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

(11) Publication number: **0 292 447 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88830228.8**

(51) Int. Cl.4: **H 01 H 50/26**

(22) Date of filing: **20.05.88**

(30) Priority: **22.05.87 IT 2064887**

(43) Date of publication of application:
23.11.88 Bulletin 88/47

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(71) Applicant: **F.E.M.E. FABBRICA EQUIPAGGIAMENTI MECCANICO ELETTRICI S.p.A.**
Viale Certosa, 1
I-20149 Milano (IT)

(72) Inventor: **Albertoni, Martino**
Via Mandresca 34
Inverigo (Como) (IT)

(74) Representative: **Rapisardi, Mariacristina, Dr. Proc.**
STUDIO TECNICO LEGALE RAPISARDI Largo V Alpini 15
I-20145 Milano (IT)

(54) Magnetic circuit particularly for safety, long-life and high-reliability relays.

(57) The magnetic circuit particularly usable for safety, long-life and high-reliability relays comprises a supporting element, a core having a polar expansion arranged facing an movable keeper oscillable about an axis of pivoting to the support; advantageously, the support has, on its end directed towards the movable keeper, an expansion for the reduction of the magnetic drop in the region of pivoting of the movable keeper to the supporting element regardless of the thickness thereof.

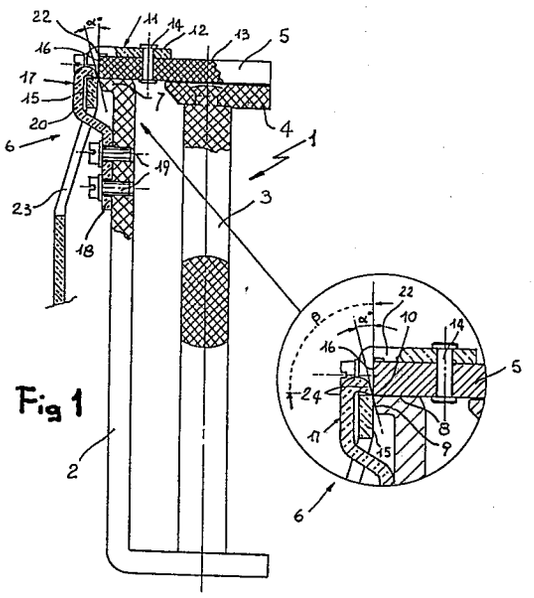


Fig 1

EP 0 292 447 A2

Description

MAGNETIC CIRCUIT PARTICULARLY FOR SAFETY, LONG-LIFE AND HIGH-RELIABILITY RELAYS

As is known, the magnetic circuits of keeper relays currently have an electromagnet which is energized by an electric current which flows in its coil so as to attract a movable keeper against the polar face or expansion.

The movement of the keeper is used appropriately to provide the required shifts on the contacts.

The return of the movable keeper to its rest position, after the end of the energizing current, is provided by means of a spring and/or counterweight.

The number, the arrangement of the contacts and the sequence of the actuations vary, in these types of relay, according to the purposes to which said relay is assigned.

In the case of safety relays intended to have a long mechanical life with various types of cycling, such as for example the relays used in electric railway-signalling systems, it is very important to provide the axis of pivoting between the movable keeper and the support of the core with strong mechanical parts and extremely reduced friction since otherwise the entire structure of the magnetic circuit would have a limited life and would furthermore not have reliable operation in use.

The magnetic circuit of relays of the above described type available on the market currently performs the relative rotation of the keeper with respect to the support of the core with very delicate mechanical elements or with considerable frictions therebetween, causing considerable limitations in use or in any case to such increases in rotation torque as to compromise its safety in operation.

Furthermore, in known magnetic circuits the lever which acts on the movable element to determine the operation of electric or even non-electric devices is usually provided monolithically with the movable keeper and is therefore also provided in magnetic material having a considerable cost, especially in large-size relays.

The aim proposed by the present invention is to eliminate the above described disadvantages by providing a magnetic circuit, particularly for safety, long-life and high-reliability relays, which has mechanical parts which determine the axis of pivoting of the movable keeper with respect to the support of the core, with very strong structure and with extremely reduced friction so as to ensure considerable resistance to mechanical stresses and practically the elimination of friction between the two elements during the rotation of the movable keeper.

Within this aim, an important object of the invention is to provide a magnetic circuit which allows to provide, as required, a wide surface arranged facing between the support and the keeper regardless of the thickness of the support of the core, achieving a reduction of the magnetic drop and therefore a better yield of said magnetic circuit.

Still another object of the present invention is to provide a magnetic circuit wherein the lever which determines the operation of the electric or even non-electric devices controlled by the relay is producible in non-magnetic material which has a modest cost which facilitates its diffusion in the various fields of application.

This aim, as well as these and other objects, are achieved by a magnetic circuit particularly for safety, long-life and high-reliability relays comprising a supporting element, a core having a polar expansion arranged facing a movable keeper oscillable about an axis of pivoting to said support, characterized in that said support has, on its end directed towards said movable keeper, an expansion for the reduction of the magnetic drop in the region of pivoting of said movable keeper to said supporting element regardless of the thickness thereof.

Further characteristics and advantages of the invention will become apparent from the description of a preferred but not exclusive embodiment of the magnetic circuit particularly for safety, long-life and high-reliability relays according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a schematic lateral elevation view of the magnetic circuit according to the invention;

figure 2 is a front elevation view illustrating the magnetic circuit according to the invention; and

figure 3 is a variated constructive aspect of the magnetic circuit illustrated in figure 1 according to the invention.

With particular reference to the above described figures, the magnetic circuit particularly for safety, long-life and high-reliability relays is generally indicated by the reference numeral 1 and comprises a supporting element of a core 3, both in magnetic material, at one end whereof there is a polar expansion 4 which is arranged facing a movable keeper 5 also provided in magnetic material.

The movable keeper 5 is oscillable about an axis of pivoting to the support 2 so that the magnetic field created by the coil generates a magnetic flow determining the force of attraction between the polar expansion and the movable keeper, which rotates about its own axis of pivoting by a presettable angle.

Advantageously, the end of the support 2, generally obtained from flat laminated material, is conveniently folded so as to have an expansion 7 which provides a sufficient and intended surface arranged facing the movable keeper. Said expansion is independent from the thickness of the plate used to produce the support so as to allow to reduce, conveniently and regardless of the thickness of the support, the magnetic drop in the axis of pivoting, which is inversely proportional to the facing surface, and thus obtain an improved magnetic yield of the magnetic circuit.

More in detail, the magnetic circuit has means 6 for the alignment of the respective ends of said movable keeper 5 and of the supporting element 2 on the axis of pivoting thereof.

The expansion 7 has a first flattened face 8, arranged facing the movable keeper 5, and a second face 9, substantially inclined and defining with the first face 8 an edge coinciding with the pivoting axis 10.

The alignment means 6 are defined by at least one bracket, generally indicated at 11, which advantageously is not in magnetic material and therefore has a modest cost and has a first portion 12 rigidly associated with a first planar surface 13 of the keeper 5 by means of a known retention element 14.

The bracket 11 furthermore has a second portion 15, extending for a portion thereof parallel to a second planar surface of said keeper and indicated at 16, which is orthogonal to the first surface 13.

The remaining portion of the bracket 11 is instead substantially inclined with respect to the second portion 15 thereof.

The bracket 11 has a port 22 which extends between the first and the second portion 12 and 15 thereof and an opening 23 provided substantially on its inclined portion.

The alignment means furthermore comprise a hook, generally indicated at 17, having a first region of itself 18 rigidly associated with the supporting element 2, for example by means of two screws 19, and a second region 20 passing through the opening 23 the end whereof engages in the port 22 of the bracket.

Conveniently, the end of the hook 17 has an edge defined by an inclined face 24 which is arranged on the same plane defined by the inclined face 9 of the expansion 7.

From the above description it is apparent that the edge of the expansion 7 and the edge of the hook 17 both coincide and are arranged on the same axis of pivoting between the movable keeper 5 and the supporting element 2 so that friction, during the relative rotation of these two elements, is practically non-existent.

More in detail, the movable keeper 5 has a maximum angle of rotation represented in the drawings at α, and accordingly the inclined face 24 of the hook and the second inclined face 9 of the expansion 7 have an inclination with respect to the face 8 which is substantially defined by an angle equal to$\beta - \alpha$, wherein β is an angle proximate to 90 degrees.

Merely for the sake of greater precision, it is furthermore stated that the bracket 11 defines with the movable keeper substantially two dihedrals with amplitude equal to β, arranged opposite and offset, which have their vertex arranged on the pivoting axis 10 and correspond to the edges of the hook 17 and of the expansion 7.

Conveniently, to reduce friction, the end of the hook 17 internal to the port 22 is laterally provided with two undercut taperings 25 and 26 which also define two vertices coinciding with the pivoting axis.

In a different embodiment, the magnetic circuit has the expansion 7 of the support 2 having the edge 30, defined by its flattened face 8 and by the second inclined face 9, conveniently rounded and protruding with respect to said flattened face 8 so as to have greater resistance against any damage deriving from external factors or from long periods of operation, together with the fact that it better defines the fulcrum line so as to have greater assurance of durability in the course of time.

The fact that the rounded edge 30 protrudes with respect to the flattened face 8 allows, during the operation of the magnetic circuit, the flattened surface 8 and the surface of the movable keeper 5, facing the latter, to be mutually spaced apart so as to avoid their impact when the movable keeper reaches the end of its stroke.

Furthermore, to avoid phenomena of microseizure of the coupling between the rounded edge 30 and one of the dihedrals defined by the bracket 11 with the movable keeper 5, the second portion 15 of the bracket 11 has a region 31 advantageously provided in antifriction material.

The operation of the magnetic circuit according to the invention is evident from what has been described and illustrated, in particular with reference to figure 1 it can be observed that the magnetic circuit closes through a core fixed to its support and to the polar expansion fixed on the other side of the core and arranged facing the movable keeper.

The magnetic field created by the coil generates a magnetic flux which in turn determines the force of attraction between the polar expansion and the movable keeper which can rotate by a certain angle about the fulcrum.

The coupling of the fixed support to the movable keeper, according to the present invention, is provided so that the two parts are free to rotate by an angle α about the line formed by the edges, respectively, of the ends defined by the expansion of the supporting element and of the machined end of the movable keeper.

By virtue of the presence of the bracket and of the hook it is possible to keep these two edges on the pivoting line so as to totally eliminate the presence of friction.

In practice it has been observed that the device according to the invention is particularly advantageous in reducing, conveniently and regardless of the thickness of the support, the magnetic drop in the fulcrum, which is inversely proportional to the facing surface, and in obtaining an improved magnetic yield of the magnetic circuit.

Furthermore, the particular execution of the fulcrum between keeper and support allows to perform the rotation of the two parts up to a maximum of an angle of $\alpha°$ without scraping and therefore without friction, making this magnetic circuit particularly suitable for relays intended for a long mechanical life and with various types of cycling.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept; moreover, all the details may be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the dimensions, may be any according to the requirements and to the state of the art.

Where technical features mentioned in any claim are followed by reference signs, those reference

signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Magnetic circuit particularly for safety, long-life and high-reliability relays, comprising a supporting element, a core having a polar expansion arranged facing a movable keeper oscillable about an axis of pivoting to said support, characterized in that said support has, on its end directed towards said movable keeper, an expansion for the reduction of the magnetic drop in the region of pivoting of said movable keeper to said supporting element regardless of the thickness thereof.

2. Magnetic circuit according to claim 1, characterized in that it comprises means for the alignment of the end of said movable keeper and of said supporting element on said pivoting axis.

3. Magnetic circuit according to claims 1 and 2, characterized in that said expansion has a first flattened face arranged facing said movable keeper and a second substantially inclined face defining with said first face an edge coinciding with said pivoting axis.

4. Magnetic circuit according to claim 2, characterized in that said alignment means comprise at least one bracket having a first portion rigidly associated with a first planar surface of said keeper, opposite to said supporting element, and a second portion extending for a portion thereof parallel to a second planar surface of said keeper orthogonal to said first surface and, for a portion, inclined.

5. Magnetic circuit according to claim 4, characterized in that said bracket has a port extending between said first and second portion and an opening affecting said inclined portion.

6. Magnetic circuit according to claim 1, characterized in that said alignment means comprise a hook having a first region of itself rigidly associated with said supporting element and a second region passing through said opening an engaging with its end in said port of said bracket.

7. Magnetic circuit according to claim 6, characterized in that said end of said hook has an edge defined by an inclined face arranged substantially on the same plane defined by said second inclined face of said expansion; said edge of said angle coinciding with said pivoting axis.

8. Magnetic circuit according to one or more of the preceding claims, characterized in that said movable keeper has a maximum angle of rotation substantially equal to α and in that said inclined face of said hook and said second inclined face of said expansion have an inclination substantially defined by an angle equal to $\beta - \alpha$.

9. Magnetic circuit according to one or more of the preceding claims, characterized in that said bracket defines with said movable keeper substantially two dihedrals having an amplitude equal to β, arranged opposite and offset, and having their vertices arranged on said pivoting axis.

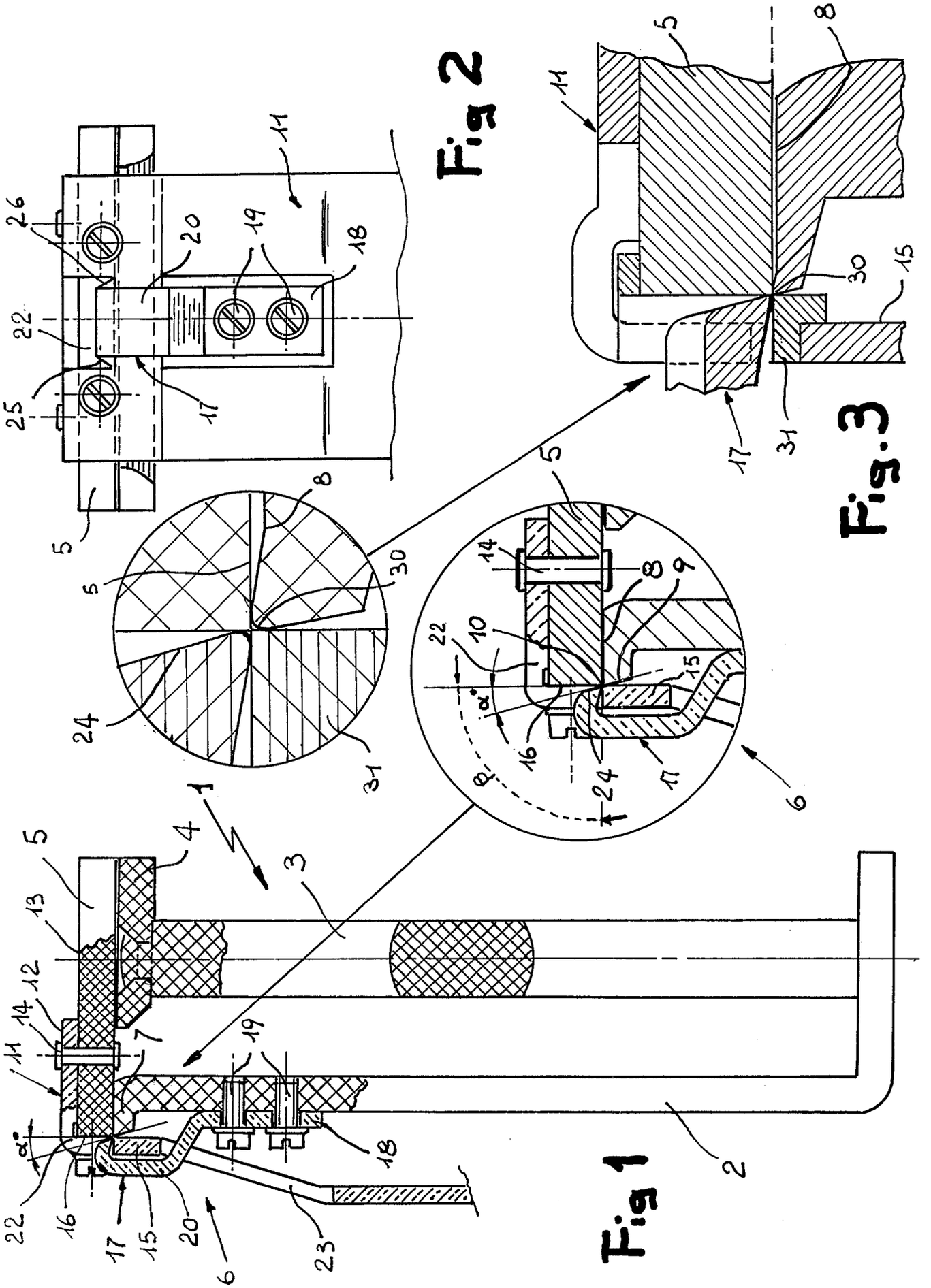
10. Magnetic circuit according to one or more of the preceding claims, characterized in that said vertices of said dihedrals are arranged respectively on said edges of said hook and said expansion and on said pivoting axis.

11. Magnetic circuit according to one or more of the preceding claims, characterized in that said end of said hook, internal to said port, is laterally provided with two undercut taperings defining two vertices coinciding with said pivoting axis.

12. Magnetic circuit according to one or more of the preceding claims, characterized in that said edge of said expansion is rounded and protruding with respect to said flattened face.

13. Magnetic circuit according to one or more of the preceding claims, characterized in that said flattened face and said movable keeper are mutually spaced.

14. Magnetic circuit according to one or more of the preceding claims, characterized in that said bracket has, on said second portion, at least one region in antifriction material.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
22
23
24
25
26
30
31
α
Fig 1
Fig 2
Fig 3