

[54] **ELECTRICAL SWITCHING APPARATUS**

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[51] Int. Cl. .... **H01h 1/12**

[58] Field of Search .... **335/198, 132; 200/280**

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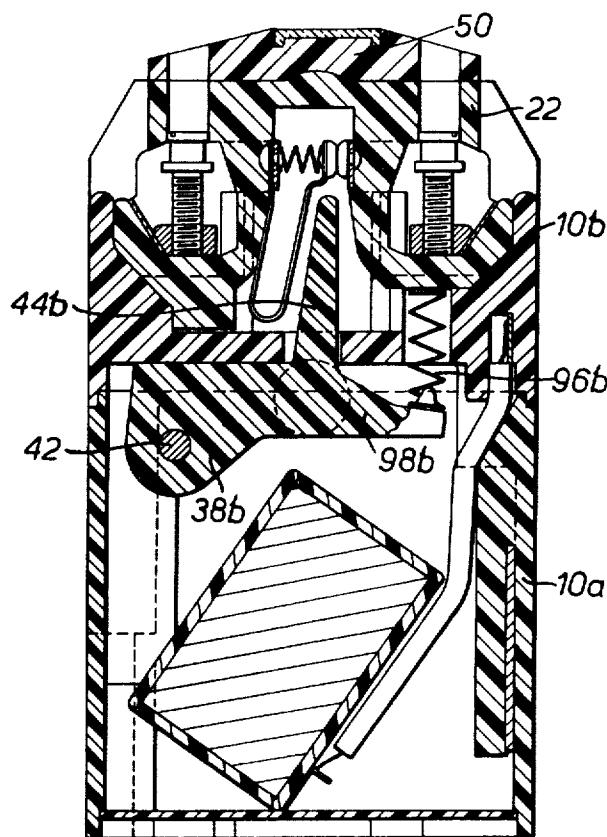
*Primary Examiner*—Harold Broome

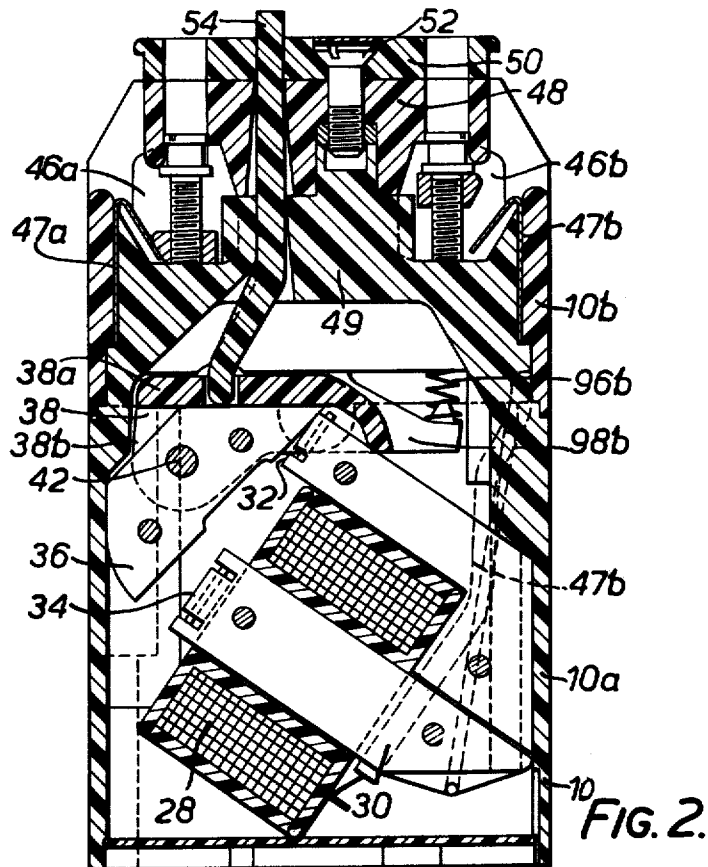
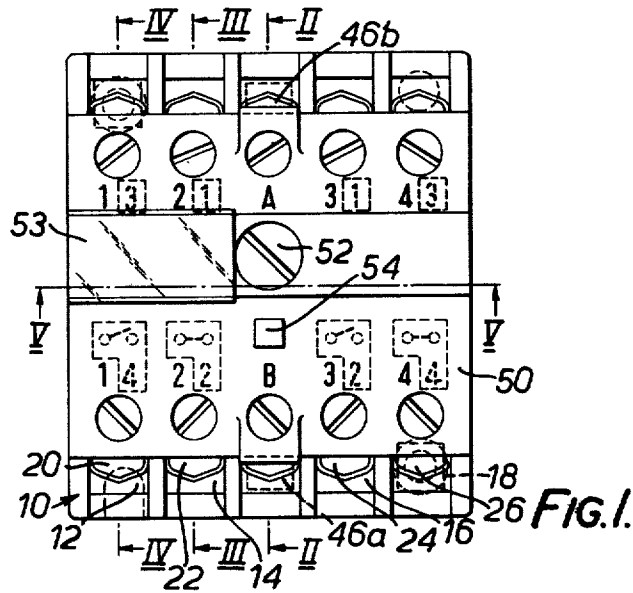
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[57] **ABSTRACT**

An electrical switching apparatus comprises at least one contact set which includes a pair of contact members resiliently biased towards contact with each other and a body member for removably receiving the contact set in first and second angular senses, for "normally open" or "normally closed" operation of the contact set. An actuator member is movably mounted in the body member and biased in one sense of displacement to hold the contact members apart when the contact set is received by the body member in one angular sense and to permit the contact members to close when the contact set is received in the other angular sense. Displacement of the actuator member, either by electromagnet or manually, causes the contact members to close or to be separated, depending on whether the contact set is received in the one or in the other angular sense.

**9 Claims, 6 Drawing Figures**





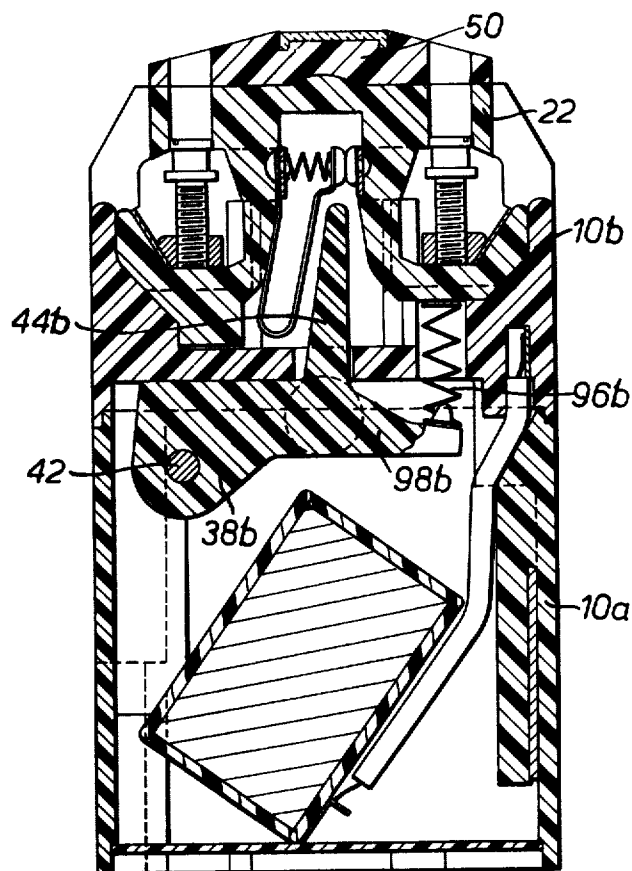


FIG. 3.

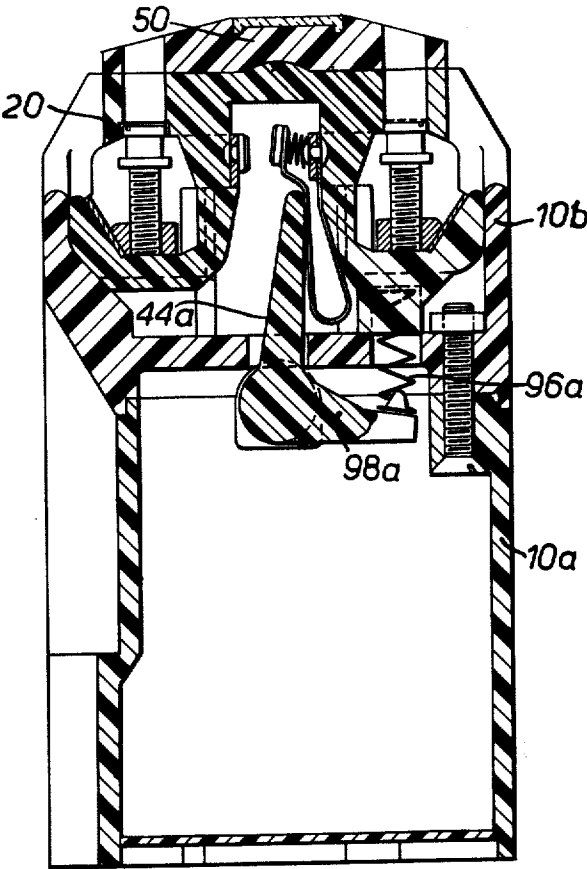


FIG. 4.

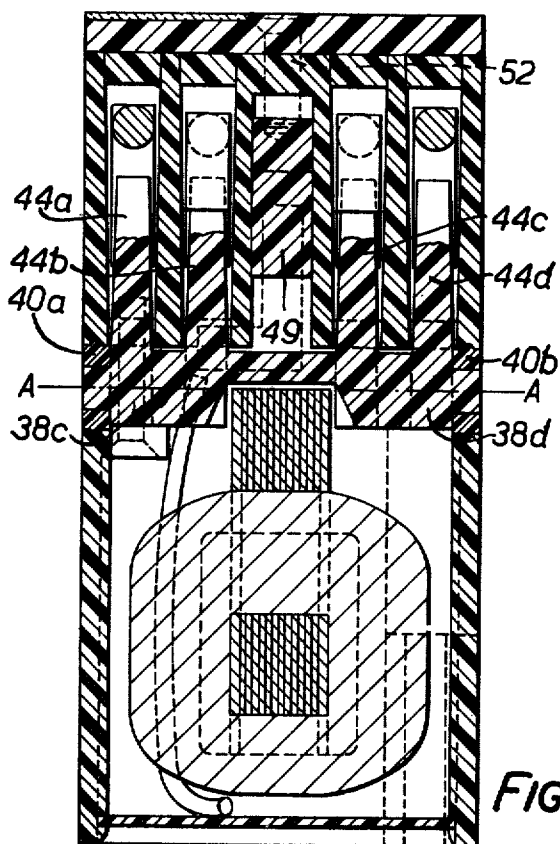


FIG. 5.

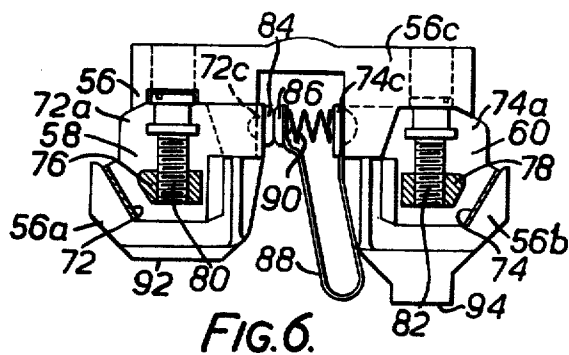


FIG. 6.

## ELECTRICAL SWITCHING APPARATUS

## BACKGROUND OF THE INVENTION

This invention relates to electrical switching apparatus. The invention is particularly applicable to an electromagnetic relay and more particularly to a relay in which one or more pairs of contact members are operated by an electromagnet. The invention is also applicable to a manually operable switch.

There is a need for a switching apparatus wherein the contact set thereof can be changed simply and quickly from "normally closed" to "normally open" operation. An object of this invention is to provide a switching apparatus which meets this need.

## SUMMARY OF THE INVENTION

As seen from one aspect, the present invention provides an electrical switching apparatus comprising a contact set which includes a pair of contact members resiliently biased towards contact with each other, a body member for removably receiving said contact set in first and second angular senses and an actuator member for said contact members, said actuator member being mounted movably in said body member so that said contact members are separable, when the contact set is received by said body member in said first and second angular senses, in response to displacement in respective senses of said actuator member.

As seen from another aspect, the present invention provides an electrical switching apparatus comprising a plurality of contact sets each including a pair of contact members resiliently biased towards contact with each other, a body member for removably receiving said plurality of contact sets, each contact set being receivable in first and second angular senses independently of the angular senses in which the other contact sets are received, and a single actuator member for the contact members of all contact sets received by said body member, said actuator member being mounted movably in said body member so that the contact members of each contact set are separable, when that contact set is received by said body member in said first and second angular senses, in response to displacement in respective senses of said actuator member.

Thus the or each contact set may be changed from "normally open" to "normally closed" and vice-versa by removing that contact set, reversing its angular position from one sense to the other, and replacing it in the body member.

For a manually operable switch the actuator member is manually displaceable. For example, a push button may be coupled to the actuator member for depression against spring bias.

For an electromagnetic relay, the actuator member is displaced from a normal position by energization of an electromagnet.

Preferably each contact set includes a pair of terminals, one for each contact member. Preferably each terminal is of the kind which is the subject of our co-pending patent application No. 12588/73.

## BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a plan view of a switching apparatus in accordance with the invention;

FIGS. 2, 3, 4 and 5 are sectional views of the switching apparatus on the lines II—II, III—III, IV—IV and V—V, respectively of FIG. 1; and

FIG. 6 is an elevational view of a contact set from the switching apparatus.

Referring now to the drawings, there is shown an electrical switching apparatus in the form of an electromagnetic relay. The relay comprises a housing or body member 10 presenting four recesses 12, 14, 16 and 18 into which are inserted respective contact sets 20, 22, 24 and 26. One such contact set is shown in FIG. 6 of the drawings and is described in more detail below; all four contact sets are identical.

The housing 10 includes a base portion 10a in which is disposed an electromagnet, comprising a coil 28 mounted on a yoke 30 which presents pole faces 32 and 34 to an armature 36. The armature 36 is carried by a lever 38 so as to be pivotable about an axis A—A (FIG. 5). Lever 38 includes an upper portion 38a and two side portions depending from the upper portion on opposite sides of the armature 36 - only one of the two side portions is shown, at 38b. The lever 38 further includes two stem portions 38c, 38d extending in opposite sidewise directions and journaled at their extreme ends in nylon bearings 40a, 40b carried in opposite sides of the housing 10. The lever 38 is thus pivotable about the axis A—A and the armature 36 is secured to the lever 38 by a pin 42 extending through the two side portions of the lever and also through the armature. A plurality of extensions 44a, 44b, 44c, 44d, one for each contact set, are formed on the lever 38 for the purpose of operating the contact members of the respective contact sets as will be explained below. Electrical terminals 46a and 46b for the coil 28 are mounted in an upper part 10b of the housing and connected to the coil 28 by conductors such as 47a, 47b which are disposed for automatic connection when the parts 10a and 10b of the housing are joined, the terminals 46a and 46b being of the kind the subject of our patent application 12588/73. A member 48 holds the terminals 46a, 46b in their recesses in a portion 49 which bridges the housing 10. Member 48 is perforated for access to the terminals 46a, 46b.

A cover plate 50 retains the contact sets 20 to 26 in position in the respective recesses in the upper portion 10b of the housing 10, the plate 50 being perforated both to allow access to the terminals 46a and 46b and similar terminals of the contact sets 20 to 26 and also to expose appropriate markings on the contact sets 20 to 26. The cover plate 50 is normally retained in place by a screw 52, which may be undone to allow the cover plate 50 to be removed thus permitting the contact sets 20 to 26 to be removed. The cover plate 50 bears a transparent slip 53 for receiving an identification tag (not shown).

The recesses 12 to 18 and the contact sets 20 to 26 are shaped so that the contact sets may each individually be inserted in either of two opposite angular directions in the respective recess; it is arranged that the contact set is normally open or normally closed, depending on the angular position chosen, which may be changed merely by removing the cover plate 50, extracting the contact set, turning it round and replacing the contact set and cover plate 50. Each contact set is arranged to bear two sets of markings, appropriate to normally open and normally closed contacts respectively, and the cover plate 50 exposes only the appro-

prate set of markings. An indicator 54 is mounted slidably in the upper part 10b of the housing and normally projects through the cover plate 50 to indicate that the electromagnet is de-energised and the relay in its rest position. The indicator 54 also serves to ensure that the cover plate 50 is placed in the correct orientation on the relay.

The contact sets are shown in more detail in FIGS. 3, 4 and 6 of the drawings. All four contact sets are identical and only one will be described in detail.

The contact set comprises an insulating body 56 having end portions 56a, 56b recessed to receive respective terminals 58, 60 and a bridging portion 56c which retains the terminals 58, 60 in position. Each of the terminals 58, 60 is of the kind which is the subject of our co-pending patent application No. 12588/73. Thus, each terminal has a metal cage comprising an inclined wall 72, 74 and side cheeks extending from opposite sides of the inclined wall; only one side cheek 72a, 74a is shown for each cage. A block 76, 78 is mounted slidably between the pair of cheeks of each cage and can be urged towards the bottom of the cage by a captive screw 80, 82 to trap an electrical lead (not shown) against the inclined wall. One cheek of each cage is formed with an extension having an inwardly turned end 72c, 74c. The inwardly turned end 72c of the extension of cheek 72a of terminal 72 is provided with a contact member 84 and a second contact member 86 is carried at one end of a folded resilient metal arm 88. The other end of the arm 88 is secured to the inwardly turned end 74c of the extension of cheek 74a of terminal 74. The two contact members are biased towards contact by a helical compression spring 90. It will be noted that the insulating body has a flat surface 92, 94 below each terminal, but that the flat surface 94 below the terminal 74 is lower than the flat surface 92 below terminal 72. Surfaces 92, 94 provide abutments for a purpose which will be explained below.

FIG. 4 shows contact set 20 received by the housing 10 in a first angular sense whilst FIG. 3 shows contact set 22 received in a second angular sense which is opposite to the first. The lever 38 and armature 36 together provide an actuator member for the contact members of the four contact sets received by the housing 10.

A helical compression spring is provided for each contact set (only springs 96a, 96b for contact sets 20, 22 being shown) and these act between respective extensions (e.g., 98a, 98b) of lever 38 and abutment 92 or 94 on the respective contact set (depending upon whether that contact set is received in the first or second angular sense). Thus, in the drawings, springs 96a and 96b act upon abutments 94 and 92 of the respective contact sets 20 and 22. The combined effect of the compression springs such as 96a and 96b is to bias the actuator member 36, 38 in one sense of displacement, namely clockwise as viewed in FIGS. 2, 3 and 4. For contact set 20 shown in FIG. 4, the corresponding extension 44a of lever 38 abuts the arm 88 to separate the contact members 84, 86 of that contact set against the bias of compression spring 90. For contact set shown in FIG. 3, the extension 44b of lever 38 is out of abutment with arm 88 and the contact members 84, 86 are permitted to make contact under the influence of the compression spring 90 of that contact set. It will be noted that the contact set 20 is shown in a normally open condition whilst the contact set 22 is shown in a

normally closed condition. Also, the bias provided by the compression springs such as 96a and 96b is greater when the contact set is in its normally open position.

Upon energisation of the electromagnet the armature 36 is attracted to the pole faces 32, 34 and this causes the actuator member to be rotated in the opposite sense of displacement to that urged by the compression springs 96a, 96b, namely counterclockwise as viewed in FIGS. 2, 3 and 4. For the normally closed contact set 22 the extension 44b abuts the arm 88 to separate the contact members 84, 86, whilst for normally open contact set 20, the extension moves out of abutment with the arm 88 and therefore permits the contact members of this contact set to close.

The indicator 54 extends downwardly to engage in an aperture on the upper portion 38a of the lever 38 and therefore moves upwardly and downwardly with rotation of the actuator member. The indicator may be used to operate the switching apparatus in a manual mode by depressing its projecting end against the bias of springs 96a, 96b.

I claim:

1. An electrical switching apparatus comprising:

- a. a contact set including a pair of contact members and biasing means resiliently biasing said contact members towards each other;
- b. a body member recessed to receive said contact set in first and second angular senses;
- c. an actuator member for said contact members; and
- d. mounting means which mounts said actuator member in said body member for displacement from one to another sense to actuate said contact members so that said contact members are separable, when said contact set is received by said body member in one of its two angular senses in response to displacement of said actuator into one of its respective senses.

2. An electrical switching apparatus as claimed in claim 1, comprising biasing means resiliently biasing said actuator member towards one sense of displacement so as normally to hold the contact members apart when the contact set is received in said first angular sense and normally to permit closure of the contact members when the contact set is received in said second angular sense.

3. An electrical switching apparatus as claimed in claim 1, comprising biasing means resiliently biasing said actuator member towards one sense of displacement with greater force when said contact set is received in said first angular sense than when received in said second angular sense, said biasing means for said actuator member normally holding the contact members apart when the contact set is received in said first angular sense and normally permitting closure of the contact members when the contact set is received in said second angular sense.

4. An electrical switching apparatus as claimed in claim 3, in which said biasing means comprises a compression spring and two abutments carried by said contact set, said spring being compressed between the actuator member and one or the other of the two abutments depending upon which of said first and second angular senses the contact set is mounted in said body member.

5. An electrical switching apparatus as claimed in claim 2, comprising an electromagnet mounted in said body member and arranged to displace said actuator

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member in the other sense of displacement thereof upon energisation.

6. An electrical switching apparatus as claimed in claim 2, comprising a manually movable coupling for displacing said actuator member in the other sense of displacement thereof. 5

7. An electrical switching apparatus as claimed in claim 1, in which said actuator member comprises a rotatable lever and said contact set includes a movable arm on which one of said contact members is carried, 10 said arm being arranged to abut one or the other of two sides of said lever depending upon which of said first and second angular senses the contact set is mounted in said body member.

8. An electrical switching apparatus as claimed in claim 7, comprising an armature carried by said lever and an electromagnet mounted in said body member. 15

9. An electrical switching apparatus comprising:

a. a plurality of contact sets each including a pair of contact members and biasing means resiliently bi- 20

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asing the contact members of the respective set towards contact with each other;

b. a body member recessed to receive said plurality of contact sets, each contact set being receivable in first and second angular senses independently of the angular senses in which the other contact sets are received;

c. a single actuator member for the contact members of all contact sets received by said body member; and

d. mounting means which mounts said actuator member in said body for displacement from one to another sense to actuate the contact members, said actuator member, depending upon the angular sense in which each of said contact sets is received in said body member, effecting open or closed contact conditions in each thereof in response to displacement of said actuator member from one to the other of its respective senses.

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