United States Patent

Minks

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[54] **ELECTROMAGNETIC FLAT-TYPE RELAY**

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[51] **Int. Cl.**.....**H01h 3/46**

[58] **Field of Search**.....335/192, 128, 124, 121, 125, 335/187, 203, 191, 202; 200/67 A

[56] **References Cited**

UNITED STATES PATENTS

3,307,127	2/1967	Leo	335/128
3,436,502	4/1969	Egli	200/67 A
3,553,729	1/1971	Mori et al.	335/192

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[57] **ABSTRACT**

An electromagnetic flat-type relay with a pressure spring permanently biased engages a slewably supported tilting member carrying the movable contact member, exerting opposite torques thereupon in both the normal and the operating position of the magnet armature. In order to avoid a sticking of the contacts said magnet armature merely performs the task of lifting the movable contact member off the respective stationary contact member until the pressure spring has reached its tilting point.

17 Claims, 5 Drawing Figures

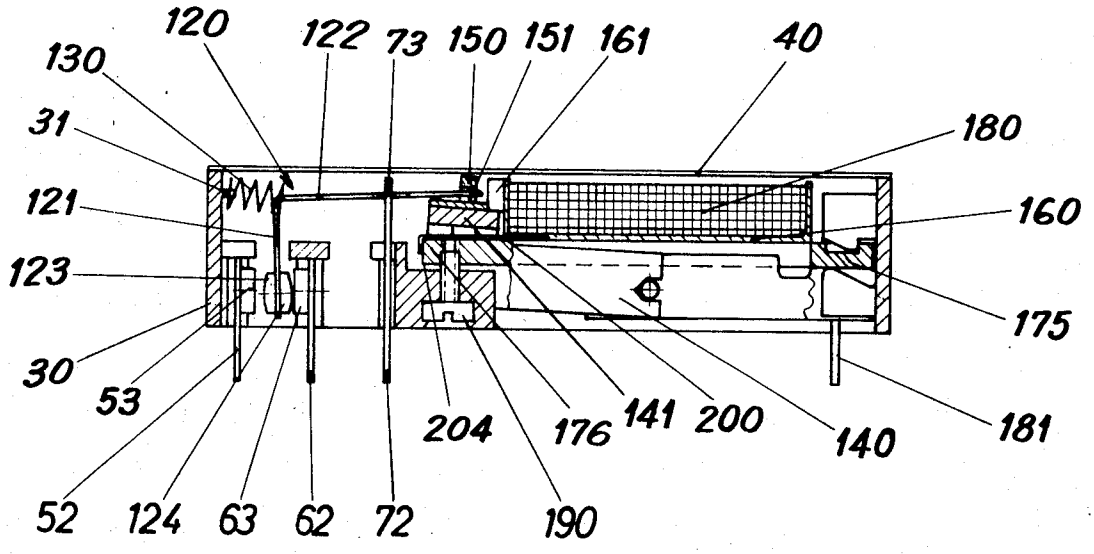
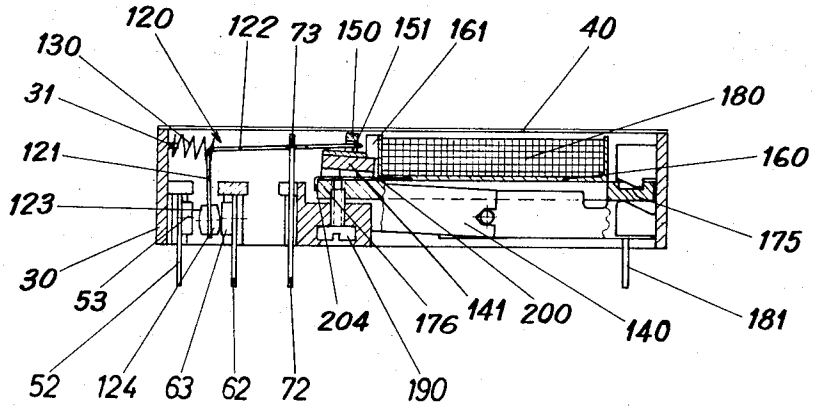


Fig.1



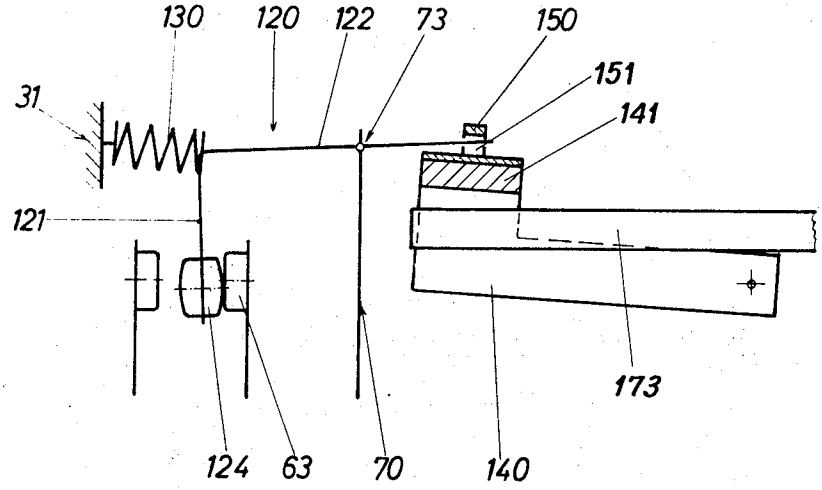


Fig.2

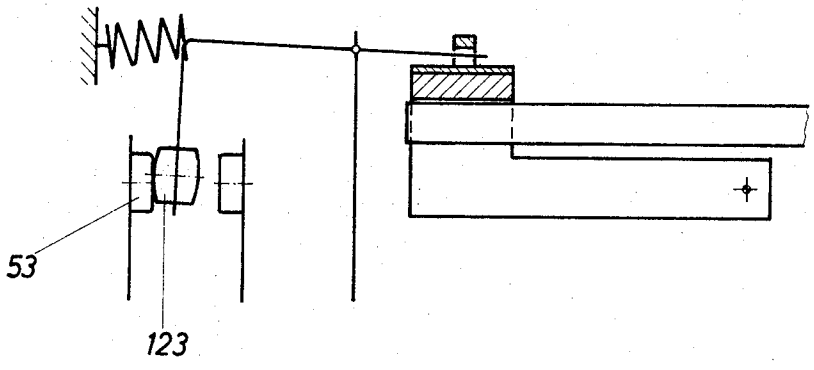


Fig.3

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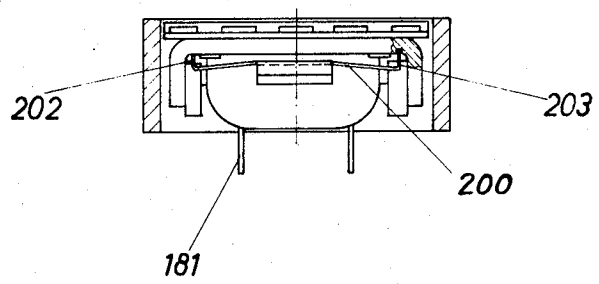

202
203
200
181

Fig.5

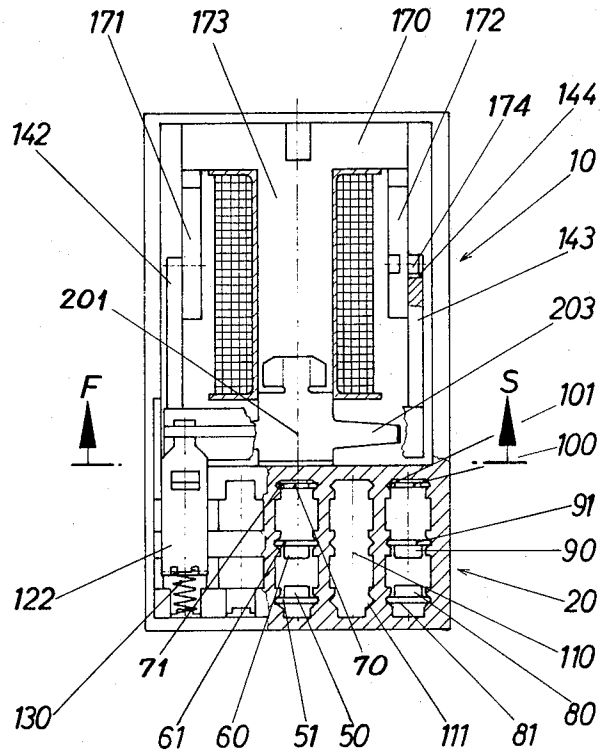

171
173
170
172
174
144
142
10
143
201
203
F
S
101
100
91
90
122
20
110
71
70
80
130
61
60
51
50
111
81

Fig.4

ELECTROMAGNETIC FLAT-TYPE RELAY

The present invention relates to an electromagnetic flat-type relay comprising a magnetic core carrying the excitation coil, and a magnetic armature hinged thereto and capable of moving approximately vertically in relation to the coil axis, for the resetting of which there is provided at least one spring element, while another spring element having the shape of a biased pressure spring takes care of establishing the necessary contact pressure between a movable contact member and a stationary contact member. The relay according to the invention is in particular suitable for being used in apparatus employing printed circuits, such as those used in the fields of communications, signaling and control engineering.

For being used in printed circuitries, electromagnetic relays must meet certain requirements. The first of these requirements is that for a small as possible overall dimension, i.e. small basal area and height. Moreover, such types of relays should be suitable for solving as many as possible switching problems. For this reason, certain requirements are placed on the contact system, not only on the design of the contact, but also on the arrangement of the contacts. In particular, care must be taken that the contact system also permits an optional switching of low-current and power contacts. Moreover, flat-type relays for the use in equipments employing printed circuits should have a high response sensitivity as well as defined contact-pressure conditions.

The aforementioned flat-type relay in which the movement of the armature is not effected in the direction of the coil axis, and the operating air gap is positioned in a plane extending almost parallel in relation to the coil axis, only partly meets these requirements (German printed application (DAS) 1.273.069). The known flat-type relay, of course, offers the advantage of having a high response sensitivity because both the contact pressure and the contact loading pressure are effected by the spring action of spring elements having a low resilient or elastic constant. Moreover, it has defined contact-pressure conditions because the pressures as exerted by the pressure springs can be already fixed in advance. By this there is also rendered superfluous a readjustment of the relay contacts and, consequently, a change of the previously determined operating data of the relay. In the conventional type of relay, however, the overall height at given winding arrangements is determined by the arrangement of the contact members because the latter, in the form of contact spring strips, are arranged in the longitudinal direction of the core on either side of the winding arrangement, and are led out on one face side of the relay in the form of electrical terminals. Apart from this, the known contact system is unsuitable for being used in many cases of practical application where randomly low-current contacts as well as power contacts are to be switched.

In a further conventional flat-type relay (DAS 1.243.272) which is designed to have the shape of a rotating-armature relay, a low overall height results from the fact that the contact system is arranged next to the driving system (electromagnet, armature) almost in direction of the coil axis. In this type of relay, of course, the winding arrangement is determinative of

the overall height of the relay, but the basal area of the relay is relatively large, because there are used two coils arranged parallel in relation to one another in one plane. Apart from this, the difficulty arises from the conventional relay to realize defined contact-pressure conditions, and the possibility of optionally switching low-current and power contacts.

In order to provide an electromagnetic flat-type relay in which likewise the winding arrangement alone is determinative of the entire overall height of the relay, whose contact system, however, results in defined contact-pressure relationships and is suitable for being used in a plurality of cases of practical application by enabling, in particular, also the optional switching of low-current and power contacts, it has already been proposed that the spring element serving the holding, guiding and resetting of the magnet armature, simultaneously also serves to actuate a movably supported contact member co-operating with one or more stationary contact members in the sense of establishing a make, break or switch-over contact, similar to a toggle switch mechanism, and that the actuating system and the contact system are arranged almost in the axial direction of the excitation coil. In this relay the spring element used for the holding, guiding and resetting of the magnet armature still performs two further functions by acting simultaneously as a contact pressure spring and as a tilting spring. From this there results a saving of additional spring elements which otherwise have to be used for effecting the biasing of the movable contact members. Owing to the tiltable switch-over mechanism there is provided the possibility of switching also a power contact, because by this there is prevented effectively a creeping switching mode. Accordingly, a relay of this type can be optionally equipped with low-current and power contact members, in particular for direct current. The arrangement of the contact system in the extension of the driving system immediately beside the latter results in a relatively small basal area and in a particularly low overall height of the relay, because the winding arrangement may occupy the entire overall height. Although the proposed relay meets the requirements as specified for the use in printed circuits and, in addition thereto, is composed of a very small number of individual parts capable of being manufactured in an inexpensive way, it still bears in some cases the disadvantage that the opening of the contacts is not effected at the desired speed although the movably supported contact member is actuated in accordance with a tilting mechanism. It has been found, that this phenomenon is caused by a more or less high degree of sticking or adherence of the contacts during the opening of the latter.

It is the object of the present invention to avoid this disadvantage, i.e. to provide an electromagnetic flat-type relay in which likewise the winding arrangement alone is determinative of the entire overall height of the relay and whose contact system is suitable for being used in a great number of cases of practical application by permitting in particular an optional switching of low-current and power contacts, with the contact system and the driving system thereof, however, being responsive to particularly low previously exactly determined operational data. The solution of this problem

with respect to the aforementioned electromagnetic flat-type relay according to the invention, resides in that the pressure spring simultaneously also actuates the movably supported contact member in accordance with a tilting mechanism, and the magnet armature initiates the movement of the tiltable contact member from the normal or operating position up to the tilting point of the pressure spring, and in which both the actuating system and the contact system are arranged almost in the axial direction of the excitation coil. In the relay according to the invention the contact pressure is achieved between the movable and the stationary contact member alone by the action of a pressure spring serving as the tilting spring, because the pressure spring is permanently biased in direction of its normal position, and because the magnet armature merely performs the task of lifting the movable contact member off the respective stationary contact member until the pressure spring has reached its tilting point. Thereupon the movable contact member is tilted by the biased pressure spring towards the other fixed or stationary contact member and is pressed-on by a defined contact pressure. Owing to the compulsory lifting of the movable contact member off its stationary contact member there is effectively avoided a sticking of the contacts in each restrictive position of the armature. In addition thereto, and by the use of a resetting spring element having a low elastic or spring constant, and with respect to the armature loading pressure, it is at the same time possible to achieve a high response sensitivity of the relay. Moreover, when employing the relay according to the invention, there will result the same advantages as those already explained in connection with the description of the earlier proposal. Accordingly, there will result from the arrangement of the contact and of the actuating system in almost the axial direction of the excitation coil, the required minimum overall height of the relay, because the winding arrangement may occupy the entire overall height. Moreover, the relay according to the invention may in turn be composed of a small number of individual parts which are inexpensive in manufacture and which, in addition thereto, may be of small dimension, and may be arranged in a compact way so that altogether there will be achieved a relay of particularly small dimensions. Owing to the tiltable switch-over mechanism there will again result the possibility of equipping the relay according to the invention optionally with low-current and power contact members.

In one advantageous further embodiment of the invention there are provided several pressure springs which are arranged next to each other of which each actuates one movably supported contact member in accordance with a tilting mechanism in which, again, the magnet armature initiates the movement of the tiltable contact members from the normal or operating position until reaching the tilting point of the pressure springs. By this there is given the possibility of switching several low-current and/or power contact members as make, break, or switch-over contacts under low operational data conditions, so that a great number of switching functions may be performed without, in the case of a given winding arrangement, the overall height of the relay having to be enlarged. In this case it is of advantage to arrange the terminal parts of the stationary and of the movable contact members in a way corresponding to the raster-size pattern, so that the relay may also be inserted in a printed circuit board.

Further details and advantages of the invention will now be explained with reference to FIGS. **1** to **5** of the accompanying drawings showing one preferred example of embodiment, and in which:

FIG. **1**, in a longitudinal section, shows the relay according to the invention,

FIGS. **2** and **3**, on an enlarged scale in a schematical representation, show the contact system, the actuating system, and parts of the driving system of the relay shown in FIG. **1**, in two different operational positions,

FIG. **4** shows this relay in a top view with the coil shown in a sectional representation, and the contact system in a partly sectional view, and

FIG. **5** shows a cross-sectional view taken along the line F–S of the view of the relay according to the invention as shown in FIG. **4**.

The flat-type relay as shown in the accompanying drawings, has a very small overall height of 10.5 mm in adaptation to the smallest spacing between the printed circuit boards of 15 mm, and is therefore particularly suitable for being built into equipments employing printed circuit boards. Owing to the favorable arrangement of the driving system **10** (excitation coil **180**, coil form **160**, magnet core **170**, magnet armature **140**) and the contact system **20** (contact members **50**, . . . **100**, **121**), which is arranged directly next to the driving system, the shown relay also has a relatively small basal area as may be taken in particular from the showing of FIG. **4**. Both of these systems are joined to one another mechanically and functionally. For effecting the mechanical connection there is used that part of the casing **30** which, towards the connecting side of the contact system **20** and for improving ventilation, is open, and is covered at least throughout the range of the contact system, by means of a dust-protection cover **40**. If necessary, this dust-protection cover **40** may also extend over the entire system **10**, **20** (FIG. **1**).

The contact system **20** may contain any arbitrary combination of make, break and two-way (switch-over) contacts, so that the contact system may be chosen to be extensively independent of the driving system **10**. The shown type of embodiment is suitable for the use in circuits requiring three switch-over or two-way contacts for high-voltage currents (central contact members **50**, **60**, **70**, **121**; outer contact members **80**, **90**, **100**, etc.). The contact positions **110** besides the central contact members **50**, **60**, **70** for high-voltage current are left free in this particular case in order to increase the air gap and creeping distances to the neighboring outer contact members **80**, **90**, **100**. However, the shown contact system **20** may also receive five low-current contacts for acting as the make, break or switch-over (two-way) contacts. By observing the electrical safety regulations, it is thus possible to make any arbitrary combination of low-current and power contacts.

To this end it is of advantage when the contact members **50**, . . . , **100**, **121**, etc. serving the manufacture of the contact system **20**, can be mounted in the same way. To this end these contact members and the supports thereof are respectively provided with equally

dimensioned mounting means. Thus, the stationary contact members **50**, . . . , **100**, . . . are provided with flat mounting members **51**, . . . , **101** having side edges of a sawtooth-shaped design with which they are inserted in a self-retaining manner in the recesses **111** of the portion of the casing **30** ending up in a pointed fashion. In order to establish a strong frictional connection between the mounting members **51**, . . . , **101** and the limiting walls of the recesses **111**, the portion **30** of the casing is made from a less hard material than the contact members **50**, . . . , **100**, in particular from a plastics material.

Use of the relay in printed circuits makes it necessary, in addition thereto, for the connecting parts **52**, **62**, **72**, etc., of the contact members **50**, . . . , **100** to be arranged at spaced relations on a raster basis corresponding to the inserting holes in the printed circuit board.

The contact members **50**, . . . , **100**, however, may differ in their dimensions from one another, quite depending on whether they are intended to be used as low-current or power contacts. As power contacts there are used the contact pieces **53**, **63**, etc. as riveted on to the contact members **50**, **60**, **80**, **90**, etc., which are made from a suitable contact material, while the low-current contacts may be formed e.g. by bent-off portions within the contact range or contact-making area of the stationary contact members, in order to obtain in this way uniform contact spacings between the stationary and the movable contact members, so that the respective stationary contact members may cooperate with the respective associated movable contact member in the sense of establishing a two-way or switch-over contact. The movable contact members **121**, etc., may also be dimensioned differently. When equipping the contact system with power contacts, the respective contact member **121** is provided on either side and within the contact-making area or contact range with contact rivets **123**, **124** for the purpose of forming thus a power contact.

At the same time, each of the movable contact members **121** forms a two-legged, almost rectangular pivoted lever **120** which, for the purpose of forming a tilting member, is tiltably supported with its other lever arm **122** on a fixed relay part, i.e. the contact member **70** or **100** respectively. To this end the contact member **70**, **100** at its end not facing the connecting part **72**, etc., is provided with a knife bearing **73** for the lever arm **122**. It will be seen that the contact member **70** merely serves as a bearing **73** and as an electrical connecting part **72** for the movable contact member **121**, but itself does not perform any contact-making function.

In order to enable the movable contact member **121** to be actuated in accordance with a tilting mechanism, there is provided a tilting spring having the shape of a helical pressure spring **130** extending almost in the longitudinal direction of the relay. This tilting spring is supported with its one end on a fixed part of the relay, hence the bearing stud **31** of the portion **30** of the casing, and engages with its other end the captured ends of the two lever arms **121**, **122** of the pivoted lever **120**, i.e. in such a way that the torques as exerted upon the pivoted lever are directed oppositely in the two operating positions of the armature. To this end both the stationary bearing **31** of the helical pressure spring **130** and the pivot or swivel bearing **73** of the pivoted lever are on one straight line extending almost parallel in relation to the axis of the excitation coil **180**, as may be taken in particular from FIGS. **2** and **3**. For avoiding the sticking of contacts between the movable contact members **123**, **124** and the stationary contact pieces **53**, **63** the lever arm **122** as extending almost in the direction parallel in relation to the axis of the coil **180**, is at its free end in the normal and operating position of the armature **140** in a force-locking connection therewith, and is swivably supported between its free and its captured end at a fixed relay part, i.e. the stationary contact member **70** while the other lever arm **121** as extending almost in a direction vertically in relation to the coil axis, carries at its free end the movable contact members **123**, **124**. A part of insulating material **150** as arranged on the U-web or limb **141** of the armature, which is provided with a window-like opening **151** into which there projects the free end of the lever arm **122** extending almost in a direction parallel in relation to the axis of the coil **180**, and acting as a coupling agent for this particular lever arm serves to establish the force-locking connection between the pivoted lever **120** and the magnet armature **140**. When moving the armature in direction towards the center E-limb of the core **173** or also in the opposite direction, there is thus taken along the free end of the lever arm **122** by the part of insulating material **150**, thus lifting the movable contact member **124** to such an extent off the associated fixed contact piece **63** or **53** respectively, until the helical pressure spring **130** has reached its tilting point. From this moment on, the movable lever arm **121** is tilted with its contact members **123**, **124** on to the other stationary contact piece **53** or **63** respectively. Owing to the pretension of the helical pressure spring **130** the movable contact members **123**, **124** is pressed on to the stationary contact piece **53** or **63** with a defined contact pressure.

The just described co-operation between the driving system **10** and the actuating and contact-system **20** is particularly evident from FIGS. **2** and **3**. While FIG. **2** shows the normal position of the armature **140** with the relay in the non-energized state, FIG. **3** shows the operating position of the armature in the energized condition of the relay. From a comparison of the two drawings it will be seen that the helical pressure spring **130** in both the normal and the operating position of the magnet armature **140** exerts opposite torques upon the pivoted lever **120** because its end engaging the pivoted lever, quite depending on the operational condition of the relay, is lying either above or below the straight line extending between the stationary bearing **31** of the pressure spring and the pivot or swivel bearing **73** of the pivoted lever.

The driving system **10** contains the U-shaped magnet armature **140** and the E-shaped magnetic core **170**, with the central limb **173** thereof carrying the coil form **160** for the excitation coil **180**. For the purpose of effecting the rotary-movable bearing of the U-shaped magnet armature **140** capable of being moved approximately vertically in relation to the axis of the coil **180**, the free ends of the U-limbs **142**, **143** are tiltably mounted to the ends of the outer E-limbs **171**, **172** of the magnetic core **170**. In this case the mounting is made in such a way that the U-web **141** of the magnet

armature **140** extends with a relatively large surface over the center limb **173** of the magnetic core **170** carrying the excitation coil **180**, being applied thereto when the relay is in the energized condition. For this purpose the U-limbs **142**, **143** of the magnet armature **140** and the two outer E-limbs **172**, **171** of the core **170** are rectangularly bent out of the plane of the U-web **141** or the center E-limb **173** respectively, around an axis extending parallel in relation to the limb axes. In this way it is achieved that each time one limb **142**, **143** of the armature **140** and one outer limb **171** or **172** of the core **170** are positioned oppositely on one piece of their lengths in a parallel arrangement, and with a slight clearance, respectively. The bearing points are formed by stud-shaped upsettings **174** at the outer E-limbs **171**, **172** of the core **170**, and by correspondingly adapted recesses or cutouts **144** provided at the free ends of the U-limbs **142**, **143** of the armature **140** for receiving the upsettings. The limiting or restricting walls of the recesses or cutouts **144** meet against the stud-shaped up-settings **174** at the bearing print. Owing to the slight clearance (play) of the pole surfaces at the bearing points and the large pole surface or area, it is safeguarded that within the magnetic circuit as completed by the magnetic core **170** and the magnet armature **140**, there practically only exists one single operating air gap between the armature and the core within the range of the U-web **141**, hence no unwanted air gap.

In order to provide the magnet armature **140** with a permanent bias (pretension) in the direction of the normal position in which the armature is applied against a limit stop **161** of the coil form **160**, there is provided a reset spring element **200** with a low spring or elastic constant between the armature and the core **170**. For realizing a space-saving embodiment and arrangement, this reset spring element is designed to have the shape of a two-arm flat spring of non-magnetic material, such as of bronze sheet metal having an enlarged end and extended central portion **201**. The spring arms **202**, **203** thereof, which are angled off at the free end, engage the U-web **141** of the armature **140** under a pretension, while its central portion **201**, under tension, is retained in a gap or slot between the center limb **173** of the core **170** and the coil form **160**. For preventing the flat spring form arching, it grips with one angled-off portion **204** of its central portion **201** over the free end **176** of the center E-limb **173**, so that the U-web **141** of the armature, in the case of an energized relay, is flatly applied to the central portion of the flat spring **200**. Accordingly, there are not required any mounting means for fixing in position the reset spring element **200**. This reset spring element **200** can be preferably manufactured by way of punching and bending.

As electrical lead-in conductors for effecting the energization of the coil **180** there are provided the connecting members **181** which likewise, just like the connecting members **52**, **62**, **72**, etc. of the stationary contact members **50**, . . . , **100** may be arranged in a raster-size pattern corresponding to that of the printed circuit. It is also possible, however, to dispose only one part of the entire connecting parts, e.g. the connecting parts or members **181** for the excitation coil **180** in a raster-sized pattern corresponding to that of the printed circuit. The remaining parts are then directed away from the printed circuit board and may, for example, form part of a conventional type of connector.

Mounting of the magnetic core **170** inside the casing **30** is preferably performed in accordance with the known snap-in technic. In this way the magnetic core **170** can be fixed by being simply inserted in the casing **30**, hence without requiring any special mounting means, hence in a way resisting twisting and displacement, as is shown in FIG. **1**. In order to be able to adjust the operating stroke (lift) of the armature **140** exactly to the tilting point of the helical pressure spring **130**, there is provided an adjusting possibility. To this end the core **170** is slewably mounted at its end **175** not facing the contact system **20**, while the other end **176** of the core is capable of being adjusted with respect to height similar to a vice mechanism. For this purpose there is provided an adjusting screw **190** which is fitted into the part **30** of the casing resisting displacement in direction of the screw axis, but capable of being turned, with this screw capable of being screwed into a threaded bore provided in the center limb **173** of the core **170**.

In the following the mode of operation of the relay will now be described in greater detail:

When the excitation coil **180** is not energized, the magnet armature **140** is retained in its normal position by the reset spring element **200**. This spring element permanently acts with its predetermined spring effect upon the armature **140** thus biasing the latter with respect to the limiting stop surface **161**. In the normal position of the magnet armature **140** the movable contact members **121** as well as the contact pieces **124** thereof, are in their right-hand operating position thus establishing an electrical connection with the stationary contact members **60**, etc., or the contact pieces **63**, etc. thereof, respectively. In this operating condition alone the helical pressure springs **130** take care of providing the necessary contact pressure between the movable contact members **121** and the stationary contact members **60**.

When the excitation coil **180** is energized, the magnet armature **140** is attracted against the top side of the center limb **173** of the magnetic core **170** in opposition to the spring action of the reset spring element **200** and the helical pressure springs **130**. The part of insulating material **150** as arranged on the U-web **141** of the magnet armature **140** displaces, in the course of this, the lever arm **122** in the downward direction thus eliminating the contact connections between the stationary contact members **60**, **100**, etc. and the movable contact members **121**. Lifting-off of the movable contact members **121** by the magnet armature **140** acting as a coupling means, however, is only effected as long as the tilting point of the helical pressure springs **130** has not yet been reached. In this operational condition the helical pressure springs **130** automatically take care of the further contact separation between the stationary contact members **60**, **100** and the movable contact members **121**, in that now the helical pressure springs, according to a tilting mechanism, cause the movable contact parts to snap over to the other stationary contact parts **50**, **80**, etc. In order to be capable of performing this snap-over without being affected by the armature **140**, the window opening **151** in the part of insulating material **150** acting as the coupling means, is chosen so

large that the free end of the lever arm **122** can move freely during the tilting movement.

For restricting the stroke or motion of the movable contact parts **121** there are accordingly only provided the stationary contact parts **50**, **60**, etc. In this particular operating condition, again alone the helical pressure springs **130** take care of providing the necessary contact pressure between the movable contact members **121** and the stationary contact members **50**.

Upon deenergization of the excitation coil **180**, under the action of the spring force as exerted by the reset spring element **200**, the magnet armature **140** is caused to return to normal in opposition to the spring action as exerted by the helical pressure springs **130**.

What is claimed is:

1. In an electromagnetic relay having a principal axis and a spring resettable armature, the combination comprising:

a two-legged pivotably mounted tilting mechanism, coupled by the free end of one leg thereof to the armature, and having at the free end of the other leg a pair of oppositely disposed contact members, for providing movement of said contact members between two limit positions as defined by a pair of oppositely arranged stationary contacts, the initial movement of said tilting mechanism being in response to movement of the armature; and

spring element means, coupled to and acting proximate the juncture of the two legs of said tilting mechanism and arranged in the form of biased pressure spring means to have a tilting point at which the direction of bias provided by said pressure spring means changes from a first to a second predetermined direction relative to said tilting mechanism, for establishing contact pressure between either one of the contact members disposed on the one leg of said tilting mechanism and a corresponding one of said stationary contacts, and for actuating movement of the contact members to one of said limit positions by way of said tilting mechanism responsive to the armature tilting said mechanism from the other limit position to said tilting point at which the bias provided by said pressure spring means becomes directed toward the second of said predetermined directions.

2. The relay according to claim **1** wherein the armature is a magnet armature and has a normal and an operating position, and wherein said spring element means includes a pressure spring arranged to engage said tilting mechanism so as to exert opposite torques thereupon in both the normal and the operating position of the magnet armature.

3. The relay according to claim **2** wherein said tilting mechanism, during the movement thereof in response and corresponding to the movement from the normal and operating position of the magnet armature until reaching said tilting point of the pressure spring, is in a substantially force-locking connection with the armature.

4. The relay according to claim **2** wherein the one end of the pressure spring is coupled to and acts on the tilting mechanism and the other end is coupled to a stationary bearing, and wherein said tiltable mechanism, having the free end of one leg thereof coupled to the armature and the other free end of which has disposed oppositely thereon said contact members, is pivotable near the center of said one leg by way of a swivel bearing, said stationary bearing and said swivel bearing being arranged in a straight line extending substantially parallel in relation to the principal axis as defined by the excitation coil of the electromagnetic relay.

5. The relay according to claim **4** wherein said tilting member is in the form of an angled pivoted lever whose said one leg extends to approximate a parallel condition in relation to the principal axis and is at its free end in about the normal and operating position of said armature in a force-locking connection therewith, and wherein said other leg extends to approximate a vertical direction in relation to the principal axis, in carrying at the free end thereof the movable contact members.

6. The relay according to claim **5** wherein the force-locking connection of said tilting member with the armature is effected by a portion of insulating material arranged on the armature which defines an aperture into which projects the free end of said one leg, said portion of insulating material being arranged to act as a coupling element for said one leg such that the latter is carried along from either of the normal or operating positions of the armature until reaching the tilting point of said pressure spring.

7. The relay according to claim **6** further including a stationary contact part coupled to said tilting member at said swivel bearing, and which, via said legs of said tilting member is electrically connected to said contact members.

8. A relay according to claim **5** further including a casing around the relay, and wherein said pressure spring is mounted with one end to a stud portion of the casing, and engages with its other end the communicating ends of said two legs of said tilting member.

9. The relay according to claim **2** wherein there is provided a plurality of juxtaposed pressure springs each actuating one pair of movably supported contact members in accordance with a separate tilting mechanism.

10. The relay according to claim **9** wherein at least one movably supported contact member pair and the one or more associated stationary contacts are power contacts.

11. The relay according to claim **9** wherein the arrangement of said movably supported contact members co-operating with said associated stationary contacts is such as to enable the establishment of a make, a break or a switch-over type contact.

12. The relay according to claim **11** wherein said stationary contacts serve to limit the operating stroke of the leg of said tilting mechanism carrying the associated contact members.

13. The relay according to claim **5** further including a magnetic core having a center limb and outer limbs, and said magnet armature also having limbs, and wherein said magnet armature is of U-shaped configuration and said magnetic core has an E-shaped configuration, with the free ends of said limbs of said armature being tiltably arranged relative to the free ends of said outer limbs of said core in such a way that the U-web of said armature extends at its free end over the center limb of said core which carries said excitation coil, and is flatly applied thereto when the relay is in its energized condition.

14. The relay according to claim 13 wherein said U-limbs of said magnet armature and the outer E-limbs of said magnetic core are in such a way bent rectangularly out of the plane of said U-web or out of the center E-limb about an axis extending parallel in relation to the limb axes, and wherein one U-limb of said armature and one outer E-limb of said core are arranged to lie opposite each other at one portion of their lengths in a parallel arrangement, and at a small mutual clearance.

15. The relay according to claim 14 wherein the outer E-limbs of said core are provided with stud-shaped upsettings, and the free ends of the U-limbs of said magnet armature are provided with correspondingly shaped recesses or cutouts for respectively forming a knife bearing.

16. The relay according to claim 13 further including a spring element serving the resetting of the magnet armature, said spring element consisting of a two-armed flat spring made from a non-magnetic material which, in its central portion is extended and enlarged, with the spring arms thereof which are angled off at the end being applied under pretension (bias) to the U-web of said armature, with the central portion thereof, under tension, being fixed in a gap provided between said central E-limb of said core and a coil form associated with the latter.

17. The relay according to claim 16 wherein said flat spring extends with its central portion over the free end of said center E-limb in such a way with an angled-off portion that the U-web of said armature is flatly applied to the center portion of said flat spring in the energized condition of said relay.

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