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MINIATURE ELECTROMAGNETIC RELAYS

Filed Feb. 5, 1965

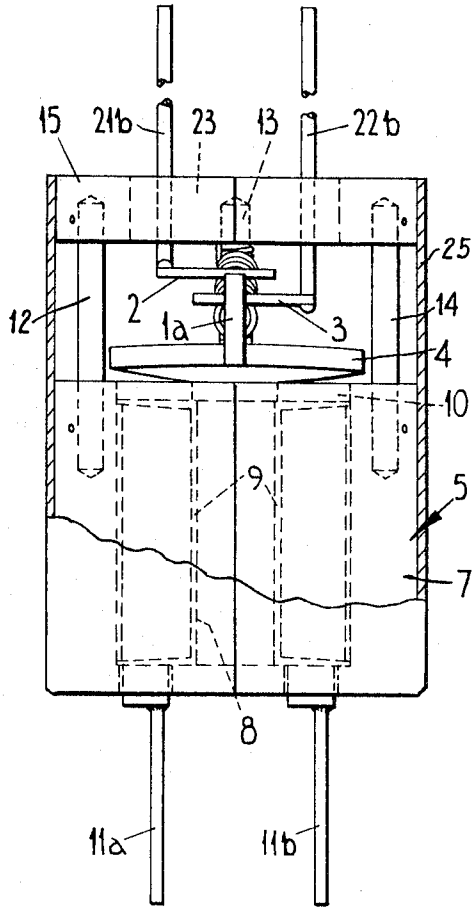

Fig. 1

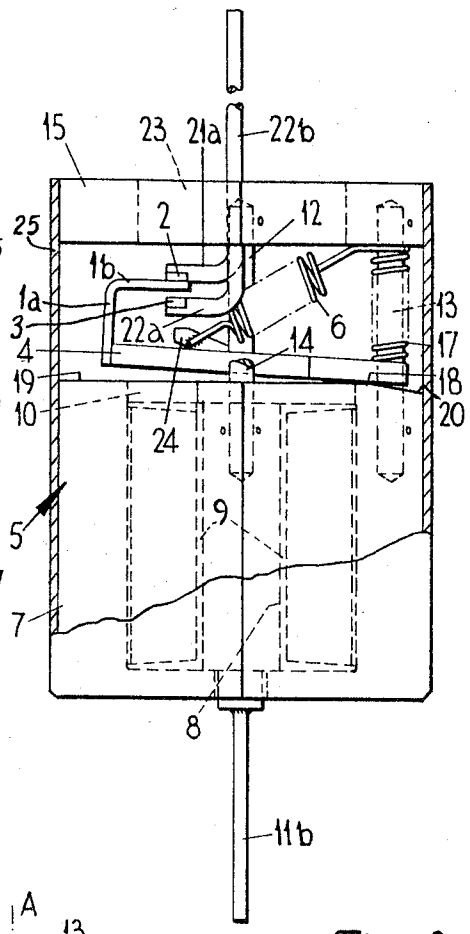

Fig. 2

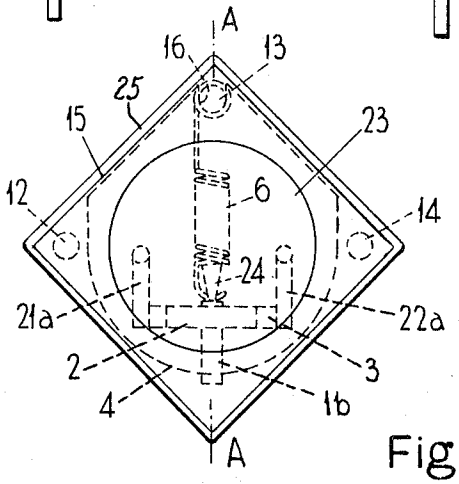

Fig. 3

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MINIATURE ELECTROMAGNETIC RELAYS

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This invention relates to miniature electromagnetic relays.

It is an object of the present invention to provide an improved miniature electromagnetic relay.

A difficulty with such a relay is to ensure that the so-called "contact pressure" obtained between a movable electric contact member and a relatively fixed electric contact member when the relay armature is in its normal, i.e. nonactuated position lies within a small range of small values, for example 8 to 12 grammes.

It is another object of the present invention to provide an improved construction of miniature electromagnetic relay in which this difficulty is overcome.

According to the present invention, a miniature electromagnetic relay comprises an electromagnet assembly, an armature formed by a plate of ferromagnetic material which supports a movable electric contact member adjacent to one edge and which is pivotally mounted adjacent to its opposite edge on a pivot edge of the electromagnet assembly, a first spring which acts on the armature so as normally to hold the movable contact member in engagement with a stop, a fixed contact member which may be said stop and a second spring which holds the armature against said pivot edge, the electromagnet assembly having an energising winding and being arranged so that by energising this winding with direct current the armature is caused to turn about its pivot against the action of said first spring and thereby carry said movable contact out of engagement with said stop and the arrangement being such that the movable contact member engages the fixed contact member in one position of the armature but not the other.

According to a feature of the present invention, a miniature electromagnetic relay comprises an electromagnet assembly, an armature formed by a plate of ferromagnetic material which supports a movable electric contact member adjacent to one edge and which is pivotally mounted adjacent to its opposite edge on a pivot edge of the electromagnet assembly, a coiled spring which acts on the armature so as normally to hold the movable contact member in engagement with a relatively fixed electric contact member and which is inclined to the armature so that only part of the pull exerted thereby acts to maintain said engagement, and a further spring which holds the armature against the pivot edge, the electromagnet assembly having an energising winding and being arranged so that by energising this winding with direct current, the armature is caused to turn about its pivot against the action of said spring and thereby carry said movable contact member out of engagement with said fixed contact member.

The relay may be of such a size that, excluding electric leads thereto, it occupies a volume less than 0.25 cubic inch.

One embodiment of a miniature electromagnetic relay in accordance with the present invention will now be described by way of example with reference to the three figures of the accompanying drawings in which:

FIGURES 1 and 2 show front and side elevations respectively of the relay, and

FIGURE 3 is a plan view of the relay.

Referring to the drawings, the relay comprises a movable electric contact member **1**, two relatively fixed

electric contact members **2** and **3**, a pivoted armature **4** which supports the movable contact member **1** and an electromagnet assembly **5** for actuating the armature. The movable contact member **1** normally is held in engagement with the fixed contact member **2** by the pull exerted on the armature **4** by a lightly stressed coiled spring **6** inclined to the armature and is moved out of engagement with this fixed contact member and into engagement with the second fixed contact member **3** when the armature is attracted by the electromagnet assembly **5**.

The electromagnet assembly **5** comprises a pot shaped yoke **7** of Swedish iron with a central core **8** of the same material, an energising winding (not shown) on a moulded insulating bobbin **9** which embraces the core and is within the yoke, and a cheek plate **10** of copper or brass which seals the open end of the yoke so that the bobbin and its winding are completely enclosed. The ends **11***a* and **11***b* of the energising winding extend through apertures in the base of the yoke **7** that are sealed against the ingress of moisture. The yoke **7** and the core **8** are of unitary construction the yoke being produced with the core by impact extrusion. The yoke **7** is generally square in its external cross-section and has three thin pillars **12**, **13** and **14** attached at three of its four corners respectively. These pillars **12**, **13** and **14** support a metal end plate **15** of the relay at a predetermined distance from the yoke **7**, the plate corresponding in cross-section to the yoke and having its sides aligned with those of the yoke.

The armature **4** comprises a substantially flat plate of Swedish iron and as can be seen in FIGURE 3, corresponds in shape to a square which has had three of its corners removed, the square substantially corresponding in size to the square cross-section of the yoke **7**. The pillar **13** passes freely through a slot **16** in the remaining corner of the armature **4** and a further coiled spring **17** which embraces this pillar is held in compression between the end plate **15** and the armature. Thus the end of the armature **4** adjacent to this pillar **13** is caused to bear against the common edge **18** of surfaces **19** and **20** of the yoke **7**. This edge **18** is perpendicular to the line A—A (FIGURE 3) through this pillar **13** and the diagonally opposite corner of the yoke **7** and comprises the pivot on which the armature **4** is able to turn when attracted by the electromagnet assembly **5**.

The movable contact member **1** is generally L shaped and has the end of one arm **1***a* attached to the end of the armature **4** that is furthest from the said pivot so that its other arm **1***b* extends towards the pivot and is substantially parallel to the armature. This latter arm **1***b* is of a precious metal alloy, for example 5% nickel, 95% gold, to ensure good electrical contact with each of the fixed contact members **2** and **3** which also are of the same alloy for this purpose. The free end of the arm **1***b* of this member **1** lies between the fixed contact members **2** and **3** which are attached to two resilient wires **21** and **22** respectively. Each of these wires **21** and **22** is bent so that one end portion **21***a* or **22***a* which carries the appropriate fixed contact member **2** or **3** is parallel to both the line A—A (FIGURE 3) and the end plate **15**, and the other end portion **21***b* or **22***b* is perpendicular to this end plate. Both of the end portions **21***b* and **22***b* of these wires are hermetically sealed in an insulating plate **23** of glass which, in turn, is hermetically sealed in an aperture through the end plate **15**. Thus the fixed contact members **2** and **3** are supported by the end plate **15** and are positioned one immediately above the other in the space between that plate and the armature **4**.

The actual position of the fixed contact member **2** is such that when it is engaged by the movable contact member **1** the coiled spring **6** is inclined at an angle of

approximately 30° to the armature 4. This spring 6 has one end anchored adjacent to the end plate 15 on the pillar 13 which carries the other spring 17 and has its other end hooked over a small tongue 24 provided on the armature 4 between the pivot and the movable contact member 1. The position of the fixed contact member 3 is such that it is engaged by the movable contact member 1 when the armature 4 is attracted against the cheek plate 10 of the electromagnet assembly 5, this occurring when the said winding is energised with a suitable value of direct current.

Because of the inclination of the coiled spring 6 to the armature 4 only about half of the pull everted by that spring is acting to turn the armature about its pivot. Furthermore this spring 6 is acting on the armature 4 at a shorter distance from the pivot than the corresponding reaction between the movable contact member 1 and the fixed contact member 2 when in engagement. Consequently, in order to ensure that the so-called contact pressure between these contact members 1 and 2 lies within a range of small values, for example 8 to 12 grams, it is necessary to arrange that the pull exerted by the spring 6 on the armature 4 lies within a relatively large range of relatively large values, for example, 20 to 30 grams, and this can be accomplished without much difficulty. The spring 6 also acts to hold the armature 4 against the pillar 13.

The relay described above is about a quarter of an inch square in cross-section and about half an inch long excluding the electric leads 11*a*, 11*b*, 21*b* and 22*b* to the said energising winding and to the fixed contact members 2 and 3.

This relay is accommodated in a metal tube 25 which has substantially the same cross-section as the yoke 7 and end plate 15 and the sides of the yoke and of the end plate may be soldered or otherwise joined to the inside walls of this tube to provide a hermetically sealed unit.

I claim:

1. In a miniature electromagnetic relay the combination of

(A) a supporting structure having a pivot edge,

(B) a pillar in said structure that is adjacent to said pivot edge,

(C) an armature formed by

(I) a plate of ferromagnetic material

(II) having a slot in an edge thereof that cooperates with said pillar to locate said armature on the pivot edge for angular motion between first and second positions relative to said structure,

(D) an electromagnet included in said structure for moving said armature to said first position,

(E) a coiled spring

(I) which is attached between said structure and said armature and

(II) which is inclined to said armature

(III) whereby the pull exerted by this spring has two mutually perpendicular components that respectively bias said armature towards said second position and hold said armature against said pillar, and

(F) a further spring which is carried by said structure and which holds said armature against said pivot edge.

2. A miniature electromagnetic relay according to claim 1 wherein the two ends of said coiled spring respectively engage the armature and the said pillar.

3. A miniature electromagnetic relay according to claim 2 wherein said further spring is a coiled spring which embraces the said pillar.

4. A miniature electromagnetic relay according to claim 3 wherein said structure comprises an electromagnet assmbly which includes said electromagnet, which has

pivot edge and from which said pillar extends, and a stop member supported at least in part by said pillar at a predetermined spacing from said electromagnet assembly, and wherein said further spring is held in compression between said armature and said stop member.

5. A miniature electromagnetic relay according to claim 4 wherein a movable contact member having an electric contact making portion is carried by said armature for movement with that armature and a fixed contact member is supported by said stop member and has an electric contact making portion that is engaged by the contact making portion of said movable contact member as the result of motion of said armature from said first position to said second position.

6. A miniature electromagnetic relay according to claim 5 wherein the stop member is in the form of a plate which also is supported by further pillars carried by the electromagnet assembly and wherein the armature, the said springs and at least the contact making portions of the contact members are in the space between this plate and the electromagnet assembly.

7. A miniature electromagnetic relay according to claim 6 which is sealed within a metal tube, the said stop member closing one end of the tube and the electromagnet assembly closing the other end of that tube.

8. A miniature electromagnetic relay comprising

(A) a supporting structure having a pivot edge,

(B) a pillar in said structure that is adjacent to said pivot edge,

(C) an armature formed by

(I) a plate of ferromagnetic material

(II) having a slot in an edge thereof that cooperates with said pillar to locate said armature on said pivot edge for angular motion between first and second positions relative to said structure,

(D) an electromagnet included in said structure for moving said armature to said first position,

(E) a coiled spring

(I) which is attached between said structure and said armature and

(II) which is inclined to said armature

(III) whereby the pull exerted by this spring has two mutually perpendicular components that respectively bias said armature towards said second position and hold said armature against said pillar,

(F) a further spring which is carried by said structure and which holds said armature against said pivot edge,

(G) a movable contact member which is carried by said armature for movement with that armature and

(H) a fixed contact member which is carried by said structure for engagement by said movable contact member in said second position of said armature.

9. A miniature electromagnetic relay according to claim 8 further comprising a second fixed contact member which is carried by said structure for engagement by said movable contact member in said first position of said armature.

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