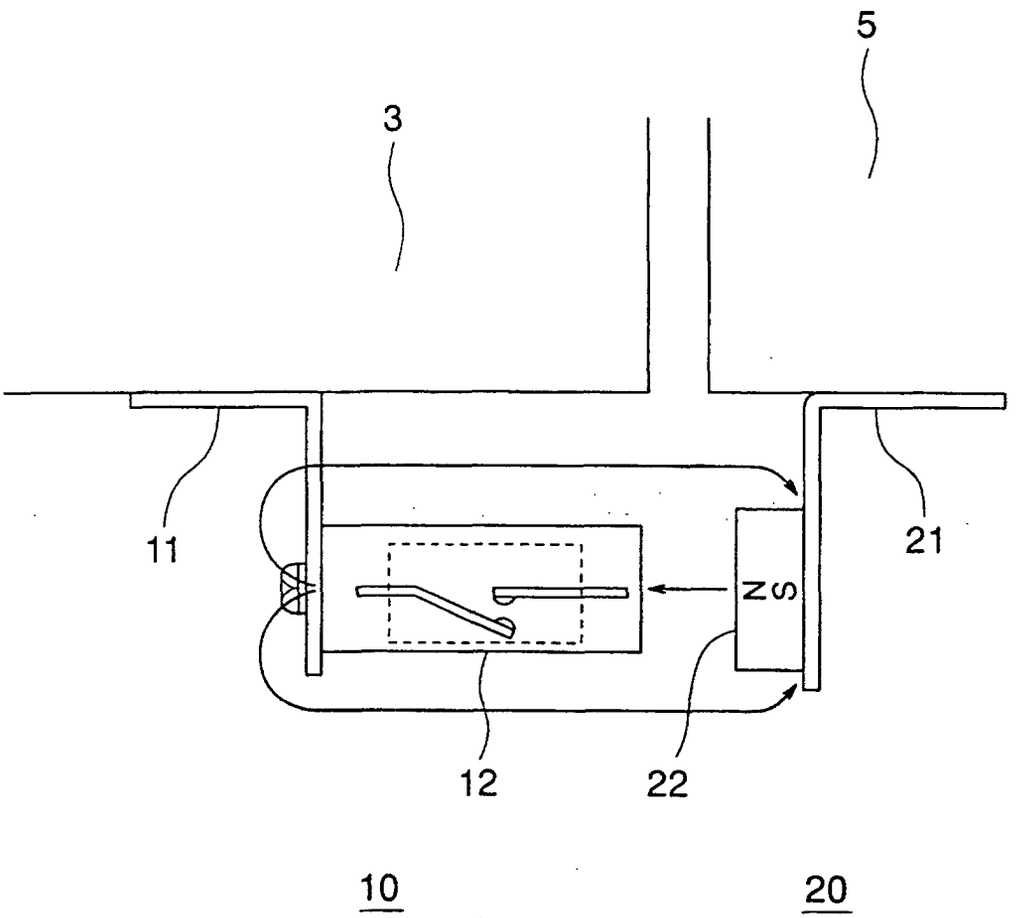


FIG. 9
PRIOR ART



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/06603

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B1/36

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[7] B66B1/00-B66B3/02

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Toroku Jitsuyo Shinan Koho	1994-2002

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.
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X A	JP 5-32381 A (Toshiba Corp.), 09 February, 1993 (09.02.93), (Family: none)	1,4 2-3,5-6
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A	US 5798490 A (Kone Oy.), 25 August, 1998 (25.08.98), & AU 8174494 A & BR 9405283 A & CA 2139142 A & CN 1112514 A & EP 0661228 A2 & FI 935909 A & JP 7-257845 A	1-6

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 April, 2002 (16.04.02)	30 April, 2002 (30.04.02)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/06603

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 178151/1984(Laid-open No. 92678/1986) (Hitachi, Ltd.), 16 June, 1986 (16.06.86), (Family: none)	1-6
A	JP 11-51696 A (Nitto Denko Corp.), 26 February, 1999 (26.02.99), (Family: none)	1-6
A	JP 7-220594 A (K.K. Nippon Automation), 18 August, 1995 (18.08.95), (Family: none)	1-6

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