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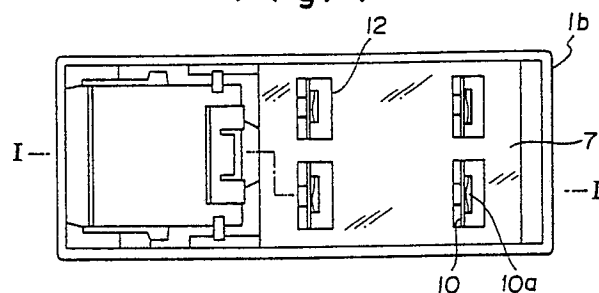
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(54) Electromagnetic relay having monitoring windows.

(57) An electromagnetic relay, comprising: an inner casing consisting of opaque and electrically insulating material accommodating moveable contact pieces and fixed contact pieces therein; an outer casing consisting of a base through which terminals pieces for the contact pieces are passed, and a transparent cover for accommodating a solenoid and said inner casing therein; and an actuating member functionally engaged to an armature of said solenoid at its one end and to said moveable contact piece at its other end. The inner casing is provided with openings for exposing the moveable contact pieces, in particular their contact points for permitting the inspection of the operation of the contact pieces and the state of the contact points. The moveable contact pieces may be provided with indication markers for facilitating the inspection of the operation of the moveable contact pieces, and the parts surrounding the openings may be provided with identification markers for identifying the corresponding moveable contact pieces.

Fig. 1



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ELECTROMAGNETIC RELAY HAVING MONITORING WINDOWS

TECHNICAL FIELD

The present invention relates to an electromagnetic relay which uses an inner casing for its contact mechanism but permits visual inspection of its contact mechanism.

BACKGROUND OF THE INVENTION

According to a conventional electromagnetic relay, its contact mechanism comprising fixed contact pieces carrying fixed contact points, moveable contact pieces carrying moveable contact points for cooperating with the fixed contact points is accommodated in an inner casing, and the base ends of the contact pieces are passed through the bottom wall of the inner casing and also the bottom wall or the base of the outer casing which encloses the inner casing. The inner casing serves as a structural member for supporting the contact pieces, and may be provided with partition walls separating contact pieces belonging different circuits apart. A solenoid is provided externally of the inner casing but internally of the outer casing, and an actuating member is engaged with an armature of the solenoid at its one end and with the moveable contact pieces at its other ends for transmitting the movement of the armature to the moveable contact pieces. The use of such an inner casing is useful not only for physically and electrically separating the contact pieces but also for facilitating the assembly work.

However, according to such an electromagnetic relay, should any failure occur, it is not easy to detect the source of the failure which is most often caused by the problems with the moveable contact pieces or their contact points.

It is also recommended to inspect the state of such electromagnetic relays at regular intervals to prevent a costly failure of the larger system which includes these electromagnetic relays. But, since they are totally covered and cannot be inspected other than electrically checking them, it is very cumbersome to inspect them and the possibility of detecting any potential failures is low.

BRIEF SUMMARY OF THE INVENTION

In view of such problems of the prior art, a primary object of the present invention is to provide an electromagnetic relay which allows any failures in its contact mechanism to be easily discovered.

A second object of the present invention is to provide an electromagnetic relay which simplifies maintenance work.

According to the present invention, these objects are accomplished by providing an electromagnetic relay, comprising: an inner casing consisting of opaque and electrically insulating material accommodating at least one moveable contact piece and at least one fixed contact piece therein; an outer casing made of transparent material at least in part thereof for accommodating a solenoid and the inner casing therein; and an actuating member functionally engaged to an armature of the solenoid at its one end and to the moveable contact piece at its other end; the inner casing being provided with an opening which exposes at least a part of the moveable contact piece through the transparent part of the outer casing.

Thus, according to the present invention, since the inner casing is provided with an opening for allowing the moveable contact piece to be monitored from outside, the position of the moveable contact piece and the state of the contact point carried by the moveable contact piece can be visually inspected as required. Therefore, according to the present invention, discovering faulty contact points can be made visually, and the state of the contact point can be readily checked, whereby the system repair and maintenance are both simplified.

According to a preferred embodiment of the present invention, the outer casing comprises a base through which terminal pieces for the solenoid and the contact pieces are passed, and a cover made of transparent material and fitted upon the base. Preferably, the moveable contact piece is integral with or attached to one of the terminal pieces passed through the base, and the opening of the inner casing is provided adjacent a free end of the moveable contact piece. Thus, the contact mechanism is both physically and electrically protected and the assembly work of the electromagnetic relay is simplified.

To even better achieve the objects of the present invention, it is preferred that the free end of the moveable contact piece is provided with an indicator marker which shows through the opening at one of its operative positions but hides from the opening at another of its operative positions. Preferably, the indicator marker consists of an extension of the moveable contact piece bent perpendicularly therefrom, and the opening consists of an L shaped opening consisting of a first portion for selectively showing the indicator marker and a second portion for showing a contact point of the

moveable contact piece.

As an advantageous way of labeling the contact points, an identification mark for the moveable contact piece may be provided on the external surface of the inner case adjacent the opening.

BRIEF DESCRIPTION OF THE DRAWINGS

Now, preferred embodiments of the present invention are described in the following with reference to the appended drawings, in which:

Figure 1 is a plan view showing a first embodiment of the present invention;

Figure 2 is a sectional view taken along line I-I of Figure 1;

Figure 3 is an enlarged fragmentary perspective view of the free end of one of the moveable contact pieces according to a second embodiment of the present invention;

Figures 4 and 5 are plan views of the electromagnetic relay of the second embodiment of the present invention showing two different states of the moveable contact pieces;

Figure 6 is a view similar to Figure 1 showing a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is a plan view of the electromagnetic relay according to the present invention, and Figure 2 shows a sectional view taken along line I-I of Figure 1.

The electromagnetic relay comprises an outer casing 1 consisting of a base 1a and a transparent cover 1b fitted thereon. A solenoid 2 consisting of a bobbin and a coil wire 2a wound thereon is vertically disposed on one side of the upper surface of the base 1a. The start and end leads of the coil wire 2a are connected to coil terminals 3 which are passed through the base 1a of the outer casing 1.

An armature 5 which is pivotally mounted on the solenoid 2 by way of a hinge spring 4 is arranged adjacent the upper end of the solenoid 2 so as to be able to move toward and away from a magnetic pole surface 2b of the solenoid 2, and an extension 6 is bent substantially perpendicularly from the armature 5 and extends in parallel with the solenoid 2 so as to be moved toward and away from the solenoid 2 according to the movement of the armature away from and towards the magnetic pole surface 2b, respectively.

Numerical 7 denotes an inner casing which is mounted on the other side of the upper surface of the base 1a. This inner casing 7 is constructed as a hollow box made of opaque and electrically in-

ulating material such as synthetic resin, and is provided with support columns for fixed contact pieces 9 and moveable contact pieces 10 which are described hereinafter and projecting walls 7a, 7b, .. serving as partition walls projecting from the bottom wall and the upper wall of the inner casing 7, respectively, in mutually opposing relationship.

The base 1a of the outer casing and the bottom wall of the inner casing 7 are provided with a plurality of terminal pieces 8 passed therethrough, and these terminal pieces 8 are connected to normally closed and normally open fixed contact pieces 9 and moveable contact pieces 10 placed between the normally closed contact pieces 9 and the normally open contact pieces 9 in the inner casing 7.

Numerical 11 denotes an actuating member which is engaged to a lower end portion of the aforementioned extension 6 at its one end to the moveable contact pieces 10 at its other parts so that the movement of the extension 6 may cause the horizontal movement of the actuating member 11 inside the box-shaped inner casing 7 and the moveable contact pieces 10 may be switched over from contacting normally closed fixed contact pieces 9 to contacting normally open fixed contact pieces 9.

Now, the top wall of the inner casing 7 is provided with rectangular windows 12 for permitting the inspection of the moveable contact pieces 10 whose lower ends are supported by the bottom wall of the inner casing 7.

In the drawings, numeral 1b denotes a transparent cover for covering the main part of the electromagnetic relay by being fitted upon the periphery of the bottom wall 1a.

Thus, since the present invention has the above described structure, when this electromagnetic relay is energized, the armature 5 is attracted to the magnetic pole surface 2b of the solenoid 2 and the movement of the extension 6 resulting from the displacement of the armature 5 causes the horizontal movement of the actuating member 11. As a result, the moveable contact pieces 10 are moved away from the normally closed fixed contact pieces 9 and are pushed against the normally open fixed contact pieces 9.

When the solenoid is deenergized, the magnetic pole surface 2b is demagnetized and the armature 5 is moved away from the magnetic pole surface 2b by the hinge spring 4. The resulting movement of the extension 6 causes the actuating member 11 to be horizontally moved back to its original position and the moveable contact pieces 10 which have been in contact with the normally open fixed contact pieces 9 are now brought back in contact with the normally closed fixed contact pieces 9 so as to achieve the desired switching operation. These contact operations can be visually

inspected from the monitoring windows 12 which are provided in the top wall of the box-shaped inner casing 7 covering the fixed contact pieces 9 and the moveable contact pieces 10.

Thus, according to the electromagnetic relay of the present invention, since the change in the contact positions resulting from the displacement of the moveable contact pieces can be easily monitored from the monitoring windows provided in the top wall of the inner casing, the contact points can be checked from the monitoring windows in case of a failure of the electronic system, and the required repair work can be quickly performed.

Also, since the wears and damages of the contact points can be easily inspected, the regular inspection work is simplified and improved system maintenance is made possible. To achieve this advantage, the monitoring windows 12 should be large enough to expose the contact points 10a to the outside.

Now, a second embodiment of the present invention is described in the following with reference to Figures 3 and 4.

According to this embodiment, each of the windows 12 is provided with a shielding portion 13 which defines the window 12, which is otherwise rectangular in shape, into the shape of letter L, and a projecting piece 14 is bent from an upper edge of each of the moveable contact pieces 10 so as to hide behind the shielding portion 13 when the solenoid 2 is deenergized as shown in Figure 4, and show in the corresponding monitoring window 12 when the solenoid 2 is energized as shown in Figure 5. The other part of the windows show the corresponding contact points 10a of the moveable contact pieces 10 so that they may be monitored for their positions and state of wear.

Therefore, when the moveable contact pieces 10 are operating properly during the energized state of the solenoid 2, the projecting pieces 14 provided in the moveable contact pieces 10 show in the monitoring windows 12 as shown in Figure 5 and the inspection of the operation of the contact points can be performed even more easily.

Figure 6 shows a third embodiment of the present invention according to which terminal numbers 16 and the polarity indications 17 of the terminal pieces are indicated around the monitoring windows 12 so as to permit recognition of the operative states of the circuits.

Although the present invention has been shown in terms of the specific types of electromagnetic relays, it can be applied to other types of electromagnetic relays. As a matter of fact, the present invention can be modified in various manners without departing from the spirit of the present invention which is set forth in the appended claims

Claims

1. An electromagnetic relay, comprising:
an inner casing consisting of opaque and electrically insulating material accommodating at least one moveable contact piece and at least one fixed contact piece therein;

an outer casing made of transparent material at least in part thereof for accommodating a solenoid and said inner casing therein; and

an actuating member functionally engaged to an armature of said solenoid at its one end and to said moveable contact piece at its other end;

said inner casing being provided with an opening which exposes at least a part of said moveable contact piece through said transparent part of said outer casing.

2. An electromagnetic relay according to claim 1, wherein said outer casing comprises a base through which terminal pieces for said solenoid and said contact pieces are passed, and a cover made of transparent material and fitted upon said base.

3. An electromagnetic relay according to claim 2, wherein said moveable contact piece is integral with or attached to one of said terminal pieces passed through said base, and said opening of said inner casing is provided adjacent a free end of said moveable contact piece.

4. An electromagnetic relay according to claim 3, wherein said free end of said moveable contact piece is provided with an indicator marker which shows through said opening at one of its operative positions but hides from said opening at another of its operative positions.

5. An electromagnetic relay according to claim 4, wherein said indicator marker consists of an extension of said moveable contact piece bent perpendicularly therefrom, and said opening consists of an L shaped opening consisting of a first portion for selectively showing said indicator marker and a second portion for showing a contact point of said moveable contact piece.

6. An electromagnetic relay according to claim 1, wherein an identification mark for said moveable contact piece is provided on the external surface of said inner case adjacent said opening.

7. An electromagnetic relay according to claim 1, wherein said opening is large enough to show a contact point of said moveable contact piece there-through.

Fig. 1

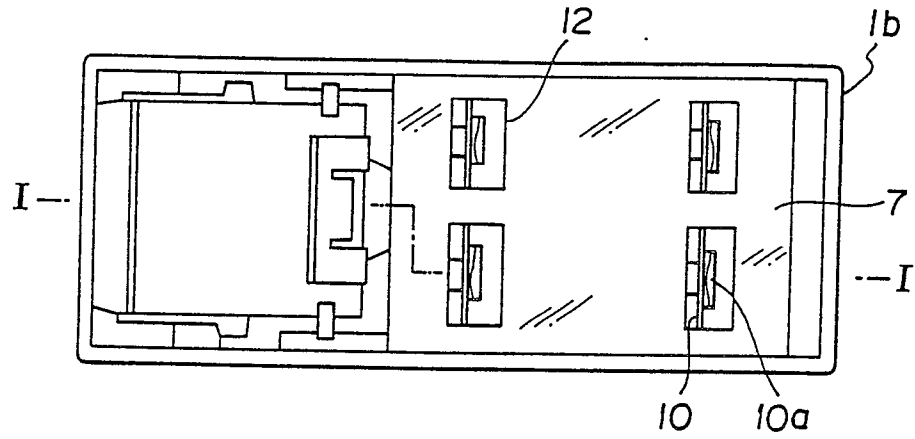


Fig. 2

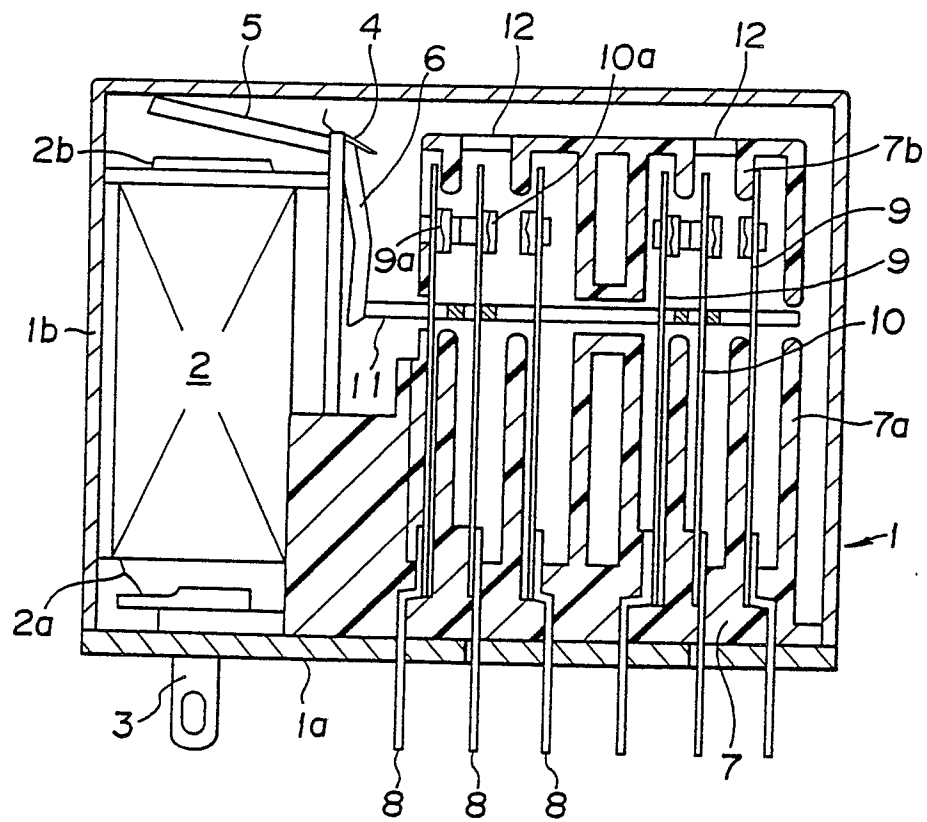


Fig. 3

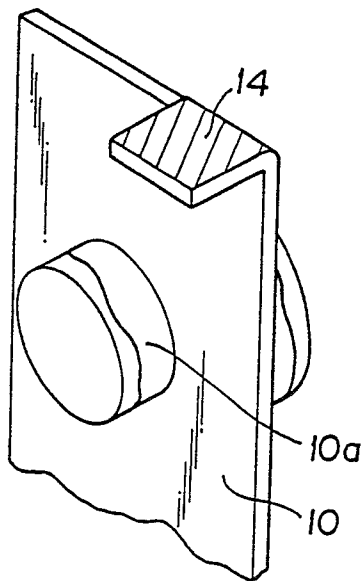


Fig. 4

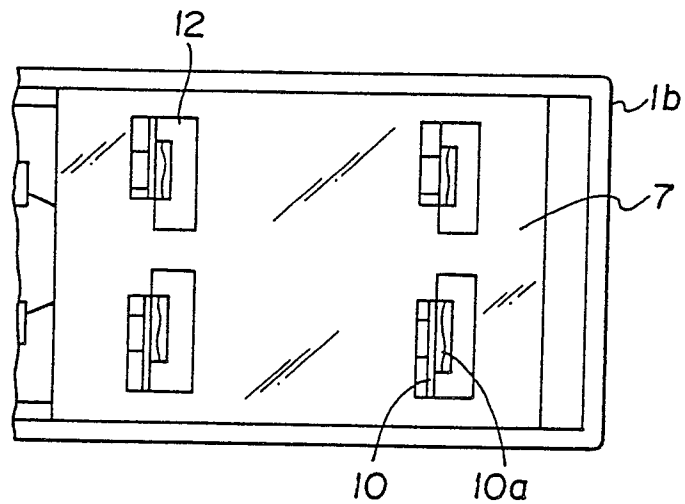


Fig. 5

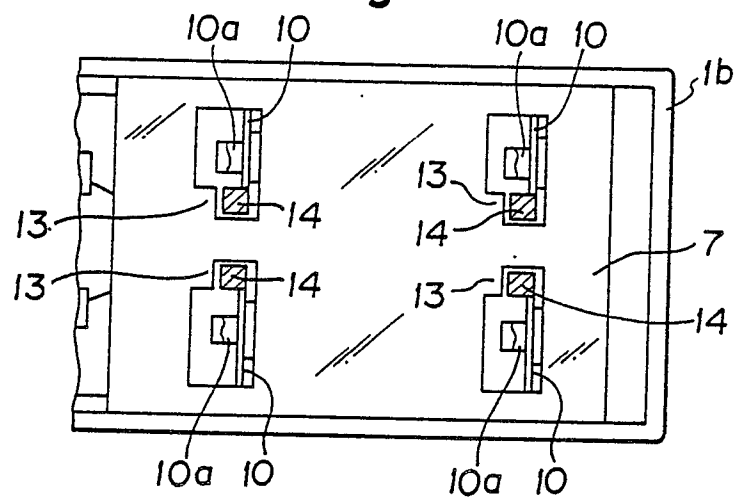


Fig. 6

