

[54] **ELECTROMAGNETIC RELAYS**

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[51] Int. Cl. **H01h 47/04**

[58] Field of Search 335/135, 136, 266, 335/107, 199, 137; 200/166 J

[56] **References Cited**

UNITED STATES PATENTS

1,763,172 6/1930 Miller et al. 335/266
2,980,891 4/1961 Steinbach et al. 335/107

2,945,107 7/1960 Hufnagel 200/166 J
2,970,200 1/1961 Walker et al. 200/166 J

FOREIGN PATENTS OR APPLICATIONS

758,688 10/1956 Great Britain 335/199

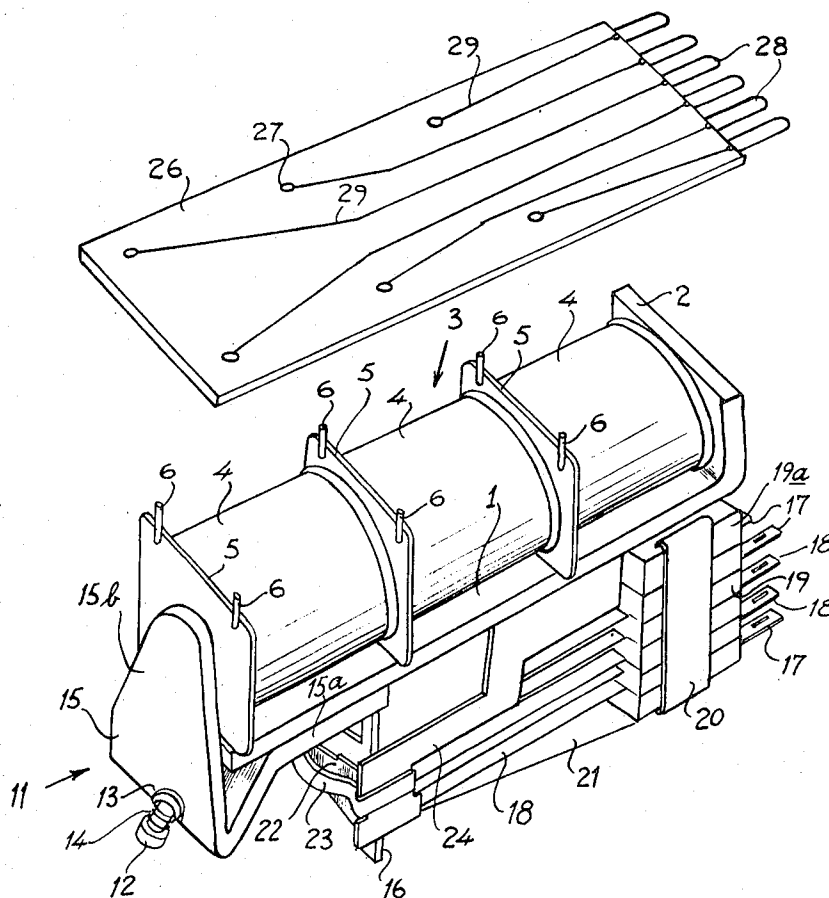
Primary Examiner—Harold Broome

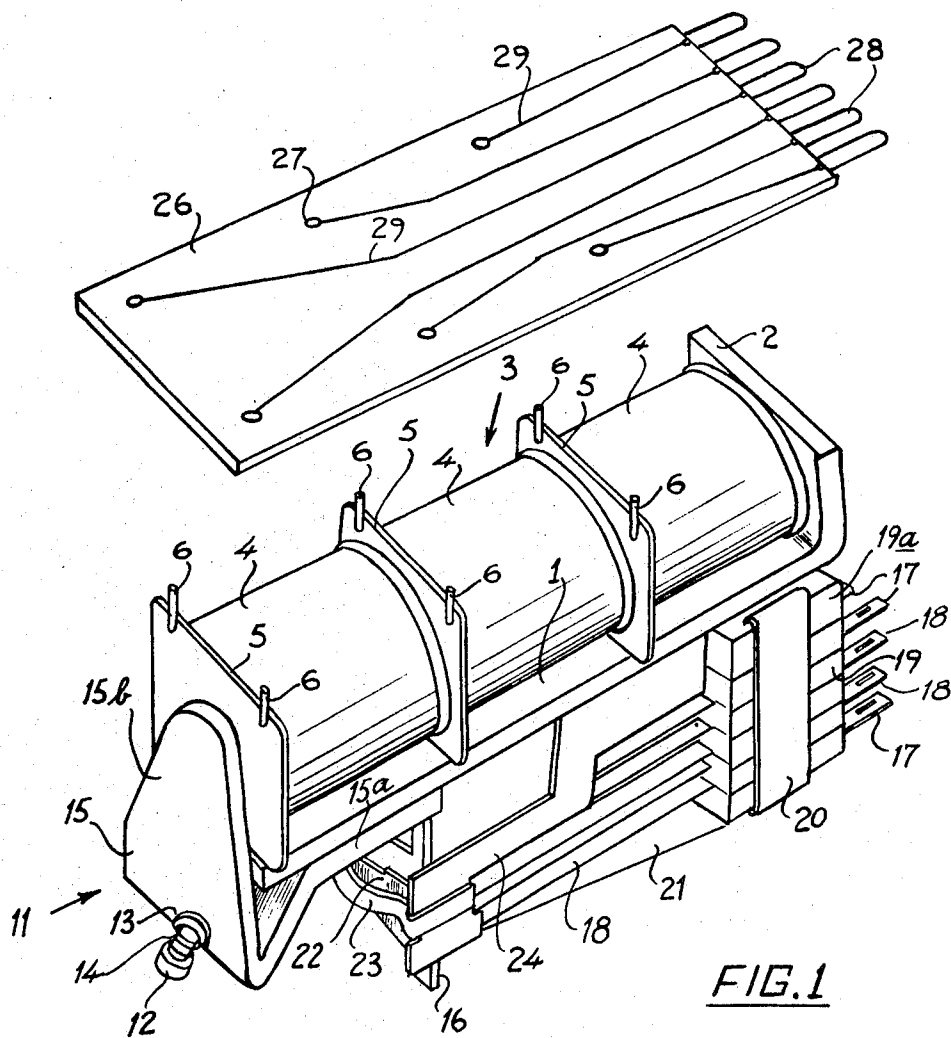
Attorney—Kurt Kelman

[57] **ABSTRACT**

An Electromagnetic relay having a modular coil formed by a number of independent coil modules. The relay is also provided with movable contact units which includes a number of contact sets. Each contact set having at least one pair of contact arms namely a movable contact arm and a fixed contact arm. A removable rest plate for the contact arms is provided in order that the contact arms of each contact set may make or break in a predetermined sequence.

9 Claims, 10 Drawing Figures





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3,763,448

4 Sheets-Sheet 2

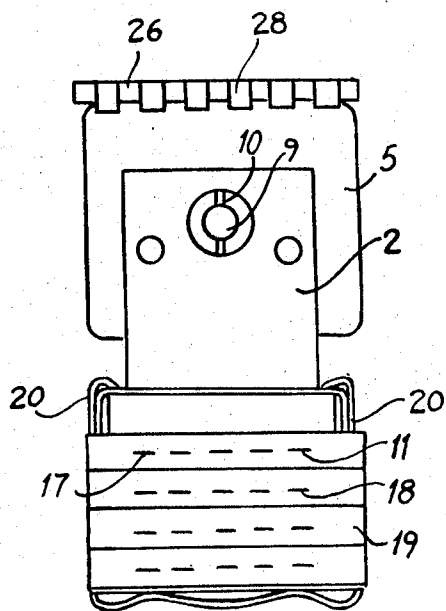


FIG. 3

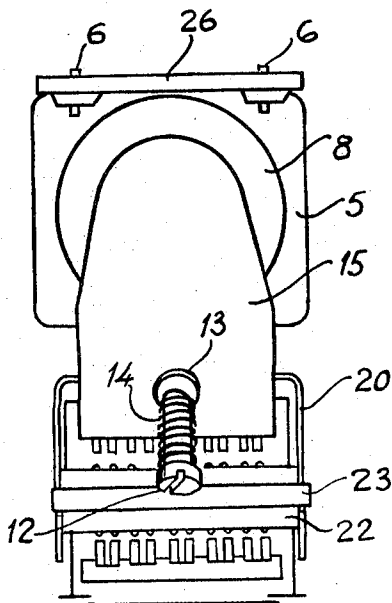
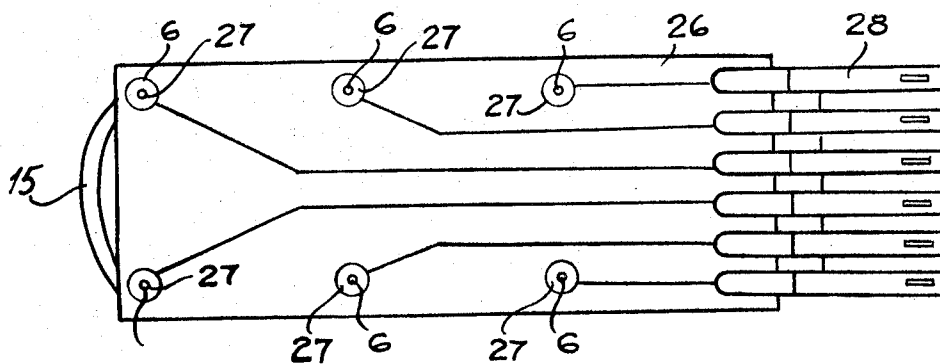
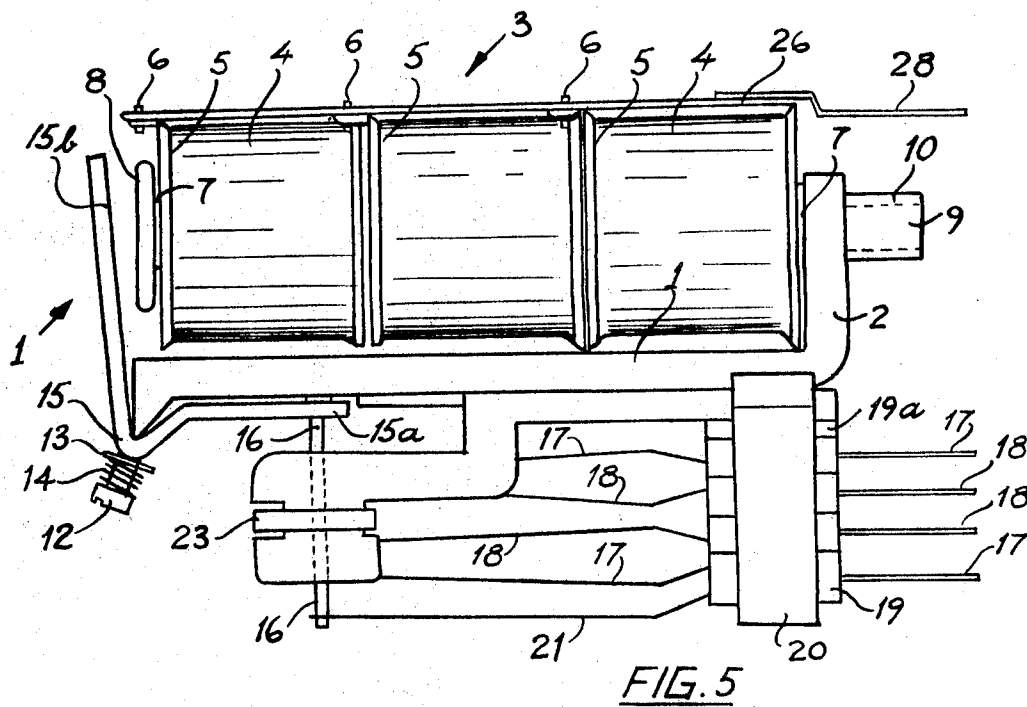
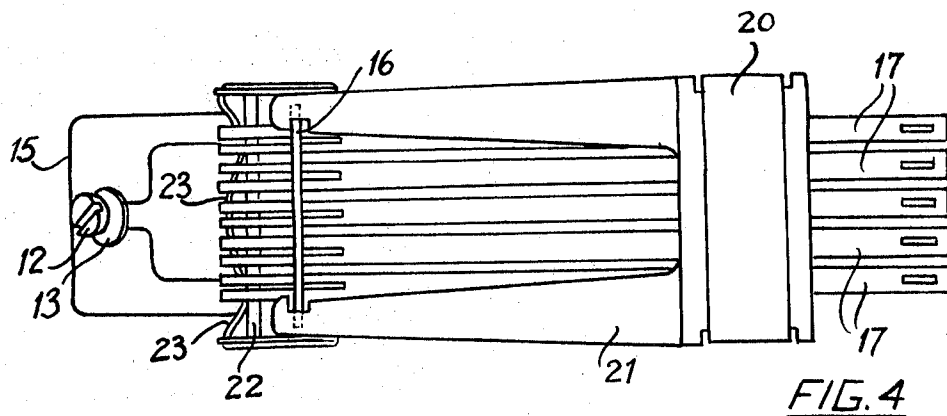


FIG. 2



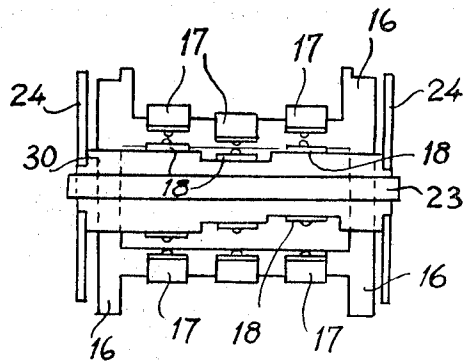


FIG. 9

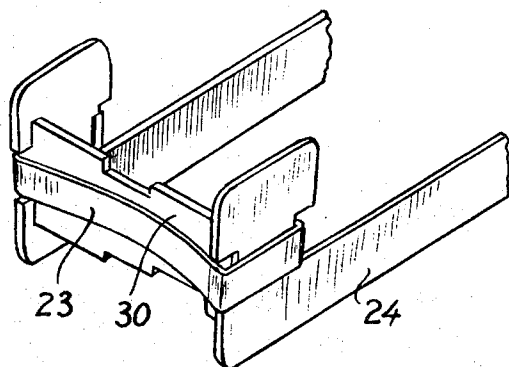


FIG. 8

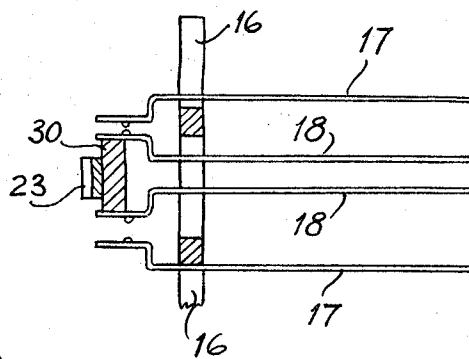


FIG. 10

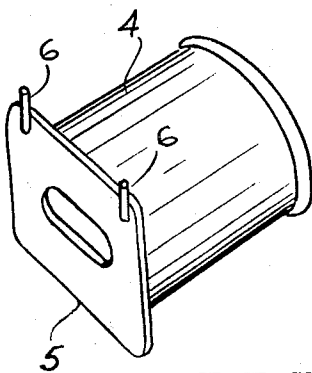


FIG. 7

ELECTROMAGNETIC RELAYS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to electromagnetic relays.

2. Description of the prior art

Electromagnetic relays comprising an inner magnetic core housed in an outer coil, or coils and a movable contact unit disposed at one end of the core. The movable contact unit includes a set of contacts and a movable armature. To cater for the requirements of equipment design electro-magnetic relays are produced with great variety of coil windings. Basically, the number of turns of the windings forming each coil and the electrical resistance of each coil and the number of coils per relay may be varied. It will be appreciated that varying the number of turns on each coil, the electrical resistance of each coil or alternatively the number of coils per relay will vary the characteristics of the electromagnetic relay. Where a relatively small number of electromagnetic relays are required it is often extremely costly to obtain the correct electromagnetic relay needed.

SUMMARY

According to the invention there is provided an electromagnetic relay comprising an inner magnetic core housed in an outer coil, a movable contact unit disposed at one end of the armature, the outer coil being a modular coil formed by a plurality of independent coil modules and electrical connection means being provided to electrically connect individual coil modules together, and/or to other electrical elements and/or to an electrical power source.

In one embodiment of the invention the electrical connection means of the printed circuit board and the movable contact unit includes a lift plate and has associated with it at least one contact set, each contact set comprising at least one pair of contact arms namely a movable contact arm and a fixed contact arm both secured relative to the outer coil, whereby in use, on operation of the electrical magnetic relay the lift plate is moved to cause the movable contact arms of each contact set to make or break their contact with the co-operating fixed contact arm.

The main advantage of the present invention is that where a relatively small number of electromagnetic relays, having certain predetermined characteristics, are required these may be provided without excessive cost or difficulty.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of an electromagnetic relay according to the invention,

FIG. 2 is a lefthand side view of the electromagnetic relay of FIG. 1,

FIG. 3 is a righthand side view of the electromagnetic relay,

FIG. 4 is a bottom view of the relay,

FIG. 5 is a side view of the relay,

FIG. 6 is a top view of the relay,

FIG. 7 is a perspective view of a coil module forming part of the relay,

FIG. 8 is a fragmentary perspective view of portion of an alternative construction of relay,

FIG. 9 is an end view of portion of the alternative construction of relay, and

FIG. 10 is a typical cross-sectional view of the portion of the relay illustrated in FIG. 9.

Referring to the drawings and initially to FIGS. 1 to 7 thereof there is provided a relay having a base plate 1 which incorporates an integral upstanding support 2. An outer coil indicated generally by the reference numeral 3 is provided; the outer coil 3 is a modular coil formed by a plurality of independent coil modules 4. Each coil module 4 is a conventionally wound coil and is provided with an end plate 5 on which are mounted a pair of input terminals 6. The coil modules 4 are mounted on the support 2 by means of an inner magnetic core 7. One end of the core 7 forms a retaining collar 8 and the other end is formed into a threaded shaft 9 shown by the interrupted lines in FIG. 5. A cylindrical nut 10 of conventional construction engages the shaft 9 and secures the core 7 to the support 2.

A movable contact unit, indicated generally by the reference numeral 11 comprises an armature 15, formed from a length of plate bent intermediate its ends and mounted by means of a bolt 12, washer 13 and spring 14 on the base plate 1. The armature 15 has mounted on it a lift plate 16, on one of its free legs 15a, the other free leg 15b in use, engages the core 7.

There are five contact sets each comprising a pair of movable contact arms 17 and fixed contact arms 18 mounted by means of insulated blocks 19 and 19a on the base plate 1. The insulated block 19 is in turn mounted by means of a spring clip 20, of conventional construction. The block 19 is in fact formed from a plurality of sheets of insulation material. A spring steel retaining plate 21 is mounted in the block 19 and engages the lift plate 16. For each contact set it will be appreciated that in any one position of the relay one of the pairs of contact arms namely a movable contact arm 17 and a fixed contact arm 18 is in a "make contact" position while the other movable contact arm 17 and fixed contact arm 18 is in a "break contact" position. The movable contact arms 17 are urged against the lift plate 16 while the fixed contact arms 17 impinge against a rigid rest plate 22 mounted by means of a spring steel clip 23 between a pair of extension arms 24 mounted on the base plate 1. Movement of the armature 15 causes the lift plate 16 to be moved relative to the base plate 1. This movement of the lift plate 16 causes one of the pair of contact arms formed by a movable contact arm 17 and fixed contact arm 18 of each contact set to break and the other pair of contact arms to make.

A printed circuit board 26 is provided with a number of holes 27 and power input contacts 28. The electrical connection between each hole 27 and each power input contact 28 is an etched contact strip 29. Each hole 27 engages an input terminal 6 of a coil module 4. Accordingly, in the embodiment as shown in FIGS. 1 to 7 each coil module 4 is individually electrically connected to a pair of power input contacts 28.

It will be appreciated that where it is desired to vary the number of coil modules it is a relatively simple matter to unscrew the nut 10, disconnect the coil modules 4 from the printed circuit board 26 and replace one or other of the coil modules 4 with a coil module 4 having a different performance characteristic. It will also be appreciated that a printed circuit board 26 of suitable construction may be provided whereby some or all of the coil modules 4 may be electrically connected in se-

ries or parallel. Similarly, the printed circuit board 26 may be used to incorporate other electrical elements such as resistors, timing circuits or the like whereby individual coil modules 4 may come into operation after other coil modules 4.

Referring to FIG. 8 to 10 similar reference numerals referring to parts similar to those described with reference to FIGS. 1 to 7 there is illustrated an alternative construction of rest plate 30 which is of stepped construction. This construction of rest plate 30 allows the contact arms 17 and 18 of each contact set to make or break in a predetermined sequence. The spring steel clip 23 facilitates the removal of the rest plate 30 and its replacement by a rest plate 30 of a different construction. The arrangement of removable rest plate 15 may of course be used with electromagnetic relays which have a coil of conventional construction and not of modular construction as described above.

I claim:

1. An electromagnetic relay which comprises in combination:

- A. a base plate;
- B. an inner magnetic core mounted on the base plate;
- C. a movable contact unit mounted on the base plate and disposed adjacent one end of the core;
- D. a plurality of independent coil modules removably mounted on a common core to form an outer modular coil having a common magnetic axis;
- E. end plates disposed between adjacent coil modules, said end plates having projecting terminals in communication with an associated coil module;
- F. electrical input means connected to each coil module by means of said projecting terminals;
- G. electrical connection means adapted for electrically interconnecting the coil modules; and
- H. a printed circuit board disposed adjacent to the coils and relative the length of the magnetic axis and having electrical connections disposed for receiving said projecting terminals.

2. A electromagnetic relay as recited in claim 1 in which the electrical input means and the electrical connection means are formed by a printed circuit board.

3. An electromagnetic relay as recited in claim 2 in which the printed circuit board electrically connects the coil modules electrically in series.

4. An electromagnetic relay as recited in claim 2 in which the printed circuit board electrically connects the coil modules electrically in parallel.

5. An electromagnetic relay as recited in claim 2 in which there are three coil modules, the printed circuit board electrically connects two of the coil modules together in series and then in parallel with the third coil module.

6. An electromagnetic relay as recited in claim 2 in which the base plate is provided with an upstanding support, and in which the core has a collar formed on one end and a threaded portion on its other end whereby the threaded portion engages the upstanding support and the core is cantilevered across the base plate.

7. An electromagnetic relay as recited in claim 1 in which the movable contact unit comprises:

- an armature pivotally mounted intermediate its ends on the base plate to form two free legs, one free leg being located adjacent the end of the core for magnetic engagement with the core;
- a lift plate mounted on the other free leg of the armature;
- a rest plate mounted in the base plate adjacent the lift plate;
- a contact set mounted on the base plate and having at least one movable contact arm which engages the lift plate and the same number of co-operating fixed contact arms which engage the rest plate.

8. An electromagnetic relay as recited in claim 7 in which the rest plate is of stepped construction whereby each movable contact arm engage or disengage from the co-operating fixed contact arm in a predetermined sequence.

9. An electromagnetic relay as recited in claim 8 in which the rest plate is releasably mounted on the base plate.

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