(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 950 253 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
21.11.2001 Bulletin 2001/47

(21) Application number: **97952536.7**

(22) Date of filing: **17.12.1997**

(51) Int Cl.[7]: **H01H 50/04**, H01H 51/22

(86) International application number:
PCT/US97/23439

(87) International publication number:
WO 98/31036 (16.07.1998 Gazette 1998/28)

(54) **RELAY MAGNET RETENTION APPARATUS**

POLARISIERTES RELAIS MIT FESTHALTEVORRICHTUNG FÜR DEN PERMANENTMAGNETEN

DISPOSITIF DE RETENUE D'UN AIMANT DE RELAIS

(84) Designated Contracting States:
DE ES FR GB IT

(30) Priority: **06.01.1997 US 778981**

(43) Date of publication of application:
20.10.1999 Bulletin 1999/42

(73) Proprietor: **Tyco Electronics Corporation**
Middletown, Pennsylvania 17057 (US)

(72) Inventor: **HALTER, James, Matthew**
Princeton, IN 47670 (US)

(74) Representative: **Göhring, Robert, Dipl.-Ing.**
Patentanwälte
Westphal, Buchner, Mussgnug
Neunert, Göhring
Waldstrasse 33
78048 Villingen (DE)

(56) References cited:
WO-A-93/23863
DE-A- 4 309 618
FR-A- 2 254 873
US-A- 5 587 693

EP 0 950 253 B1

Description

Related Application

[0001] This application is related to U.S. Patent 5,587,693, entitled "Polarized Electromagnetic Relay", filed on August 7, 1995, issued on December 24, 1996, and assigned to the same assignee as that of the present application.

TECHNICAL FIELD OF THE INVENTION

[0002] The present invention relates to an electromagnetic relay featuring structure which retains the magnet in place during assembly and operation, according to the preambles of claims 1 and 4, as for example known from FR-A-2 254 873.

BACKGROUND OF THE INVENTION

[0003] Electromagnetic relays generally include a frame structure for receiving a permanent magnet coupled magnetically between an electromagnetic block and an armature. Generally, cut-out portions along the magnet's perimeter align with posts protruding from a bobbin on the electromagnetic block to retain the magnet in place. Retention features, for example deformable plastic tabs located on the bobbin or other part of the frame, prevent the magnet from backing out.

[0004] Although these retention features retain the magnet on the block, however, in assembling the relay additional labor is required to align the magnet with the posts and in fixing the retention features. Further, the retention features may loosen their hold on the magnet over time due to the operation of the relay. Further still, since cut-out portions are provided on the magnet, the magnet's magnetism is reduced.

SUMMARY OF THE INVENTION

[0005] The principal objective of this invention is to provide improvements in the frame structure of an electromagnetic relay which permit controlled retention of the magnet assembly both during assembly and in operation.

[0006] These and other objects are achieved by the present invention which provides an electromagnetic relay according to claims 1 and 4.

[0007] Advantageously, the invention provides that the magnet retention element formed on the at least one of the pole pieces retains the magnet in place between the electromagnetic block and the armature. During operation the magnet retention element prevents the magnet from moving out of position.

[0008] Preferably, the permanent magnet consists of a bar-shaped or plate-shaped three-pole magnetized permanent magnet disposed between the free ends of the pole pieces, which magnet is magnetized to have the same poles at its lengthwise ends adjacent to the pole pieces and to have the opposite pole intermediate its ends adjacent to the central portion of the armature which is balanced upon this pole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] For better understanding of the invention, reference is made to the following description of an exemplary embodiment thereof, and to the accompanying drawings wherein:

FIG. 1 is an exploded perspective view of a relay constructed in accordance with the present invention;
FIG. 2 is a perspective view of the relay of FIG. 1 showing details of the magnet retention structure of the present invention;
FIG. 3 is an enlarged perspective view of the magnet retention structure in accordance with one embodiment of the present invention;
FIG. 4 is a perspective view of the assembled relay of FIG. 1; and
FIG. 5 is an exploded perspective view of an alternative embodiment of the relay;

DETAILED DESCRIPTION

[0010] Referring now to Figure 1, there is shown an electromagnetic relay of the present invention. The relay is of bistable operation and of single-pole double-throw contact arrangement. The relay comprises a base 10 of insulating material which defines a main or bottom plane for the relay. A pair of stationary or fixed contact terminals 11 and 12 are fastened in the base 10; these fixed terminals 11 and 12 are disposed perpendicular to the bottom plane and are provided with fixed contacts 13 and 14. A movable contact terminal 15 is disposed parallel to the fixed contact terminals. All the terminals are inserted into slots 16 (not visible) in the base 10 and are fixed by caulking or by any other suitable sealant or method. Further, coil terminals 17 and 18 and a common coil terminal 19 are fastened in the base 10 in a similar manner. A pair of suppression resistors 20 or other components may be arranged on the base 10 and connected to the coil terminals 17, 18 and 19 by clamping their wires between clamping nuts 21 in the base and fork-like clamping claws 22 of the respective coil terminals. In a single input version (not shown), the common coil terminal 19 as well as one of the suppression resistors 20 may be omitted.

[0011] An electromagnet block 30 arranged on the base 10 comprises a bobbin 31 with a pair of coils 32 and 33 wound thereon between end flanges 34 and 35 and a center flange 36. An iron core 37 of cylindrical shape is inserted axially into the bobbin and coils and is coupled at its ends to a pair of plates-like pole pieces 38 and 39 which are arranged in recesses 341 and 351,

respectively, of the end flanges 34 and 35 and are provided with through holes 381 and 391, respectively, corresponding in diameter to the core 37.

[0012] A plate-like elongate permanent magnet 40 is disposed along one lateral side of the bobbin in a plane perpendicular to the base plane and bridging the end flanges 34 and 35 as well as the pole pieces 38 and 39. A magnet retention element 42 is formed on each of the pole pieces 38 and 39 to prevent the magnet 40 from backing out. As shown in Figures 2 and 3, the retention element 42 is a projection extending inwardly from a planar surface 41 of each pole piece 38 and 39. The projection is preferably stamped into each of the pole pieces 38 and 39.

[0013] The permanent magnet 40 is magnetized in a three-pole manner so as to have the same magnetic poles (south poles S) at both ends and the opposite pole (north pole N) in its center. An elongate, plate-like armature 50 which is slightly bent into a V-shape, is balanced on the center pole N of the permanent magnet 40 so as to form air gaps between its end portions and either one of the pole pieces 38 and 39. Either end of the armature is divided into a pair of legs 51 and 52, respectively, by means of recesses 53 and 54, respectively.

[0014] A strip-like movable contact spring 55 which is made from a resilient material like stainless steel, is fastened to the central part of the armature 50 by means of rivets 56 or the like. A pair of movable contacts 57 and 58 are fixed to the ends of the movable spring 55 by welding or any other suitable method. Since the movable spring 55 is made from a metal having poor conductivity, a flexible composite copper braid 62 is welded directly between the movable contacts 57 and 58 and the movable spring 55 to carry the load current between these movable contacts and the movable contact terminal 15.

[0015] The movable spring has a pair of torsion pivot arms 59 extending transversely in opposite directions from a central portion thereof and defining a pivot axis for the armature 50. Each of the pivot arms 59 has an eyelet 60 for fastening the movable spring 55 and the armature 50 on the center flange 36 of the bobbin 30. For receiving the pivot arms 59, the bobbin 30 forms a pair of posts 43 extending from the center flange 36 on either side of the armature, and the pivot arms may be fastened by any suitable method.

[0016] When the relay parts are assembled along the broken lines shown in Figure 1, the central part of the braid 62 is welded to the terminal 15. Further, winding terminals 44, 45 and 46 which are anchored in the bobbin flanges 34, 35 and 36, are connected by welding or any other suitable method to the coil terminals 17, 18 and 19. The assembled relay is shown in Figure 4. A plastic cap, not shown, may be put over the assembled relay to form a closed casing together with the base 10.

[0017] In operation which the coils 32 and 33 are deenergized, the armature 50 is held or kept latched in either of the two stable positions on either one of the pole pieces 38 or 39, respectively. For moving the armature from one position to the other, a voltage pulse is applied across an appropriate coil 32 or 33 in case of a dual input wiring. In this case, the two coils 32 and 33 are wound in a common direction and have end terminals 44 and 45 as well as a common terminal 46. Armature transfer will occur by applying a voltage pulse across one of the coils 32 or 33. In case of a single input wiring, the two coils 32 and 33 are connected in series, and the center winding terminal 46 as well as the common coil terminal 19 can be omitted. In this case, armature transfer will occur by toggling the voltage pulse polarity across the two coils 32 and 33 connected in series.

[0018] An exploded view of an alternative embodiment of the electromagnetic relay is shown by Figure 5. The relay generally operates in the same manner and comprises the same components as the relay shown by Figures 1-4, except for the pair of torsion pivot arms 59 included in the latter. Specifically, a magnet 100 is secured to a bobbin 102 by two pole pieces 104 and 106 having a magnet retention element 108 to prevent the magnet 100 from backing out.

[0019] When the relay parts are assembled along the broken lines shown in Figure 5, a movable spring 110 is fastened to an armature 112 on a center flange 114 of the bobbin 102 by means of rivets 116 or the like. A pair of movable contacts 118 and 120 are fixed to the ends of the movable spring 110 by welding or any other suitable method. The bobbin 102 is provided on a base 122 having a bottom plane which is perpendicular to fixed terminals 124 and 126. Fixed contacts 128 and 130 are disposed through fixed terminals 124 and 126 and braid 132 to secure the fixed terminals 124 and 126 to the relay. The central part of the braid 132 is welded to terminal 134. Further, winding terminals 136, 138 and 140 which are anchored in the bobbin flanges 142, 144 and 146, are connected by welding or any other suitable method to coil terminals 148, 150 and 152 to fully assemble the relay.

[0020] The embodiments described herein are merely illustrative of the principles of the present invention. Various modifications may be made thereto by persons ordinarily skilled in the art, without departing from the scope of the invention as defined by the claims.

Claims

1. An electromagnetic relay having an insulating base (10), an electromagnet block (30) on the base (10), the electromagnet block (30) including a permanent magnet (40), a core (37), a bobbin (31), at least one winding about the core (37), a pair of pole pieces (38, 39) extending substantially perpendicularly from the core (37), at least one magnet retention element (42) formed on at least one of the pole pieces (38, 39) in a position to retain the permanent magnet (40) in operative juxtaposition relative to the

bobbin (31),

characterized in that said permanent magnet having two pairs of substantially parallel continuous and recessless edges.

2. The electromagnetic relay of claim 1, wherein the magnet retention structure comprises at least one projection (42) extending from each of the pole pieces (38, 39).

3. The electromagnetic relay of claim 2, wherein the at least on projection (42) is stamped into each of the pole pieces (38, 39).

4. An elecuomagnetic relay comprising:

an insulating base (10) defining a bottom plane;
an electromagnetic block (30) on the base (10) having a core (37), means for exciting a coil (32, 33) including a bobbin (31) and at least one winding about the core (37), and a pair of pole pieces (38, 39) extending perpendicularly from the ends of said core (37);
an elongate armature (50) pivotally supported at its central portion to be movable about a center pivot axis for angular movement between two contact operating positions, either end portion of the armature (50) on either side of the pivot axis defining an air gap with one of said pole pieces (38, 39);
a permanent magnet (40) coupled magnetically between said core (37) and said armature (50) so as to induce the same magnetic poles in both said pole pieces (38, 39) and to provide an opposite pole in closely adjacent relationship to said central portion of the armature (50), at least one of the pole pieces (38, 39) including a magnet retention element (42) positioned to retain the permanent magnet (40) in operative position;
at least one movable contact spring (55) fixedly connected to the armature (50) at a portion intermediate the ends thereof and being formed with contact arms in the vicinity of either armature end portion, said contact arms carrying movable contacts to be moved according to the armature movement in and out of contact with corresponding fixed contacts (13, 14) mounted on said base (10);
a pair of torsion pivot arms (59) extending transversely in opposite directions from said at least one contact spring (55) along the pivot axis of said armature (50), the distal end of either pivot arm (59) being fixedly connected to a support extending on either side of the armature (50) and being part of or fixedly connected to said electromagnetic block (30); and
a conductor connecting said contact arms with a movable contact terminal (15) mounted on said base,

characterized in that said permanent magnet having two pairs of substantially parallel continuous and recessless edges.

5. The electromagnetic relay of claim 4, wherein the permanent magnet (40) and said armature (50) are arranged along a lateral side of said bobbin (31), said pivot axis as well as said fixed and moveable contact terminals (13, 14, 15) extending essentially perpendicular to said bottom plane.

6. The electromagnetic relay of claim 4, wherein the movable contact terminal (15) is disposed parallel to said fixed contacts (13, 14).

7. The electromagnetic relay of claim 4, wherein the permanent magnet is a three-pole magnetized magnet (40).

8. The electromagnetic relay of claim 4, wherein a cap is placed over the electromagnetic relay to form a closed casing together with said base (10).

Patentansprüche

1. Elektromagnetisches Relais mit einem Isoliersokkel (10) und einem Elektromagnetblock (30) auf dem Sockel (10), wobei der Elektromagnetblock (30) enthält: einen Dauermagneten (40), einen Kern (37), einen Spulenkörper (31), wenigstens eine Wicklung um den Kern (37), ein Paar Polstücke (38, 39), die sich im wesentlichen senkrecht vom Kern (37) erstrecken, wenigstens ein Magnetfesthalteelement (42), das_an wenigstens einem der Polstücke (38, 39) in einer Position zum Festhalten des Dauermagneten (40) in einer neben dem Spulenkörper (31) liegenden Betriebsstellung ausgebildet ist,
dadurch gekennzeichnet, daß der Dauermagnet zwei Paare im wesentlichen paralleler, durchgehender und aussparungsloser Ränder aufweist.

2. Elektromagnetisches Relais nach Anspruch 1, bei dem die Magnetfesthaltekonstruktion wenigstens einen sich von jedem der Polstücke (38, 39) erstrekkenden Vorsprung (42) umfasst.

3. Elektromagnetisches Relais nach Anspruch 2, bei dem wenigstens ein Vorsprung (42) aus jedem der Polstücke (38, 39) ausgestanzt ist.

4. Elektromagnetisches Relais, das aufweist:

einen eine Bodenebene definierenden Isolier-

sockel (10) ;

einen elektromagnetischen Block (30) auf dem Sockel (10), der einen Kern (37), eine Anordnung zur Erregung einer Spule (32, 33) mit einem Spulenkörpers (31) und wenigstens einer Wicklung um den Kern (37) und ein Paar Polstücke (38, 39), die sich von den Enden des Kerns (37) aus senkrecht erstrecken, aufweist;

einen länglichen Anker (50), der an seinem mittleren Teil schwenkbar gelagert ist, so daß er sich um eine mittlere Schwenkachse zur Winkelbewegung zwischen zwei Kontaktbetätigungspositionen bewegen kann, wobei jeder Endteil des Ankers (50) auf beiden Seiten der Schwenkachse mit einem der Polstücke (38, 39) einen Luftspalt definiert;

einen Permanentmagneten (40), der zwischen dem Kern (37) und dem Anker (50) magnetisch gekoppelt ist, so daß er in den beiden Polstükken (38, 39) die gleichen magnetischen Pole hervorruft und in eng benachbarter Beziehung zu dem mittleren Teil des Ankers (50) einen entgegengesetzten Pol bildet, wobei wenigstens eines der Polstücke (38, 39) ein Magnetfesthalteelement (42) enthält, das zum Festhalten des Dauermagneten (40) in Betriebsstellung positioniert ist;

wenigstens eine bewegliche Kontaktfeder (55), die an einem Teil des Ankers (50) zwischen seinen Enden fest mit diesem verbunden ist und die in der Nähe beider Ankerendteile mit Kontaktarmen versehen ist, wobei die Kontaktarme bewegliche Kontakte tragen, die gemäß der Ankerbewegung in und außer Kontakt gebracht werden, wobei korrespondierende feste Kontakte (13, 14) an dem Sockel (10) befestigt sind;

ein Paar Torsionsschwenkarme (59), die sich von der wenigstens einen Kontaktfeder (55) aus entlang der Schwenkachse des Ankers (50) quer in entgegengesetzte Richtungen erstrecken, wobei das distale Ende beider Schwenkarme (59) mit einer Stütze fest verbunden ist, die sich auf beiden Seiten des Ankers (50) erstreckt und die Teil des elektromagnetischen Blocks (30) ist oder fest mit diesem verbunden ist; und

einen Leiter, der die Kontaktarme mit einem an dem Sockel angebrachten Anschluss (15) für bewegliche Kontakte verbindet,

dadurch gekennzeichnet, daß der Permanentmagnet zwei Paare im wesentlichen paralleler, durchgehender und aussparungsloser Ränder aufweist.

5. Elektromagnetisches Relais nach Anspruch 4, bei dem der Permanentmagnet (40) und der Anker (50) entlang einer lateralen Seite des Spulenkörpers (31) angeordnet sind, wobei sich die Schwenkachse sowie die Anschlüsse (13, 14, 15) für die festen und beweglichen Kontakte im wesentlichen senkrecht zur Bodenebene erstrecken.

6. Elektromagnetisches Relais nach Anspruch 4, bei dem der Anschluss (15) für die beweglichen Kontakte parallel zu den festen Kontakten (13, 14) angeordnet ist.

7. Elektromagnetisches Relais nach Anspruch 4, bei dem der Permanentmagnet ein dreipolig magnetisierter Magnet (40) ist.

8. Elektromagnetisches Relais nach Anspruch 4, über dem eine Abdeckung zur Bildung eines geschlossenen Gehäuses zusammen mit dem Sockel (10) angeordnet ist.

Revendications

1. Relais électromagnétique comportant une base isolante (10), un bloc d'électroaimant (30) sur la base (10), le bloc d'électroaimant (30) comprenant un aimant permanent (40), un noyau (37), une bobine (31), au moins un enroulement autour du noyau (37), une paire de pièces polaires (38, 39) partant essentiellement perpendiculairement du noyau (37), au moins un élément de retenue d'aimant (42) formé sur l'une au moins des pièces polaires (38, 39) dans une position permettant de retenir l'aimant permanent (40) en juxtaposition opérationnelle avec la bobine (31),
caractérisé en ce que
l'aimant permanent comporte deux paires de bords continus essentiellement parallèles et sans creux.

2. Relais électromagnétique selon la revendication 1, dans lequel
la structure de retenue d'aimant comprend au moins une saillie (42) partant de chacune des pièces polaires (38, 39).

3. Relais électromagnétique selon la revendication 2, dans lequel
la saillie au moins unique (42) est estampée dans chacune des pièces polaires (38, 39).

4. Relais électromagnétique comprenant :

une base isolante (10) définissant un plan de fond ;

un bloc électromagnétique (30) placé sur la base (10) et comportant un noyau (37), des moyens pour exciter une bobine (32, 33) ces moyens comprenant une bobine (31) et au moins un enroulement autour du noyau (37), ainsi qu'une paire de pièces polaires (38, 39) partant perpendiculairement des extrémités du noyau (327) ;
une armature allongée (50) supportée en pivotement dans sa partie centrale de manière à pouvoir se déplacer autour d'un axe de pivot central pour effectuer un mouvement angulaire entre deux positions d'actionnement de contact, l'une ou l'autre partie d'extrémité de l'armature (50), de chaque côté de l'axe de pivot, définissant un intervalle d'air ou entrefer avec l'une des pièces polaires (38, 39) ;
un aimant permanent (40) couplé magnétiquement entre le noyau (37) et l'armature (50) de manière à induire les mêmes pôles magnétiques dans les deux pièces polaires (38, 39) et à fournir un pôle opposé à proximité immédiate de la partie centrale de l'armature (50), l'une au moins des pièces polaires (38, 39) incluant un élément de retenue d'aimant (42) positionné pour retenir l'aimant permanent (40) en position de fonctionnement ;
au moins un ressort de contact mobile (55) relié de façon fixe à l'armature (50) dans une partie intermédiaire entre ses extrémités et
muni de bras de contact au voisinage de l'une ou l'autre partie d'extrémité de l'armature, ces bras de contact portant des contacts mobiles destinés à être déplacés suivant le mouvement de l'armature pour venir en contact et hors contact avec des contacts fixes correspondants (13, 14) montés sur la base (10) ;
une paire de bras de pivot de torsion (59) s'étendant transversalement dans des directions opposées en partant du ressort de contact au moins unique (55), suivant l'axe de pivot de l'armature (50), l'extrémité distale de l'un ou l'autre bras de pivot (59) étant relié de façon fixe à un support s'étendant de l'un ou l'autre côté de l'armature (50) et faisant partie du bloc électromagnétique (30) ou se trouvant relié de façon fixe à celui-ci ; et
un conducteur reliant les bras de contact une borne de contact mobile (15) montée sur la base,

caractérisé en ce que
l'aimant permanent comporte deux paires de bords continus essentiellement parallèles et sans creux.

5. Relais électromagnétique selon la revendication 4, dans lequel
l'aimant permanent (40) et l'armature (50) sont disposés le long d'un côté latéral de la bobine (31), l'axe de pivot de même que les bornes de contact fixes et mobiles (13, 14, 15) s'étendant essentiellement perpendiculairement au plan de fond.

6. Relais électromagnétique selon la revendication 4, la borne de contact mobile (15) est disposée parallèlement aux contacts fixes (13, 14).

7. Relais électromagnétique selon la revendication 4, dans lequel
l'aimant permanent est un aimant magnétisé à trois pôles (40).

8. Relais électromagnétique selon la revendication 4, dans lequel
un couvercle est placé sur le relais électromagnétique pour former un boîtier fermé avec la base (10).

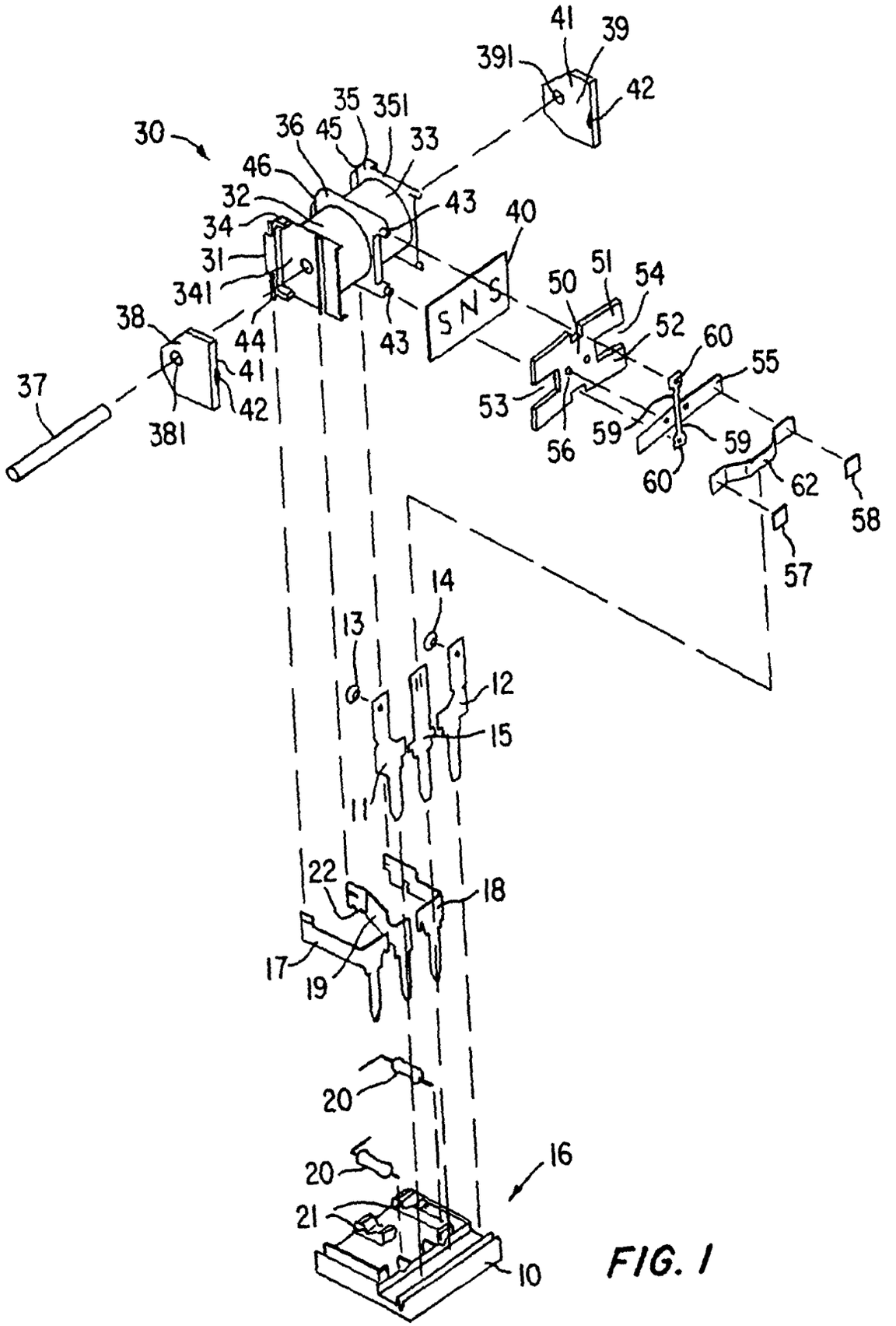
41
39
391
42
35
351
36
45
33
30
46
32
43
40
34
31
341
S N S
50
51
54
38
44
52
60
55
41
43
37
53
59
59
42
56
60
62
58
381
57
14
13
12
15
11
22
18
17
19
20
20
16
21
10

FIG. 1

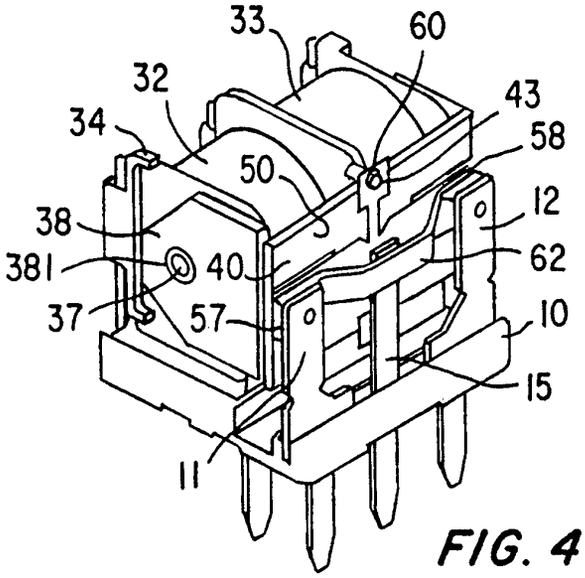

FIG. 4

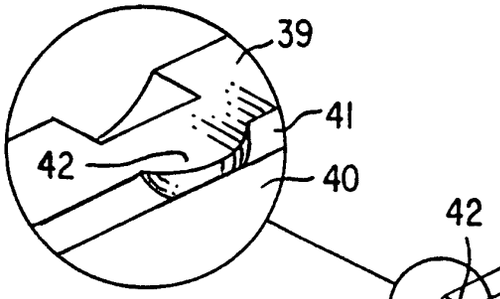

FIG. 3

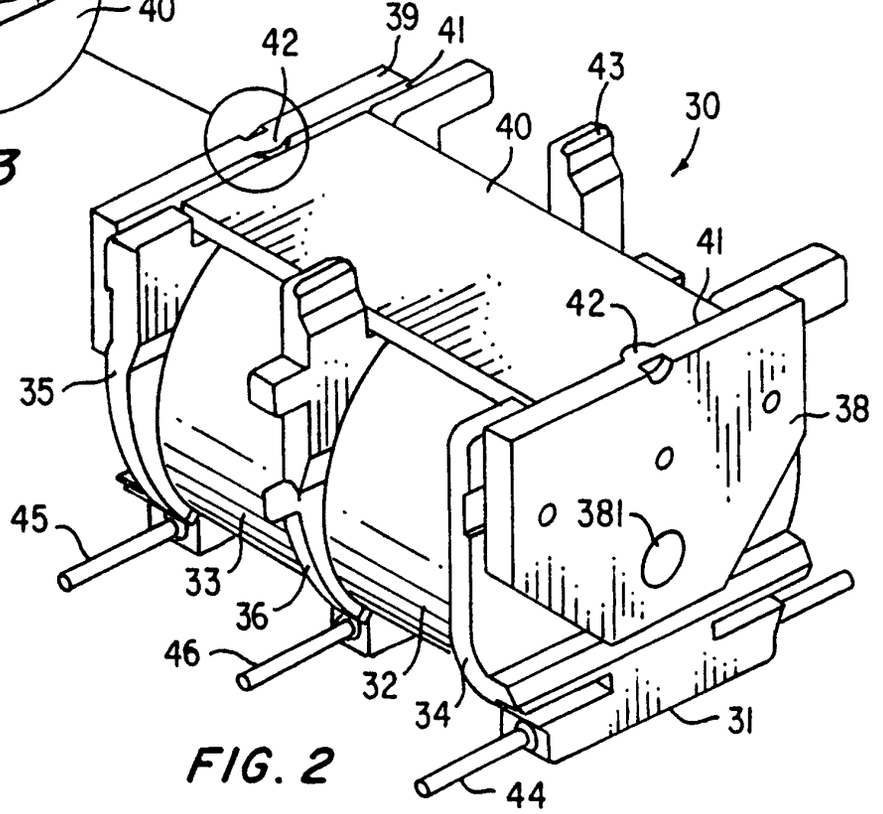

FIG. 2

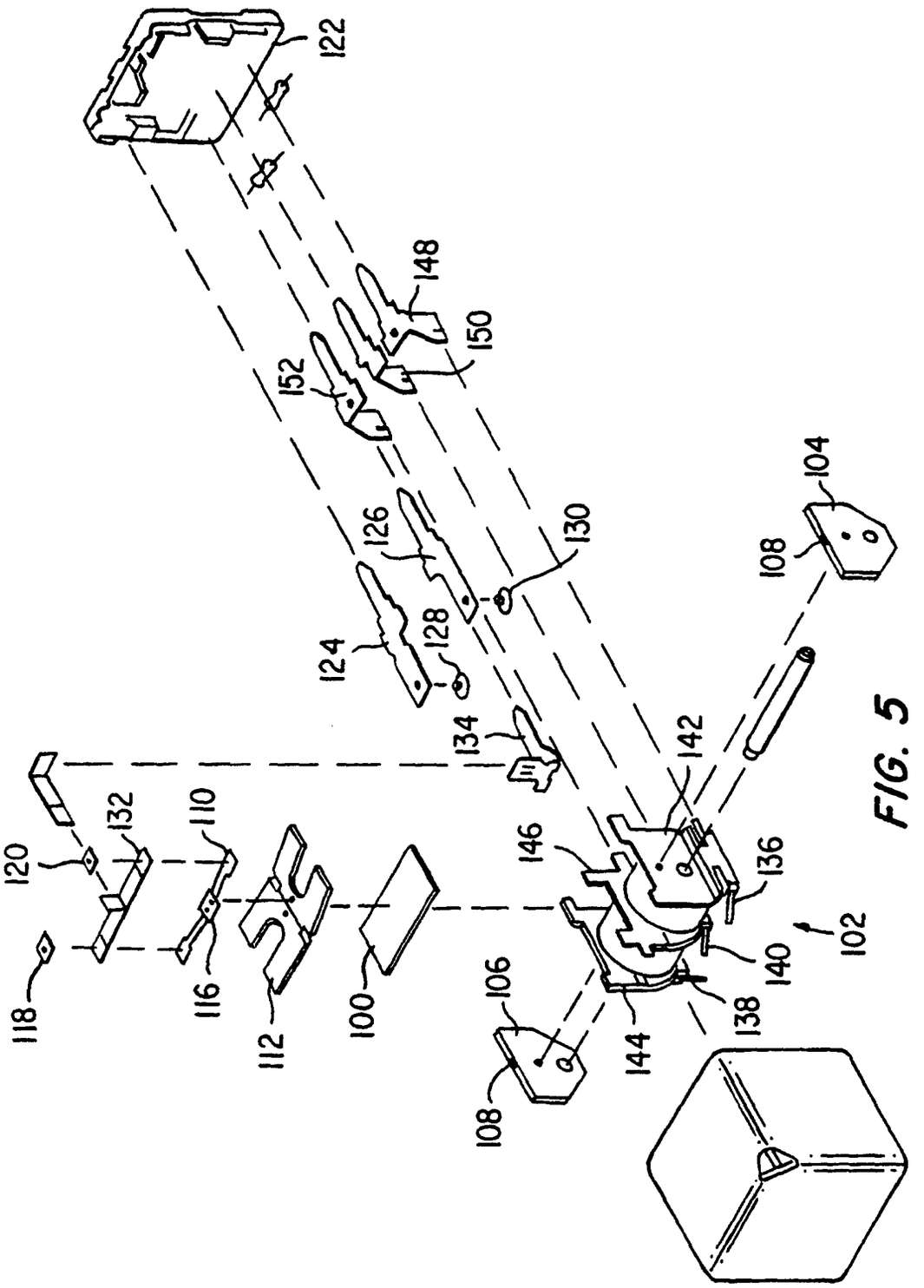
122
148
150
152
126
130
124
128
134
142
104
108
120
132
110
146
136
102
118
116
112
100
106
140
138
144
108

FIG. 5