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K. W. GRAYBILL ET AL

2,820,866

RELAY

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FIG. 1

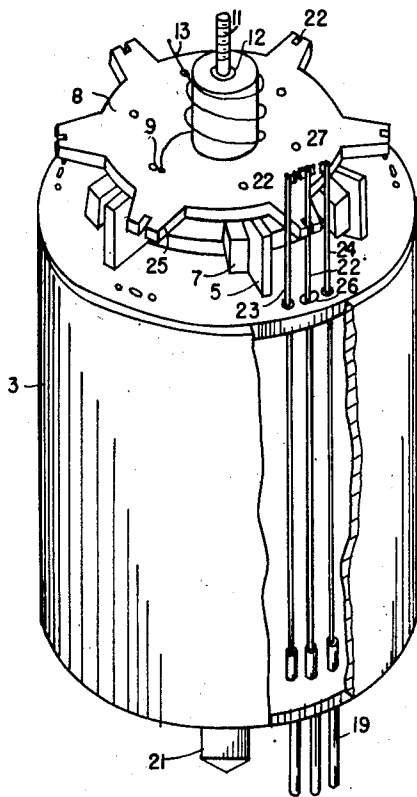


FIG. 3

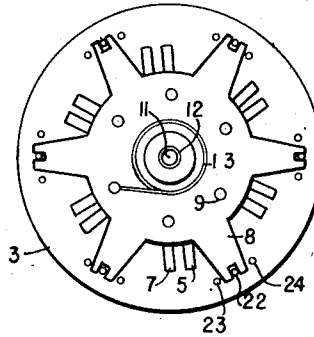
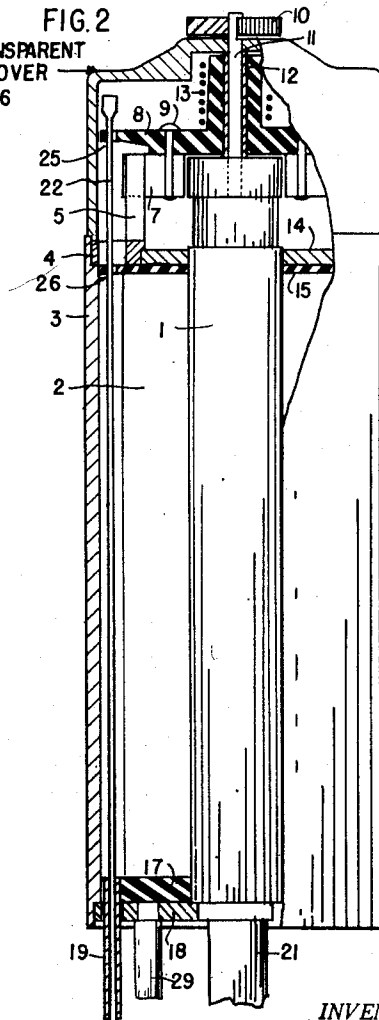


FIG. 2
TRANSPARENT
COVER



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ATTY

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2,820,866

RELAY

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4 Claims. (Cl. 200-104)

The present invention relates to electromagnetic relays of the multiple contact type and more particularly to the mechanical construction thereof.

One object of the invention is to provide a relay wherein the individual adjustment of relay springs is eliminated.

Another object is to provide a relay having a dust tight enclosure which allows observation of operating parts without the necessity of removing cover or parts of enclosure.

A further object is to provide an external means for making relay adjustment without the necessity of removing the dust tight cover.

Another object is to provide a magnetic relay in which an iron shell serves as an enclosure as well as a conductor in the magnetic circuit.

An additional objective of this invention is to provide a relay which can be plugged into an appropriate receptacle thereby eliminating the necessity of making terminal connections each time the relay is connected or disconnected from a circuit.

Another object is to provide a multiple contact relay which requires a mounting area equal to only a fraction of the mounting area of the conventional multi-contact relay.

These objects are accomplished by providing a relay with a straight iron core, a rotary armature, and contact springs mounted circumferentially between a relay coil and a magnetic-iron shell which also serves as part of the enclosure. Certain of the contact springs are engaged and moved by a rotor that forms part of the armature assembly. Such movement causes these contact springs to make and break contact with other contact spring members.

A transparent cover completes the enclosure and permits an inspection of the contacts attached to contact springs and the armature assembly without the removal of the cover.

Adjustment of the spring tension on the movable armature assembly is accomplished by turning the transparent cover, without the necessity of removing the cover and the consequent admission of dust. By the use of a positioning pin in the base and terminal prongs to which contact springs are terminated, a plug-in type of connection is obtained.

Fig. 1 is a perspective view of the preferred embodiment of this invention with a portion of the enclosure cut away.

Fig. 2 is a side view of a section through the central vertical axis of the relay.

Fig. 3 is a top view of the relay with transparent cover 6 and cover retaining thumb nut 10 removed.

The preferred embodiment of the invention is illustrated in the drawings. The structure includes an electromagnetic coil 2 with a straight iron core 1. A magnetic-iron shell 3 provides an enclosure for the coil and also provides a return path for the magnetic circuit. The core 1 and outer shell 3 are connected at the bottom of the assembly by a base plate 18 of iron or other suitable

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magnetic material. Connected to the shell 3 at the top end of the assembly, is top plate 4, made of magnetic-iron or the like and having 6 pole faces 5, which project perpendicularly from the upper plane surface thereof. Centering plate 14 of brass or other non-magnetic material aligns core 1 with top plate 4.

The rotary armature 7 is a magnetic-iron member secured by rivets 9 to rotor 8 which is made of phenolic or other suitable insulating material and has a bearing sleeve 12 pressed into its center. The entire assembly is supported by and rotates about pin 11 which is threaded into the upper end of core 1. The armature 7 contains six radial arms extending from its center. Each arm has a face that rests opposite a face of one of the pole pieces 5, the radial arms completing the magnetic circuit from the core to the pole faces and the outer shell.

Components of the magnetic circuit are shown as solid members in the drawings, but these parts may be laminated where the relay coil is to be operated by alternating current.

Air gaps between the radial arm faces on the armature 7 and the face sections of the pole pieces 5 provide the working gap of the magnetic circuit. Magnetic flux therefore flows through the coil core 1 into the armature 7 through the radial arms, across the air gap into the pole faces 5, through the top plate 4 to the outer shell 3 and through the base plate 18 back to coil core 1.

It can be seen that when the relay coil 2 is energized each radial arm of the armature 7 will be attracted to the adjacent pole face 5 of the pole piece 4, thereby causing rotary motion of the armature assembly.

Contact members or springs 22, 23 and 24 are distributed circumferentially between the outside surface of the coil 2 and the outer shell 3. These contact springs consist of round wire with upper ends flattened, to which ends electrical contacts 27 are suitably attached. In the present embodiment, each three successive contact springs form one single-pole double-throw contact group. A total of six such groups are disclosed, but any number of groups may be used. Each spring is anchored in an insulating member 17 at the lower end of the coil 2. This member may also serve as the lower spool-head of the coil. Each spring is additionally supported by a metal tube 19 into which the spring is inserted and soldered, the metal tubes thereby forming contact pins or prongs which are suitable for plug mounting in a corresponding socket or base. Holes of such size as to provide adequate clearance must be provided in base plate 18 at points where prongs 19 pass through the base plate, since the prongs must be completely insulated from the base plate. Upper spool-head 15 provides support in the form of snug or tight fitting holes for the outside or stationary contact spring members 23 and 24 of each double throw switching arrangement. By means of clearance holes 26, each common or movable contact spring 22 of a double-throw switching arrangement is afforded clearance through upper spool-head 15.

The contact springs are made of straight wire and are set so that they are free from tension. The preferred embodiment shows a plurality of double-throw contact groups with outside contact springs 23 and 24 rigidly supported by upper spool-head 15. Each common or movable contact spring 22 is engaged by a slot in the end of each radial arm 25 in rotor 8, so that rotation of the armature assembly, which includes rotor 8, armature 7 and arms 25, causes contact springs 22 to move and make contact with the normally disengaged one of the outside or stationary contact springs 23 and 24. All contact springs are sufficiently straight and accurate in form so that they will not require individual adjustment to meet normal operating requirements.

Moving springs are not tensioned individually but a

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master spring or torque spring of coiled wire 13 is adjustable to provide restoring tension to all main springs simultaneously.

During the normal or de-energized position of the relay, a tension is exerted by torque spring 13 upon the armature assembly, tending to move radial arms of armature 7 away from respective pole pieces 5. Rotor 8 of the armature assembly is so positioned with respect to the contact springs that common contact springs 22 are biased or forced against one of the two outside contact springs, contact springs 23 in the present embodiment. Hence, contact springs 22 and 23 constitute the normally closed portion of the double-throw switch group and contact springs 22 and 24 constitute the normally open portion thereof.

When the armature 7 is magnetically attracted to the pole faces 5 it must overcome the restoring force of the main spring 13 and deflect the common contact springs 22. The outside or make and break contact springs 23 and 24 are held by upper spooled-head 15 and are so positioned that when the contact end is deflected the spring bends or bows in the long section between the two supporting spool-heads 15 and 17. A proper deflector-pressure characteristic is obtained by the selection of wire diameter and by positioning of the holding insulators or spool-heads.

At the armature end of the relay, a transparent cover 6 is fitted over the end of the magnetic shell 3 in order to provide a dust tight enclosure for the mechanism. Cover 6 is secured by thumb nut 10 which engages pivot pin 11. The upper ends of contact springs 22, 23 and 24 are located below the top inside surface of the transparent cover 6 and can be readily observed without removing the cover.

The torque spring 13 is fitted over the hub of rotor 8. One end of this spring is anchored to assembly rivet 9 and the other end is held in a notch or recess appearing on the inside of transparent cover 6. By loosening the thumb nut 10 on the outside of transparent cover 6, the cover can be rotated so as to increase or decrease the tension of the torque spring 13 thus permitting the only necessary adjustment of the relay to be made without exposing the moving parts of the relay to dust.

A center guide pin 21 and a locking guide pin 29 are suitably attached to base plate 18, projecting outward therefrom and serve, together with terminal prongs 19, to provide a plug-in form of connection for this relay which eliminates the necessity of making terminal connections each time the relay is inserted or removed from a circuit. The compact arrangement of terminal prongs 19 about the base plate of the relay result in a mounting area that is considerably smaller than the mounting area required by the conventional multi-contact relay in which individual terminal connections are required to be made.

Having described the invention, that which is believed to be novel and for which protection of Letters Patent is desired will be pointed out in the appended claims.

What is claimed is:

1. In a relay, a core, an electromagnetic coil about said core, a first shell secured to and enclosing said coil, pole pieces secured to said core, an armature rotatably mounted on one end of said core, said armature magnetically attracted to said pole pieces from a normal position upon energization of said coil, a plurality of contact springs arranged circumferentially about said coil and within said first shell, means for imparting motion to certain of said contact springs which thereby contact certain others of said springs in response to movement of said armature, a spring for biasing said armature in said normal position, and a second transparent shell enclosing said armature and the contacts of said contact springs and secured to said biasing spring, the condition of said contacts being visible through said second transparent shell,

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said second shell manually adjustable to adjust said biasing spring in accordance with a desirable change of said springs indicated by said visible condition of said springs.

2. In a relay, an electromagnetic coil having a core, an armature rotatably mounted on an extension of said core, a first shell enclosing said coil, pole pieces concentrically secured to said shell, a magnetic circuit comprising said core, said armature, said first shell, and said pole pieces, said magnetic circuit energized responsive to energization of said coil, means for biasing said armature in a normal position, said armature rotated from said normal position responsive to said energization of said coil, a plurality of contact springs arranged circumferentially about said coil and within said first shell, a rotor mounted on said core extension rotatable with said armature, means on said rotor for operating certain of said contact springs into cooperative relation with adjacent others of said springs when said armature is rotated from said normal position, a transparent second shell pivotally mounted on said core extension and secured to said biasing means, said second shell enclosing said contact springs and permitting continuous observation of the conditions of said contact springs in their normal and operated positions, said second shell manually pivoted about said core extension to adjust said biasing means in accordance with a desired change of said springs in said observed condition.

3. In a relay, a coil having a core, an armature rotatably mounted on an extension of said core, means for biasing said armature in a normal position, energization of said coil rotatably operating said armature from said normal position, a series of springs having contacts thereon movably controlled by said armature and operated thereby, a sectional shell surrounding said relay and spring contacts, and means for both inspecting and adjusting said contacts during operation of said relay comprising a transparent section of said shell adjustably secured to said biasing means and enclosing said spring contacts, said section manually pivoted about said core extension to adjust said biasing means and thereby said armature to thereby adjust said contacts in accordance with the inspected condition of said contacts.

4. In an electromagnet relay, a coil having a core, an armature rotatably mounted on said coil, adjustable means for biasing said armature in a normal position, energization of said coil operating said armature from said normal position, contact springs movably controlled by said armature and operated in accordance with the adjustment of said biasing means when said armature is operated from said normal position, a bi-sectional envelope for said relay and contact springs, a first section of said envelope mounted on an extension of said core manually rotatable with respect to the second section of said envelope, said first section being transparent to permit continuous observation of said operation of said contact springs, said biasing means adjustable responsive to said rotation of said first section in accordance with said observation to thereby adjust said operation of said contact springs.

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