July 5, 1966 M. AMANN 3,259,717

MINIATURE ELECTROMAGNETIC RELAY

Filed July 12, 1963 3 Sheets-Sheet 1

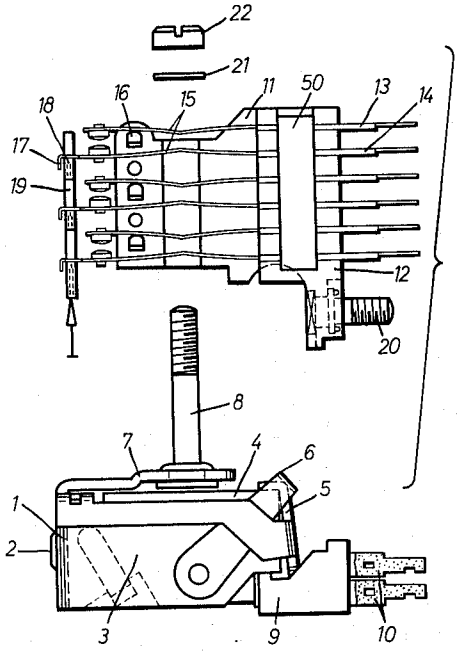

Fig.1

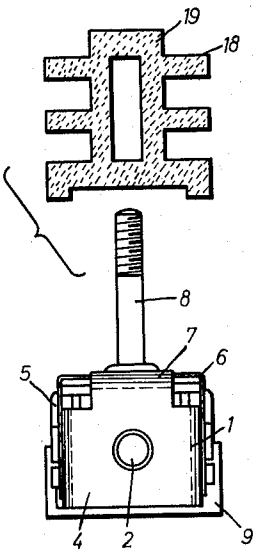

Fig.2

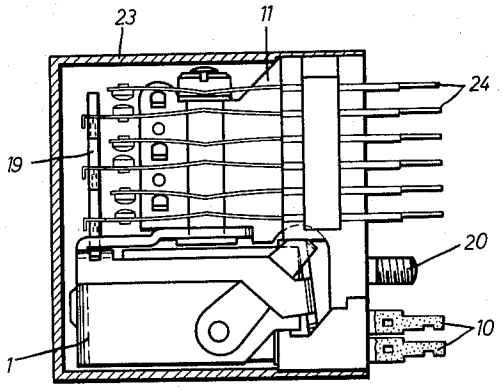

Fig.3

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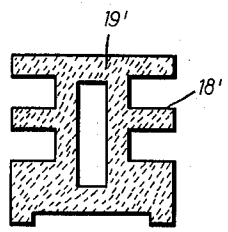

Fig. 4a

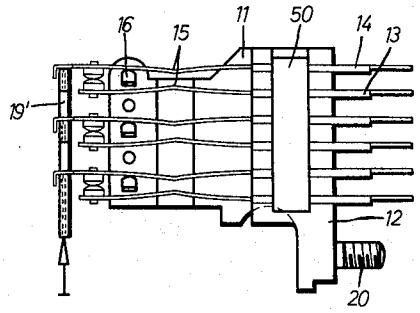

Fig. 4b

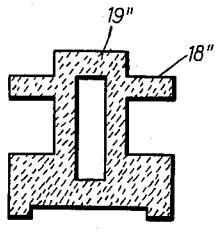

Fig. 5a

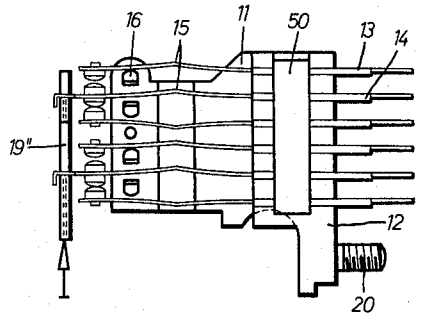

Fig. 5b

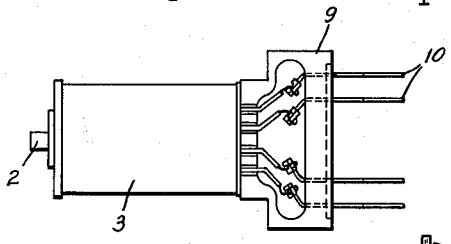

Fig. 12

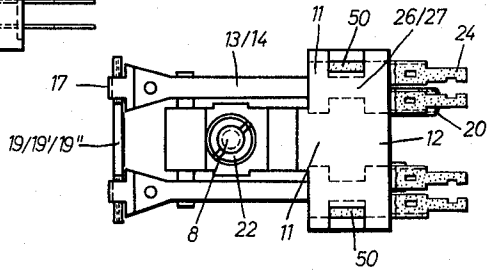

Fig. 6

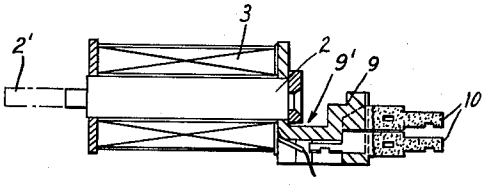

Fig. 13

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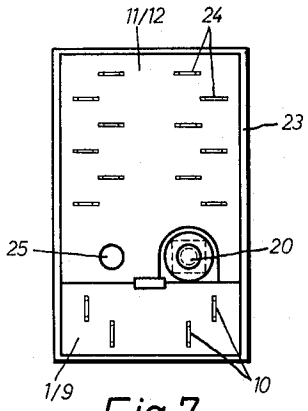

Fig.7

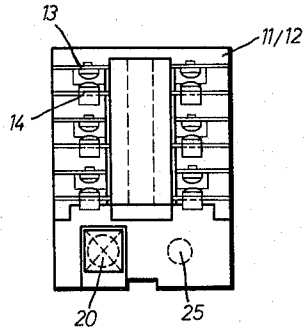

Fig.8

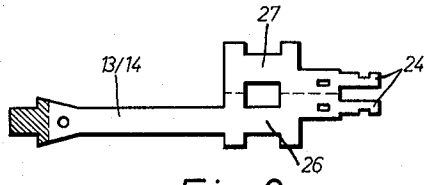

Fig.9

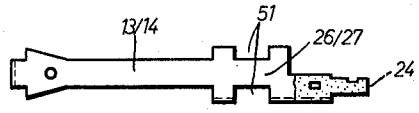

Fig.10

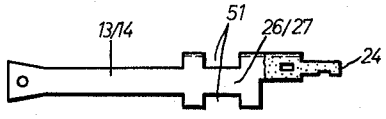

Fig.11

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United States Patent Office 3,259,717 Patented July 5, 1966

3,259,717

MINIATURE ELECTROMAGNETIC RELAY

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Filed July 12, 1963, Ser. No. 294,664
Claims priority, application Germany, July 21, 1962, St 19,508
1 Claim. (Cl. 200—104)

The invention relates to electromagnetic miniature relays having a unitary contact spring set and a unitary magnetic system readily detachable from one another to enhence testing operations and to reduce inventory.

Miniature relays are known in which the magnetic system consists of an angular armature and a U-shaped iron core having groups of contact spring sets located side by side and securely mounted on the legs of the core. The contact spring sets consist of individual contact springs, insulating intermediate layers, soldering lugs and supporting sheet metal strips which are placed one above another and held in place by threaded bolts. These relays consist of many individual parts which must be carefully manufactured and exactly arranged. In addition, high installation costs are incurred when assembling the many individual parts, for example as the contact springs must be individually adjusted and checked. Due to the many contact combinations required, for example the break contacts, made contacts and switch-over contacts, as well as many different windings requirements for different core operating voltages, large inventories are required for these known miniature relays. Therefore the construction and the manufacturing of such relays are very expensive and complicated.

Accordingly, it is an object of this invention to avoid the above disadvantages of the known miniature relays. This is achieved in that the inventive miniature relay consists of two readily detachable component groups compatable with each other and each suitable for separate fabricating and testing.

According to a preferred embodiment of the invention, the spring set component group consists of a T-shaped insulating body, with the horizontal portion supporting one end of two sets of contact springs and with the vertical portion extending longitudinally with the springs. The horizontal leg of the T-shaped insulating body is provided with slots into which prestressed contact springs will be inserted without readjustment and secured into position.

According to a further feature of the invention the connecting terminals for the spring sets are arranged in two groups side by side and the connecting terminals for the magnetic system are similarly arranged in such a way that the relay can directly be soldered directly to a printed circuit board.

The miniature relay according to the invention has various advantages. The arrangement of the relay in two separate component groups which can be mounted and tested individually, permits the elimination of many single parts of the hitherto known design of a contact spring set. For example, the insulating intermediate layers, the soldering lugs, the supporting metal sheets, the insulating tube, the cover plate, and the mounting screw. The spring contact sets of the present invention can be individually checked for their mechanical and electrical properties, kept on stock, used in exchange, or used as an addition to the magnetic basic body.

The invention will now be described with the aid of the accompanying drawings in which:

FIG. 1 shows a side view of the unitary spring set and unitary magnetic structures separated from one another.

FIG. 2 shows the front view of the relay of FIG. 1 in which the spring set and the associated mounting parts have been omitted.

FIG. 3 shows a side view of the completed relay having a protective cover or cap thereon with the cap shown in cross-sectional form.

FIG. 4*a* shows a front view of an operating plate of the relay arranged to accommodate six break contacts.

FIG. 4*b* shows a side view of a spring set comprising six break contacts with the operating plate of FIG. 4*a* inserted into proper association with a contact springs.

FIG. 5*a* shows a front view of an operating plate of the relay arranged to accommodate four switch-over contacts.

FIG. 5*b* shows a side view of a spring set comprising four switch-over contacts with the operating plate of FIG. 5*a* inserted into proper association with the contact springs.

FIG. 6 shows a top view of the assembled relay.

FIG. 7 shows a rear view of the insulating spring base plate which supports the contact springs and the magnet base plate which supports the magnetic structure.

FIG. 8 shows a front view of a completely assembled relay.

FIG. 9 shows a top view of a contact spring after punching but before forming.

FIGS. 10 and 11 show a top view on various types contact springs.

The magnetic base body **1** in FIG. 1 consists of a core **2**, a coil **3**, a yoke **4**, an armature **5**, an armature mounting **6**, a mounting angle **7**, a supporting bolt **8**, a pressed or molded part **9** and a soldering-type or plug-in-type terminals **10**. The spring set assembly **11** is arranged above this body **1**. The spring set assembly essentially consists of a molded or sprayed base body **12**, contact springs **13** and **14** inserted into base **12** and the operating plate **19** hooked into the contact springs **14** for the operation of the contact springs **13** and **14**. A relay mounting bolt **20** is inserted into the molded or sprayed part **12**. Support tabs **16** are sprayed on part **12** in order to support the free end of the contact springs **13** or, depending on the equipment, the contact spring **14**.

FIG. 1 shows the inventive relay having make contacts only. The contact springs **13** and **14** are provided with a prestressing bend at point **15** and the contact spring **14** has a bend at point **17**. The spring **14** is inserted into the operating plate **19** at point **18**. After mounting the spring set element **11** on magnetic body **1**, both basic bodies **1** and **11** are connected together by mounting bolt **8**, washer **21** and nut **22**.

FIG. 2 shows a front view of the magnetic base body **1** and the operating plate **19**.

FIG. 3 shows an assembled relay consisting of the magnetic body **1** and the spring set element **11** with the operating plate **19** inserted into the contact springs. A relay cap **23**, shown in section, encloses the relay. The bolt **20**, forming a part of the spring set component **11** serves to mount the relay on a relay strip or secure it to a plate or board having circuitry printed thereon.

FIG. 4*a* shows an operating plate **19'** with edges or rests **18'** for supporting the contact springs **13** and **14**. This operating plate **19'** is arranged to accommodate six break contacts.

FIG. 4*b* shows the spring set element **11** having the six break contacts in assembled position on the operating plate **19'**.

FIG. 5*a* shows an operating plate **19''** with rests or edges **18''** for supporting a spring set element **11** equipped with four switch-over contacts.

FIG. 5*b* shows the spring set element **11** having the four switch-over contacts in assembled position on the operating plate **19''**.

FIG. 6 shows a top view of the spring set element **11** assembled on the magnetic body **1** of the relay. An operating plate **19**, **19'**, or **19''** can be inserted into the spring set element **11** depending on the particular combination of contact springs **13** and **14** (make contacts, break contacts or switch-over contacts). Insulating strips **50** are provided to keep all contact springs in place. Plug-in type or soldering type terminals **24** are provided at one end of the contact springs **13** and **14**. The magnetic base body **1** normally located below the spring set element **11** is omitted in FIG. 6 for purposes of simplicity.

FIG. 7 shows a rear view of the base body **12**. As already mentioned, bolt **20** serves to mount the relay on a relay strip or to a printed circuit plate. The pin **25** is either sprayed on or molded onto the molding part **12** of the spring set or consists of a metal pin inserted into the molded part **12**, and precludes rotation of the relay when mounted in position. The contact spring ends **10** and **24** are arranged in two groups either side by side or above one another to enable soldering of the terminals ends into the soldering eyelets of the printed circuit board.

FIG. 8 shows the front view of spring set element **11**. In this view, the operating plate **19** has been omitted.

FIGS. 9, 10, and 11 show examples of contact springs **13** or **14**.

FIG. 9 shows a contact spring **13** or **14** as a completely punched and unformed part. At the plug-in-type or soldering-in-type connecting ends **24** the contact spring is folded over so that the rear end of the contact springs **13** and **14** is reinforced.

FIGS. 10 and 11 show different designs of contact springs **13** and **14** having folded rear terminal ends **24**. The contact springs **13** and **14** are kept in place in the spring set element **11** at points **26**, **27** (FIG. 6), by two rectangular recesses **51** adapted to receive insulating strips **50**. The prestressed contact springs are suitably hardened at point **15** or are provided at the surface **26/27** with a hardening adhesion or foil such as bronze. Molded part **12** includes slots into which the contact springs are inserted or pressed while in their prestressed condition. The molded part **12** consists of a heat resistant spray or molding compound.

After inserting the contact springs **13** and **14** into the molded part **12**, the entire component will be exposed to a heat treatment, for example within a high frequency field. During this heat treatment the foil applied at the spots **26** and **27** of the contact springs **13** and **14**, will be hardened and the contact springs **13** and **14** within the molded part **12** remain firm with regard to their location. During the heating process the contact springs **13** and **14** are rigidly secured into position.

FIG. 12 shows a part of the magnetic body **1**. This part consists of a core **2**, a coil **3**, an insulating part **9** and terminal pins **10**. The coil **3** can be provided with more than one winding. The yoke **4** (FIGS. 1 to 3) is not shown secured to the core **2** of the magnetic body **1** in the figure.

FIG. 13 shows a cross-sectional view of the portion of the magnetic unit **1** of FIG. 12. The connecting ends of the coil **3** are not yet connected with terminal pins **10** within the recesses of the insulating body **9**. The core **2** has an extended pin **2'** which can be used to hold the core during winding. Prior to securing the yoke **4** to the magnetic body **1**, pin **2'** will be flattened to form a rivet head.

While the principles of the invention have been described above in connection with specific circuitry and applications, it is to be understood that this description is made only by way of example and not as a limitation on the scope of the invention.

I claim:

An electromagnetic relay structure comprising an adjustable magnet system assembly and a separately detachable and adjustable spring contact assembly, said spring contact assembly including a plurality of relay type contact springs fastened thereto, first support means including a first supporting bolt connected to said magnet system assembly mounting said spring contact assembly directly to said magnet system assembly, an operating plate associated with said spring contact assembly engaging said magnet system assembly and engaging said relay contact springs and thereby operating said spring contact contact assembly in response to operation of said magnet system assembly, said operating plate being removably supported to permit its ready replacement by another structurally different operating plate selected to operate said spring contact assembly as determined by the arrangement of contacts in the spring contact assembly and providing another predetermined switching function, second support means comprising a second supporting bolt connected to said spring contact assembly and protruding therefrom in a manner enabling the spring contact assembly to receive mechanical support from outside sources, said first and second supporting means being held by their respective connections in positions normal to one another, said spring contact assembly including a unitary T-shaped spring contact support body having a longitudinal leg and a transverse leg, an aperture in the longitudinal leg receiving said supporting bolt, said contact springs having one end thereof rigidly secured in the transverse leg of said T-shaped support body, said longitudinal leg of said T-shaped body including a plurality of support means supporting the free ends of predetermined ones of said contact springs, and said contact springs each including a terminal portion extending externally of said transverse leg of said T-shaped support body and arranged to slidingly engage an associated printed circuit board.

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