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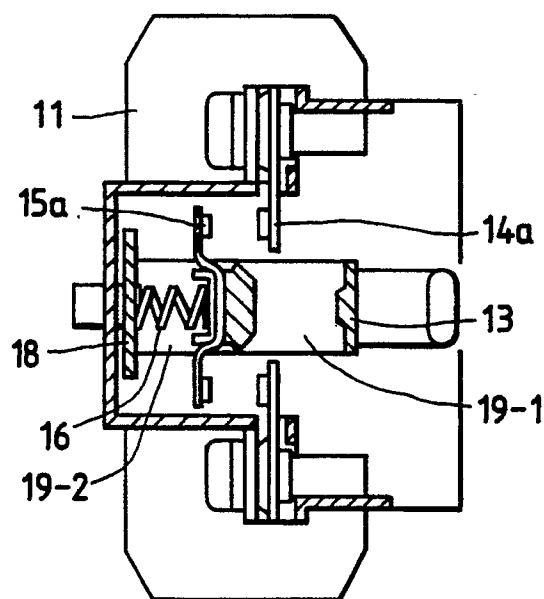
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54 **Contact device.**

57 A contact device includes a housing, a fixed contact, and a moving contact attached to a support frame, the support frame and moving contact movable within the housing perpendicular to the fixed contact. A stopping arm projects from the support frame to restrict movement of the support frame within the housing.

FIG. 1



CONTACT DEVICE

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a contact device and more specifically to a contact device to be attached to an electromagnetic switch for increasing the number of contacts.

Description of the Related Art

An electromagnetic contactor, such as an auxiliary relay, usually has auxiliary contacts. Occasionally, more auxiliary contacts are needed due to construction of a controlled circuit. In such a case, a separate contact device is attached to an electromagnetic contactor or an auxiliary relay to increase the number of the auxiliary contacts.

Fig. 3 is a side-elevational view showing a conventional contact device 1 attached to a head portion of a conventional electromagnetic contactor 2. Fig. 4 is a perspective view of the contact device 1 of Fig. 3. Fig. 5 is a perspective view of the electromagnetic contactor 2 of Fig. 3. When the two are to be connected together, frame hook portions 12 formed on a frame 11 of the contact device 1 are inserted in an engaging portion 21 of the electromagnetic contactor 2 to effect the desired connection. At this time, a contact support connector portion 13a of the contact device 1 is connected to a contact support 22 of the electromagnetic contactor 2. Through the operation of the contact support 22 of the electromagnetic contactor 2, a contact support 13 of the contact device 1 is driven (upward and downward in the drawings) to thereby open and close a contact (not shown).

A conventional a-contact is shown in Fig. 6. In Fig. 6, fixed a-contacts 14a are mounted within a frame 11. A conventional b-contact is shown in Fig. 7. In Fig. 7, fixed b-contacts 14b are mounted within the frame 11. The movable contact 15a (Fig. 6), 15b (Fig. 7) is supported on the contact support 13 through a contact spring 16. In the a-contact construction, the movable contact 15a is provided in corresponding relation to the fixed contact 14a, and in the b-contact construction, the movable contact 15b is provided in corresponding relation to the fixed contact 14b.

In such conventional contact devices, considering the disengagement of the contact support 13 from the frame 11 when all the contacts are of a b-contact construction as shown in Fig. 7, the mov-

able contact 15b is engageable with a distal end 14b₁ of the U-shaped fixed b-contact 14b, which thus serves as a stopper for preventing the contact support 13 from becoming disengaged from the frame 11.

Fig. 8 is a cross-sectional view of a second embodiment of a conventional b-contact construction which differs from that of Fig. 7 in that each fixed b-contact 14b is of a flat plate-like shape, and that a cover 17 is provided to serve as a stopper for preventing the contact support 13 from being disengaged from the frame 11.

As discussed above, conventional contact devices are shown in Figs. 6 - 8. The conventional contact device of a b-contact construction needs a stopper so that a contact support can not be disengaged from a frame. In Fig. 7, a fixed contact has a U-shaped cross-section, and a problem arises from this that since the width H of this U-shape is large, its dimension in a direction of movement of the contact support is large. With respect to the example shown in Fig. 8, since the cover is provided as a stopper, the number of the component parts as well as the time required for assembly is increased, resulting in increased costs.

It is an object of the present invention to provide a contact device which does not increase the dimension of a stopper, provided for preventing the disengagement of a contact support, in a direction of movement of the contact support, and also does not cause increased costs.

SUMMARY OF THE INVENTION

According to the present invention, the above object has been achieved by a contact device comprising fixed contacts fixed to a frame, a contact support mounted within said frame and being movable in its axial direction, and a movable contact mounted on said contact support through a contact spring, the contacts being opened and closed by the axial movement of said contact support, wherein a projecting piece is formed on an inner end of said contact support and projects from the opposite sides of said inner end; and the distance between the opposite ends of said projecting piece is greater than the distance between said fixed contacts.

In this construction, the projecting piece is formed on the inner end of the contact support, and therefore even in the case where the movable contact is arranged outwardly (the right side as shown in the drawings) of the fixed contacts, when

the contact support supporting the movable contact is moved, the projecting piece formed on the inner end of the contact support is abutted against the rear surface of the fixed contacts, so that the contact support will not be disengaged from the frame. The projecting piece can be very thin, and therefore the dimension in the direction of movement of the contact is not increased.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view of an a-contact device according to the present invention;

Fig. 2 is a cross-sectional view of a b-contact device according to the present invention;

Fig. 3 is a side-elevational view, showing a contact device attached to an electromagnetic contactor in an overhung manner;

Fig. 4 is a perspective view of the contact device of Fig. 3;

Fig. 5 is a perspective view of the electromagnetic contactor of Fig. 3;

Fig. 6 is a cross-sectional view of a conventional a-contact device;

Fig. 7 is a cross-sectional view of a conventional contact device; and

Fig. 8 is a cross-sectional view of yet another conventional b-contact device.

Additional objects and advantages of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations pointed out in the claims.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figs. 1 and 2 show preferred embodiments of the present invention. Fig. 1 is a cross-sectional view of an a-contact device. Fig. 2 is a cross-sectional view of a b-contact device. Referring to Figs. 1 and 2, fixed contacts attached to a frame 11 have a flat plate-like shape. In an a-contact device, there are provided fixed a-contacts 14a. In a b-contact device, there are provided fixed b-contacts 14b. Each of movable contacts 15a and 15b is supported on a contact support 13 through a contact spring 16, and is provided at contact support windows 19-1 and 19-2, respectively.

In the a-contact device shown in Fig. 1, the movable contact 15a is disposed inwardly (the left

side as shown in Fig. 1) of the fixed a-contact 14a. Therefore, when the contact support 13 moves in a right-hand direction, the movable contact 15a is brought into contact with the fixed a-contact 14a, so that the contact support 13 will not become disengaged from the frame 11.

In the b-contact device shown in Fig. 2, the movable contact 15b is disposed outwardly (the right side as shown in Fig. 1) of the fixed b-contact 14b. Therefore, when the contact support 13 is moved in a right-hand direction, the contact support 13 will tend to disengage from the frame 11. However, a projecting piece 18 formed on an inner end of the contact support 13 abuts against the rear surfaces of the fixed b-contacts 14b, thereby preventing the disengagement.

According to the present invention, the projecting piece is formed on the inner end of the contact support, and therefore the projecting piece performs the function of a stopper so that the contact support will not be disengaged from the frame. Further, there is no need to increase the number of the component parts and also no need to bend the fixed contact into a U-shaped cross-section, and therefore the cost of the material of the fixed contact is reduced to thus achieve a cost reduction. Further, since the fixed contact has a flat plate-like shape, its dimension in the direction of movement of the contact support is decreased, and an inexpensive, small-size contact device can be achieved.

Additional advantages and modifications will readily occur to the skilled in the art. The invention in its broader aspects is, therefore, not limited to the specific details shown and described. Accordingly, departures may be made from such details without departing from the scope of the applicant's invention.

Claims

1. A contact device, comprising:
means for housing the contact device;
a first contact portion attached to a first contact arm, said first contact arm fixedly depending from said housing means in a first direction;
a second contact portion attached to a second contact arm, said second contact arm being alternately movable within said housing means in an engaging direction, perpendicular to said first direction so as to bring said second contact portion into engaged relationship with said first contact portion, and a disengaging direction perpendicular to said first direction so as to bring said second contact portion out of engaged relationship with said first contact portion; and
means for supporting said second contact arm and

movable with said second contact arm within said housing means alternately in said engaging and disengaging directions, including a stopper spaced from said second contact arm extending from said supporting means in the first direction for stopping movement of said supporting means within said housing means. 5

2. The contact device of Claim 1, wherein said second contact arm is located on said supporting means between said stopper and said first contact arm, and said stopper engages said housing means to stop movement of said support means in the disengaging direction. 10

3. The contact device of Claim 1, wherein said second contact arm is located on said supporting means so that said first contact arm extends between said second contact arm and said stopper, and said stopper stops movement of said support means in the disengaging direction. 15

4. The contact device of Claim 1, further including means for urging said second contact arm into engagement with said first contact arm. 20

5. The contact device of Claim 1, wherein said urging means includes a spring connecting said second contact arm and said supporting means. 25

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FIG. 1

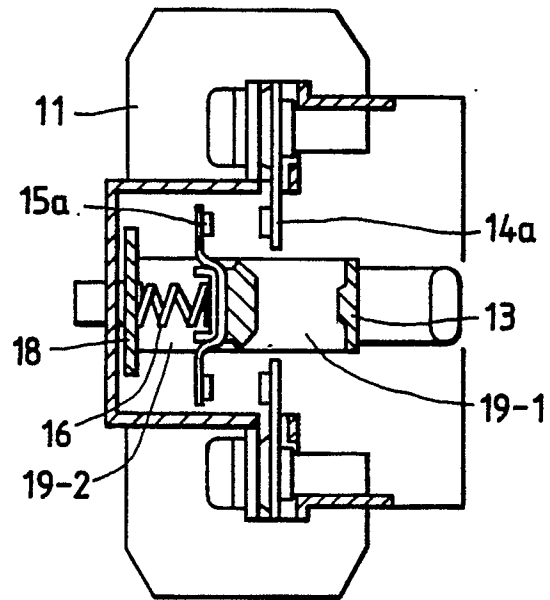


FIG. 2

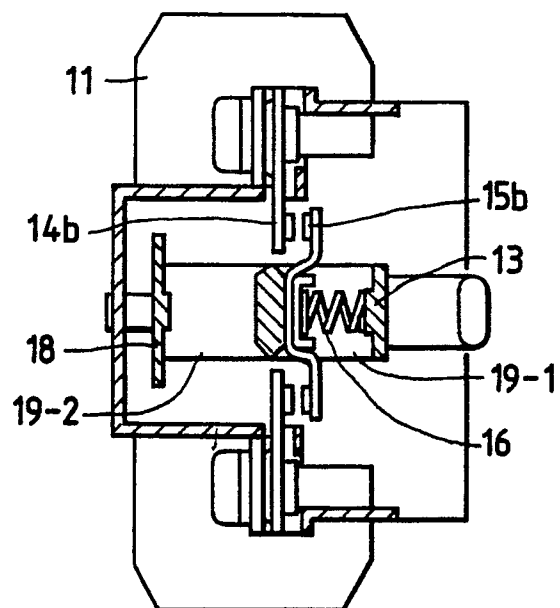


FIG. 3

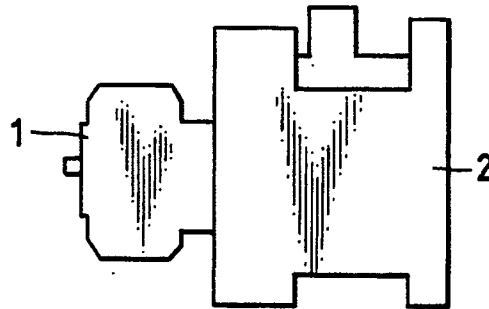


FIG. 4

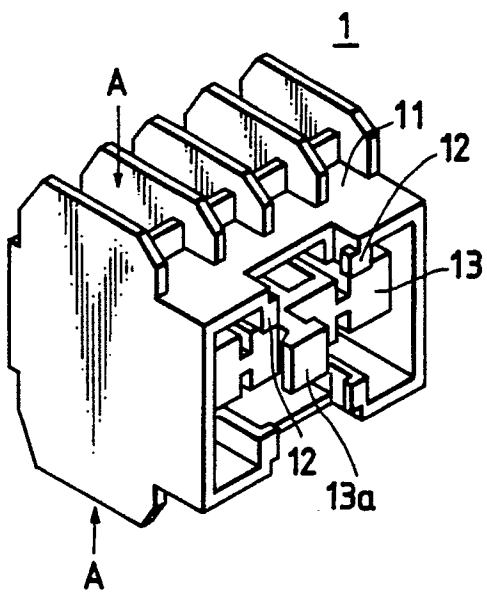


FIG. 5

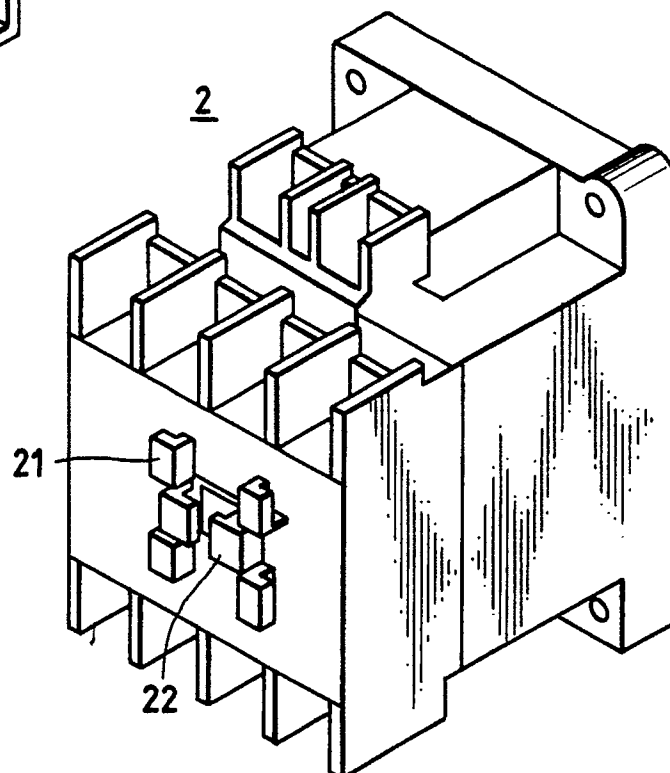


FIG. 6

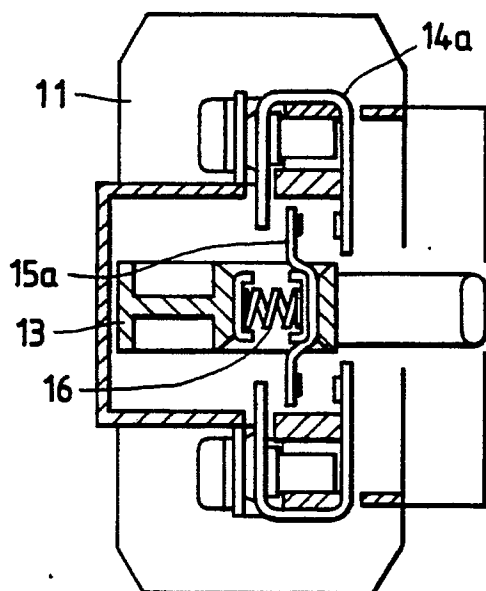


FIG. 7

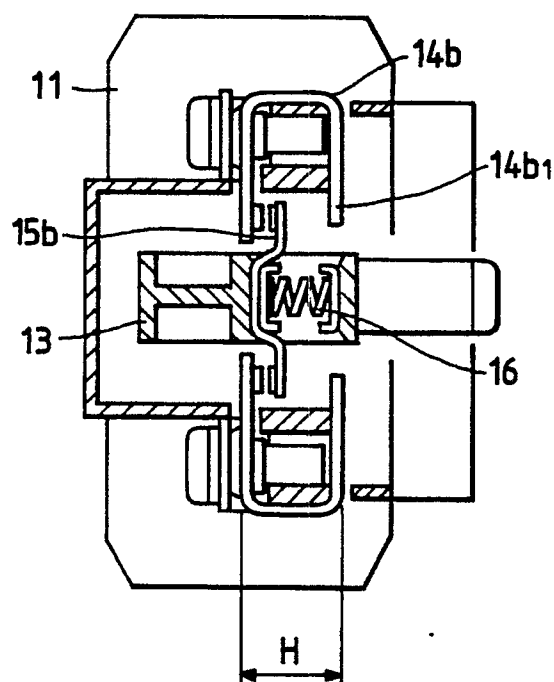


FIG. 8

