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Snap-acting switch device in combination with an auxiliary switch

This invention concerns improvements in or relating to electrical snap-acting switch devices of the kind having a movable contact carried by a snap spring element which is acted upon by an operating element to cause snap movement of the movable contact relative to a fixed contact.

In such switch devices the snap operation of the switch in a contact-opening or a contact-closing sense occurs at specific points in the travel of the switch operating element.

Normally the calibration of such a switch device, that is, the determination of the points in the travel of the switch operating element at which snap operation of the switch occurs, would be carried out by adjusting the normal rest position of the part of the snap spring element which is engaged by the switch operating element. Another known method of calibration is to adjust the position of the fixed contact by means of a setting screw acting upon a support member carrying the fixed contact, as described in U.S. Patent Specification No. 2985738.

It is also known, for example in U.S. Patent Specification No. 3688060, to provide an auxiliary switch in combination with a snap action switch device, to be operated at a predetermined point in the travel of an operating tongue of the snap action switch. The operation of the auxiliary switch may provide a signal monitoring of the snap action switch itself.

An object of the present invention is to facilitate the assembly and calibration of a snap-acting switch device in combination with an auxiliary switch so that the components of the device can be assembled on and fixed to an insulating base without recourse to elaborate calibration procedures.

According to the present invention there is provided a snap-acting switch device comprising a snap spring element carrying a movable contact cooperating with a fixed contact, the snap spring element being operable by deformation of an operating tongue projecting cantilever-fashion with the snap spring element from an insulating base, and an auxiliary switch operable by the said tongue at a predetermined point in its travel, characterised in that,

— the fixed contact is carried by a deformable support member which is given a predetermined deformation upon assembly of the device to preset the operating point of the switch contacts upon displacement of the operating tongue, and

— the auxiliary switch has an operating lever arm which is assembled on the base with one end in superimposed relation with the operating tongue of the snap spring element, said lever arm extending generally transversely with respect to the direction of cantilever projection

of the said operating tongue.

By effecting a deformation of the support member of the fixed contact the operating point of the switch, specifically the point in the travel of the switch operating element at which the switch contacts open, can be predetermined, without changing or adjusting the position of any part of the snap spring element. This in turn is an important practical consideration, since it means that the switch device can be assembled with the snap spring element in a fixed predetermined position, calibration being effected subsequent to assembly of the switch device by controlled deformation of the fixed contact.

Moreover, the simple superimposition of the operating tongue of the snap spring element and the operating lever arm of the auxiliary switch facilitates the assembly of the switch device. By arranging the operating lever arm of the auxiliary switch transversely to the direction of cantilever projection of the operating tongue of the snap spring element the point of engagement of the operating tongue with the said lever arm can be determined accurately while allowing a wide tolerance in the relative positioning of the snap spring element and the operating lever arm.

Since the switch device is calibrated by deformation of the fixed contact support member it is not necessary to make provision for the adjustment of the snap spring element itself, and this, as well as simplifying the assembly of the switch device, also ensures that the position of the point of engagement with the snap spring element of the switch operating element is always the same relative to the supporting structure of the snap spring element. This in turn is an important consideration where the snap spring element is arranged to initiate operation of an auxiliary switch, since the point of operation of the switch can then be predetermined in the assembled switch device.

To predetermine the operating point of the auxiliary switch the operating lever arm of the latter preferably has a heel of predetermined dimensions which is engageable by the operating tongue of the snap spring element. Since the operating lever arm is arranged transversely to the operating tongue it can be arranged that the heel engages the tongue substantially at a point, where the heel and the tongue intersect; by shaping or cutting this heel to an appropriate depth it is possible to predetermine accurately the operating point of the auxiliary switch, without changing the operating points of the snap spring element itself and the main switch contacts associated therewith.

The required deformability of the fixed contact support member may be achieved by providing apertures in the support member close to and on opposite sides of the fixed contact. These apertures, as well as weakening the sup-

port member to give it the desired deformability, are preferably so disposed that they assist in ventilating the space in the immediate vicinity of the fixed and movable contacts. Such ventilation has the effect of sweeping ozone away from the vicinity of the switch contacts and thereby minimising the likelihood of arcing between the contacts.

Contact ventilation apertures may alternatively, or in addition, be provided in the snap spring element carrying the movable contact, in the immediate vicinity of the movable contact: such apertures may be positioned so as to enhance the torsional or flexural resilience of the snap spring element in the vicinity of the movable contact carried thereby so as to give rise to a sliding or rocking movement of the movable contact relative to the fixed contact prior to separation of the contacts, thereby achieving a "wiping" action, which is desirable in switch contacts for the avoidance of contact welds.

The invention will be further described, by way of example, with reference to the accompanying purely diagrammatic drawings, in which:

Figure 1 is a plan view of a switch device according to one embodiment of the invention, and

Figure 2 is a cross-section of the switch device taken on the line II—II of Figure 1.

The electrical switch device illustrated in the drawings has a moulded plastics base 1 in which electrically conductive metal strips 2, 3, are supported, the strips 2, 3, being parallel to each other and extending along opposite sides of the base 1, each strip 2, 3, being anchored to the base 1 at two positions spaced apart along its length by upsetting and staking portions of the respective strip in appropriately positioned apertures moulded in the base 1. Each strip 2, 3, has an outwardly projecting terminal portion 4, 5, respectively.

The switch device has a snap acting switch blade 6 comprising a snap spring element projecting cantilever fashion from a tab 7 which is secured by rivets 8 to the terminal strip 2. The switch blade 6 has two projecting cantilever arms 9, 10, which at their ends remote from the anchoring tab 7 are drawn together and interconnected by a rectangular contact element 11 which constitutes a movable contact of the switch device. The contact element 11 is located beneath the terminal strip 3 in the plan view of Figure 1 and is therefore shown in ghost outline in Figure 1, the contact element 11 cooperating with a fixed contact 12 (Figure 2) carried on the underside of the terminal strip 3.

The drawing together of the two cantilever arms 9, 10, of the switch blade 6 prestresses the entire blade with a dish-deformation, predisposing the blade for snap movement between configurations of opposite dish deformation. Such snap movement of the blade is effected by means of a switch operating

element 13, part of which is shown diagrammatically in Figure 2, which acts upon a raised protuberance 14 formed on a central tongue 15 of the switch blade, the tongue 15 being formed integrally with the blade and lying symmetrically between the two cantilever arms 9, 10.

In the illustrated embodiment the switch contacts are normally open (Figure 2) the spacing between the movable contact 11 and the fixed contact 12 in the open condition being predetermined by a setting screw 16 engaged in a threaded aperture in the base 1. Closure of the switch contacts is effected by displacement of the switch operating element 13 in the direction indicated by the arrow in Figure 2 to bend the central tongue 15 towards the base 1. At a predetermined point in the movement of the switch operating element 13 the deformed blade 6 reaches a point of instability, at which point the blade undergoes a snap movement towards an opposite dished configuration, in which the two cantilever arms 9, 10 bend in the opposite direction to the central tongue 15, away from the base 1, bringing the movable contact 12 into engagement with the fixed contact 11.

The switch blade 6 in the illustrated embodiment is mounted in a monostable manner, so that once operated as described above to close the switch contacts the stressing of the switch blade is such as to return the blade to its original configuration. Consequently, in this position the central tongue 15 exerts an elastic return force on the operating element 13, so that upon release of the latter the operating element 13 is moved in the opposite direction of the arrow in Figure 2, causing the switch blade 6 to revert to its original stable configuration with a further snap movement, thereby causing rapid opening of the switch contacts.

The point at which the contacts open upon release of the switch operating element 13 is predetermined by the position of the fixed contact 12. In accordance with the present invention calibration of the switch device, that is, the predetermination of the position of the switch operating element 13 in its return movement at which the switch contacts 11, 12 open, is effected after assembly of the components of the switch device by deformation of the terminal strip 3 carrying the fixed contact 12. Such deformation is made possible by the fact that the terminal strip 3 has an unsupported portion, spaced from the base 1, between its two points of anchorage to the base 1. Furthermore, such deformation is facilitated by providing the unsupported portion of the terminal strip 3 with apertures 17, 18, punched or drilled in the strip 3 prior to its assembly with the base 1 on opposite sides of the fixed contact 12, the apertures 17, 18, being located on the longitudinal centre line of the strip 3.

Upon assembly of the switch device the terminal strip 2 with the switch blade 6 riveted

thereto is first placed in position on the base 1, and the second terminal strip 3 carrying the fixed contact 12 is then placed in position so that the fixed contact 12 lies over the movable contact 11 carried by the switch blade 6. After securing the two terminal strips 2, 3, in position on the base 1 the unsupported region of the terminal strip 3 carrying the fixed contact 12 is deformed towards the base 1 by a suitable calibrating tool until the desired switch operating point is reached.

The apertures 17, 18, in the terminal strip 3, as well as facilitating the deformation of the fixed contact support constituted by the terminal strip 3, also act as ventilation holes promoting the flow of air between the contacts 11 and 12, and thereby removing ozone which would otherwise accumulate in the region of the two contacts 11, 12, and which could promote the establishment of an arc between the contacts when the switch opens. By ventilating the space in the immediate vicinity of the contacts 11, 12, the apertures 17, 18, in effect allow the air around the contacts to be changed after each make and break of the contacts. The apertures 17, 18, during the movement of the contact 11 away from the fixed contact 12, create a blowing effect which promotes a flow of fresh air and helps to extinguish the arc which may form between the contacts when opening the switch under electrical load conditions.

Since the cantilever-mounted switch blade 6 is supported in a fixed position relative to the base 1 the rest position of the central operating tongue 15 is also predetermined relative to the base 1. This is an important advantage as regards the calibration of an auxiliary switch, one form of which is illustrated in Figures 1 and 2. The auxiliary switch in the illustrated embodiment has a fixed contact 19 carried by a support member 20 fixed to the base 1 and formed with an outwardly projecting terminal portion 21. The contact 19 cooperates with a movable contact 22 carried at one end of a transverse arm of a T-shaped switch blade 23 which is supported cantilever fashion from the base 1 by a flexible support arm 24 constituting the stem or trunk of the T-shaped blade 23. The other end of the lateral arm or cross piece of the T-shaped blade 23 is bent at right angles to the said arm to form an upstanding heel 25 which cooperates with a flat end portion 26 of the central operating tongue 15 of the main switch blade 6.

An auxiliary switch setting screw 27 screwed into the base 1 engages the cross arm of the T-shaped auxiliary switch blade 23 between the operating heel 25 and the contact 22, providing a fulcrum for the auxiliary switch blade.

In the embodiment illustrated in the drawings the movable contact 22 of the auxiliary switch blade is arranged beneath the fixed contact 19 in the plan view of Figure 1. With this arrangement, the auxiliary switch contacts 19, 22 are normally open and are closed upon pivotal

movement of the auxiliary switch blade about the fulcrum screw 27, such pivotal movement being caused by engagement of the flat end portion 26 of the central tongue 25 of the main switch blade 6 with the upstanding heel 25 of the auxiliary switch blade, as a result of an excursion of the switch operating element 13 in the direction indicated by the arrow in Figure 2 beyond the normal excursion which closes the main switch contacts 11, 12. In a temperature sensing or thermostatic switch unit such an excursion of the switch operating element 13 would result from the sensing of an excessively high temperature, for example, the temperature in a freezer or refrigerator in the event of compressor motor failure. For such an application the closure of the auxiliary switch contacts 19, 22 could be utilised to operate a lamp to signal the motor failure.

The operating point of the auxiliary switch contacts, that is, the point in the excursion of the switch operating element 13 at which the auxiliary switch contacts 19, 22, are closed, can be predetermined by cutting or shaping the operating heel 25 of the auxiliary switch blade to an appropriate depth, thereby enabling the adjustable fulcrum afforded by the screw 27 to be replaced by a fixed fulcrum if desired.

Although the illustrated version of the auxiliary switch is a normally open switch, the auxiliary switch could alternatively be arranged so that its contacts were normally closed, by simply inserting an alternative fixed contact support 20 in which the fixed contact 19 is normally positioned below the movable contact 22 of the auxiliary switch blade, rather than above the contact 22 as in the embodiment of Figure 1. Alternatively, two different types of auxiliary switch blade 23 may be employed in conjunction with a single fixed contact 19 according to whether the auxiliary switch contacts are to be normally open or normally closed: in this case, the auxiliary switch blade 23 would have a cranked end carrying the movable contact 22, this cranked end lying beneath the fixed contact 19, as in the embodiment illustrated in Figure 1, for a normally open auxiliary switch, and above the fixed contact 19 for normally closed auxiliary contacts.

The resilient stem portion (arm 24) of the T-shaped auxiliary switch blade 23 serves the following purposes: (a) it acts as a return spring maintaining the auxiliary switch contacts 19, 22 normally open or closed, according to requirements; (b) it acts as a torsion spring biasing the moving contact 22. In addition, the resilient cross-piece of the T-shaped blade 23 permits, by virtue of its flexibility and the location of the fulcrum (screw 27), overtravel of the tongue 15 once the auxiliary contacts 19, 22 are closed. Current is supplied to the movable contact 22 of the auxiliary switch blade through the stem portion (arm 24) which is in electrical contact with the terminal strip 2 through a metal spacer element 28 (Figure 2).

Claims

1. A snap-acting switch device comprising a snap spring element (6) carrying a movable contact (11) cooperating with a fixed contact (12), the snap spring element being operable by deformation of an operating tongue (15) projecting cantilever fashion with the snap spring element from an insulating base (1), and an auxiliary switch (19, 20) operable by the said tongue (15) at a predetermined point in its travel, characterised in that,

— the fixed contact (12) is carried by a deformable support member (3) which is given a predetermined deformation upon assembly of the device to preset the operating point of the switch contacts (11, 12) upon displacement of the operating tongue (15), and

— the auxiliary switch has an operating lever arm (23) which is assembled on the base (1) with one end in superimposed relation with the operating tongue (15) of the snap spring element, said lever arm (23) extending generally transversely with respect to the direction of cantilever projection of the said operating tongue (15).

2. A switch device as claimed in Claim 1, in which the operating lever arm (23) carries an auxiliary switch contact (22) at its other end and engages a fulcrum (27) intermediate its ends, the said operating lever arm (23) being supported intermediate its ends by a flexible support arm (24) projecting cantilever-fashion from the base (1) in substantially the same direction as the snap spring element (6).

3. A switch device as claimed in Claim 2, in which the flexible cantilever support arm (24) and the operating lever arm (23) of the auxiliary switch are formed in one piece as a T-shaped auxiliary switch blade (23).

4. A switch device as claimed in Claim 1, Claim 2 or Claim 3, in which the operating lever arm (23) of the auxiliary switch has a heel (25) of predetermined dimensions at the said one end which is engageable by the operating tongue (15) of the snap spring element.

5. A switch device as claimed in any one of Claims 1 to 4, in which the support member (3) carrying the fixed contact (12) is provided with apertures (17, 18) close to and on opposite sides of the fixed contact (12), said apertures (17, 18) being so disposed that they assist in ventilating the space in the immediate vicinity of the fixed and movable contacts (11, 12) and also facilitate the deformation of said support member upon assembly of the device.

6. A switch device as claimed in any one of Claims 1 to 5, in which contact ventilation apertures (17, 18) are provided in the snap spring element in the vicinity of the movable contact (11) carried thereby.

7. A switch device as claimed in Claim 6, in which the ventilation apertures (17, 18) are positioned so as to enhance the torsional or flexural resilience of the snap spring element in

the vicinity of the movable contact (11) carried thereby so as to give rise to a sliding or rocking movement of the movable contact (11) relative to the fixed contact (12) prior to separation of the contacts.

8. A switch device as claimed in any one of the preceding claims, in which the support member of the fixed contact (12) comprises a terminal strip (3) mounted upon the base (1), the terminal strip (3) being anchored to the base at two spaced apart positions between which the said strip (3) is unsupported, and the said fixed contact (12) being carried by the said unsupported part of the terminal strip.

Patentansprüche

1. Schnappschaltvorrichtung, bestehend aus einer Schnappfeder (6) mit einem bewegbaren Kontakt (11), der mit einem festen Kontakt (12) zusammenwirkt, welche Schnappfeder durch die Deformation einer Betätigungszunge (15), die mit der Schnappfeder frei vorkragend von einem Isolationsgrundkörper (1) absteht, betätigt wird, ferner bestehend aus einem Zusatzschalter (19, 20) der durch die Betätigungszunge (15) an einem vorbestimmten Punkt ihres Betätigungsweges bedient wird, dadurch gekennzeichnet, daß der feste Kontakt (12) von einem deformierbaren Halteglied (3) getragen ist, dem eine vorbestimmte Deformation durch die Anordnung der Vorrichtung vorgegeben ist, um den Ruhepunkt des Schalterkontaktes (11, 12) bei der Verstellung der Betätigungszunge (15) einzustellen, und daß der zusätzliche Schalter einen Druckhebelarm (23) aufweist, welcher am Grundkörper (1) angebracht und mit einem Ende mit der Betätigungszunge (15) der Schnappfeder überlagert ist, wobei sich der Hebelarm (23) grundsätzlich quer zur Richtung der vorkragenden Betätigungszunge (15) erstreckt.

2. Schaltvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Druckhebelarm (23) an seinem anderen Ende einen zusätzlichen Schaltkontakt (27) berührt, wobei der Druckhebelarm (23) zwischen seinen Enden durch einen biegsamen Stützarm (24), der sich im wesentlichen freikragend in dieselbe Richtung wie das Schaltfederelement (6) von dem Grundkörper (1) erstreckt, gehalten wird.

3. Schaltvorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß der biegsame, vorkragende Stützarm (24) und der Druckhebelarm (23) des Zusatzschalters als einteiliges, T-förmiges Zusatzschaltblatt ausgebildet sind.

4. Schaltvorrichtung nach den Ansprüchen 1, 2 oder 3, dadurch gekennzeichnet, daß der Druckhebelarm (23) des Zusatzschalters einen Absatz (25) von vorgegebener Größe hat, der sich an dem Ende befindet, welches mit der Betätigungszunge (15) der Schnappfeder in Wirkverbindung steht.

5. Schaltvorrichtung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß

das den festen Kontakt (12) tragende Halteglied (3) mit Ausschnitten (17, 18) versehen ist, die dicht zu beiden Seiten des festen Kontaktes (12) angebracht sind, wobei die Ausschnitte (17, 18) so angeordnet sind, daß sie dazu beitragen, den Raum in unmittelbarer Umgebung des festen und des beweglichen Kontaktes (11, 12) zu belüften und die Verformung des Haltegliedes (3) durch den Aufbau der Vorrichtung erleichtern.

6. Schaltvorrichtung nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Kontaktbelüftungsausschnitte (17, 18) an der Schnappfeder in der Nähe des beweglichen Kontaktes (11) angebracht sind.

7. Schaltvorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die Belüftungsausschnitte (17, 18) so angebracht sind, daß sie die Dreh- oder Biegeelastizität der Schnappfeder in der Umgebung des beweglichen Kontaktes (11) begünstigen und dabei so gehalten sind, daß sie vor der Kontakttrennung eine gleitende oder Hin- und Herbewegung des bewegbaren Kontaktes (11) im Verhältnis zum festen Kontakt (12) erhöhen.

8. Schaltvorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Halteglied des festen Kontaktes (12) aus einer Anschlußklemmleiste (3) besteht, welche am Grundkörper an zwei voneinander entfernten Stellen verankert ist, zwischen welchen die Leiste (3) nicht befestigt ist und wobei der feste Kontakt (12) an diesem freien, unbefestigten Teil der Klemmleiste angeordnet ist.

Revendications

1. Dispositif interrupteur à action brusque comprenant un élément élastique à action brusque (6) portant un contact mobile (11) opérant avec un contact fixe (12), l'élément élastique à action brusque pouvant être actionné par la déformation d'une languette de commande (15) faisant saillie en porte-à-faux, avec l'élément élastique à action brusque, d'une base isolante (1), et un interrupteur auxiliaire (19, 20) pouvant être actionné par ladite languette de commande (15) en un point déterminé de son parcours, caractérisé en ce que le contact fixe (12) est porté par un élément porteur déformable (3) auquel on a imparti une déformation prédéterminée au moment du montage du dispositif pour fixer d'avance le point de fonctionnement des contacts d'interrupteur (11, 12) lorsque la languette de commande (15) se déplace, et en ce que l'interrupteur auxiliaire possède un bras de levier de commande (23) monté sur la base (1) de façon qu'une de ses extrémités soit superposée à la languette de commande (15) de l'élément élastique à action brusque, ledit bras de levier (23)

s'étendant généralement transversalement à la direction de la saillie en porte-à-faux de ladite languette de commande (15).

2. Dispositif interrupteur selon la Revendication 1 dans lequel le bras de levier de commande (23) porte un contact d'interrupteur auxiliaire (22) à son autre extrémité et prend contact avec un point d'appui (27) situé entre ses extrémités, ledit bras de levier de commande (23) étant supporté entre ses extrémités par un bras porteur flexible (24) saillant en porte-à-faux de la base (1) essentiellement dans la même direction que l'élément élastique à action brusque (6).

3. Dispositif interrupteur selon la Revendication 2, dans lequel le bras porteur flexible en porte-à-faux (24) et le bras de levier de commande (23) de l'interrupteur auxiliaire sont faits d'une seule pièce sous forme d'une lame d'interrupteur auxiliaire en forme de T.

4. Dispositif interrupteur selon la Revendication 1, la Revendication 2, ou la Revendication 3, dans lequel le bras de levier de commande (23) de l'interrupteur auxiliaire comporte un talon (24) de dimensions prédéterminées à ladite première extrémité, pouvant être pris en contact par la languette de commande (15) de l'élément élastique à action brusque.

5. Dispositif interrupteur selon une quelconque des Revendications 1 à 4, dans lequel l'élément porteur (3) portant le contact fixe (12) est pourvu d'évidements (17, 18) proches du contact fixe (12) et de part et d'autre de lui, lesdits évidements (17, 18) étant disposés de façon à aider à ventiler l'espace au voisinage immédiat des contacts fixe et mobile (11, 12) et de façon à faciliter la déformation dudit élément porteur lors du montage du dispositif.

6. Dispositif interrupteur selon une quelconque des Revendications 1 à 5, dans lequel des orifices de ventilation (17, 18) sont ménagés dans l'élément élastique à action brusque au voisinage du contact mobile (11) qu'il porte.

7. Dispositif interrupteur selon la Revendication 6, dans lequel les orifices de ventilation (17, 18) sont placés de façon à améliorer l'élasticité torsionnelle et flexionnelle de l'élément élastique à action brusque au voisinage du contact mobile (11) porté par lui de façon à engendrer un mouvement glissant ou basculant du contact mobile (11) par rapport au contact fixe (12) avant la séparation de contacts.

8. Dispositif interrupteur selon une quelconque des Revendications précédentes, dans lequel l'élément porteur du contact fixe (12) comporte une plaquette de connexion (3) montée sur la base (1), la plaquette de connexion (3) étant ancrée à la base en deux points espacés l'un de l'autre entre lesquels ladite plaquette (3) n'est pas supportée, et ledit contact fixe (12) étant porté par ladite partie non supportée de la plaquette de connexion.

Fig. 1.

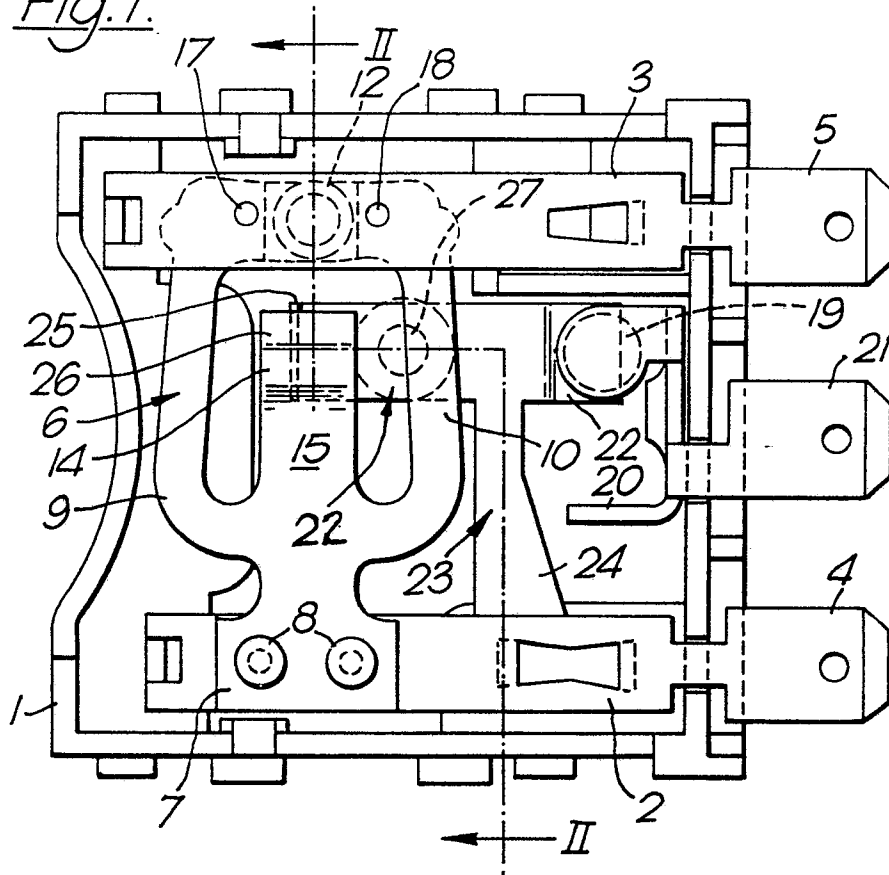


Fig. 2.

