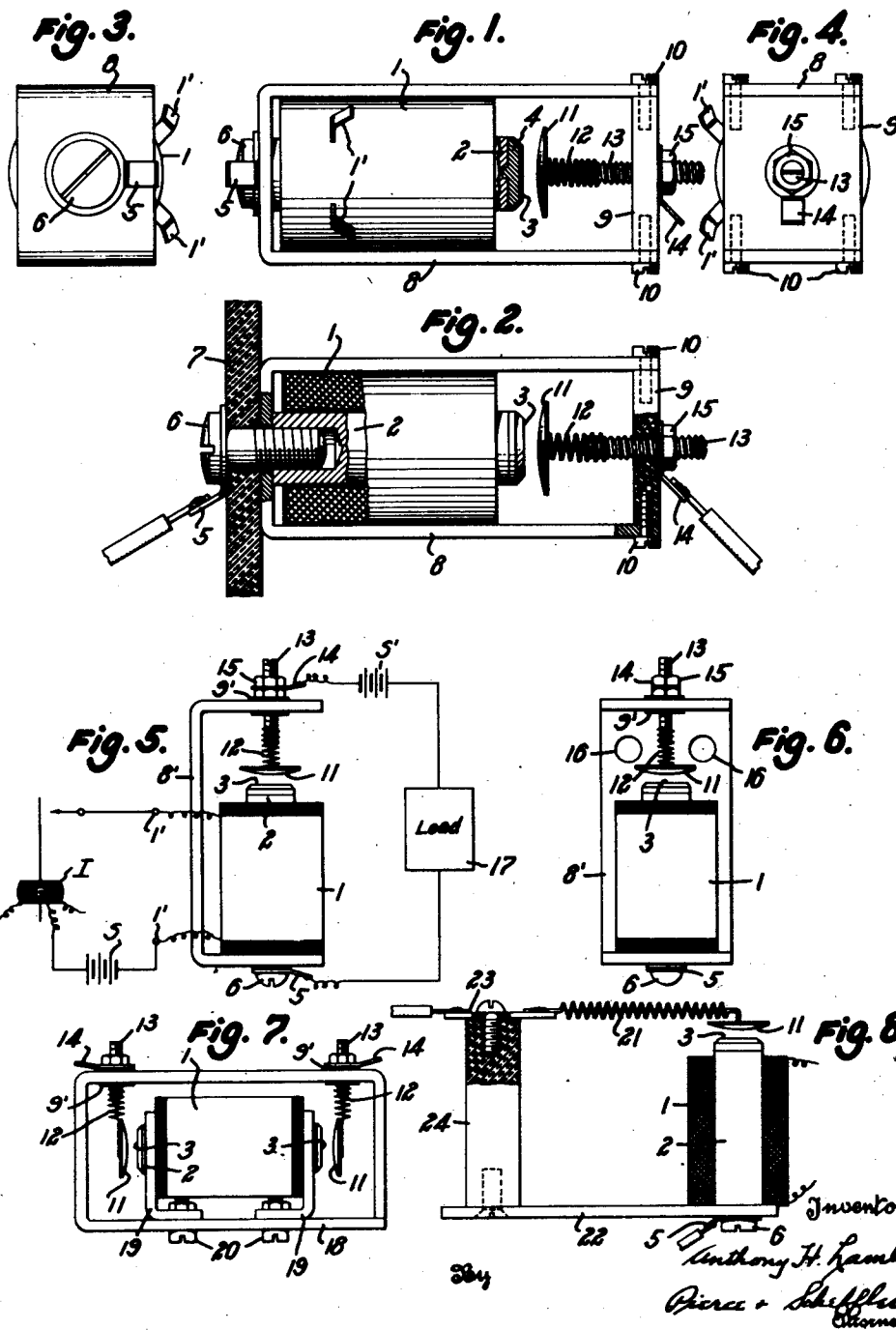


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ELECTRICAL RELAY

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ELECTRICAL RELAY

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This invention relates to electrical relays and particularly to novel mechanical constructions for small auxiliary relays such as commonly termed "power relays" in the instrument relay control art.

There are limits to the electrical loads that may be directly controlled by the contacts of sensitive instrument type relays, and one or more auxiliary or power relays may be connected between the instrument type relay and the load circuit when the latter is of such character that the contacts of the instrument type relay would be badly pitted and/or welded to each other if connected directly into the load circuit to open and close the same. The power relays have been of the pivoted armature type, with the moving contact carried by or actuated by the armature. The accumulations of dust and lint in the armature bearings have been the most general source of difficulty with prior power relays, and some special uses have their own problems such as, for example, difficulties from the freezing of moisture on the hinge or bearings in the case of relays on high altitude aircraft. The design and adjustment of prior power relays have been rather critical as the safety factor for insuring reliable operation has been only about 25%, i. e. the relay may fail to operate if the source voltage drops 25% below normal.

Objects of the present invention are to provide relays that substantially completely eliminate all difficulties from dust, lint, moisture and corrosive vapors, and that function satisfactorily over a wide range of subnormal source voltages. Objects are to provide relays of small size and simple design that have no bearings and hinge pins, the moving contact or contacts being free-floating on resilient supporting members. More specifically, an object is to provide power relays for industrial control use in which the moving contact is carried by a coiled spring.

These and other objects and advantages of the invention will be apparent from the following specification when taken with the accompanying drawings in which:

Fig. 1 is an elevation of a bearingless relay embodying the invention;

Fig. 2 is a similar view showing the relay mounted on a panel, and with some parts in section;

Figs. 3 and 4 are end elevations as seen from the left and the right, respectively, of Fig. 1;

Fig. 5 is a side elevation of another embodiment, with the primary control circuit and the load circuit shown diagrammatically;

Fig. 6 is a front elevation of the relay of Fig. 5;

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Fig. 7 is a side elevation of a double contact relay embodying the invention; and

Fig. 8 is a side elevation of another embodiment.

In the several views of the drawings, the reference numeral 1 identifies a coil or winding having terminal lugs 1', the coil being of annular cross-section and provided with a cylindrical core of soft iron 2 that constitutes one contact element of the relay. The outer or contact end of the core 2 is provided with a thin layer 3 of a noble metal or an alloy of good contact characteristics, the layer 3 being applied directly to the core 2 or, preferably, being a coating on a contact plug or rivet 4 having a stem that is force-fitted into an axial bore of the core 2. The coil 1 may be wound upon the core 2 or may be separately wound and cemented to the core. A terminal lug 5 is secured to the core 2 by a screw 6 and, in some embodiments of the invention, the screw 6 may constitute the means for securing the relay to a panel 7, see Fig. 2.

Referring particularly to Figs. 1 to 4 inclusive, the coil 1 and core 2 are mounted within a U-shaped bracket or yoke 8 of iron to which they may be cemented or may be held by a clamping action when the plate or cross-bar 9 of insulating material is secured between the ends of the yoke 8 by screws 10. The movable contact of the relay is a soft iron button 11 having a spherical or otherwise rounded surface opposed to the core or stationary contact 2, the button 11 having a cover layer, not separately shown, of a noble metal or good contact alloy. The movable contact 11 is "floated" in spaced relation to the core 2 by a coiled or helical spring 12 that has one end welded or brazed to the contact 11, the other end of the spring being threaded upon a supporting screw 13 that is threaded through the insulating plate 9. A terminal lug 14 is secured to the screw 13 by a nut 15 that has the additional function of a locknut to prevent inadvertent rotation of the screw 13.

The effective resiliency of the spring 12 may be adjusted by threading it to a greater or less extent upon the screw 13, and the spacing of the contact 11 from the core 2 may be adjusted in the same manner or, alternatively, by turning the supporting screw 13 in the insulating plate 9.

The free floating of the movable contact has a number of advantages in addition to those that result from the elimination of a hinge or pivotal support. Stable operation under relatively high vibration is obtained, and reliable contact closures result from the floating support and the rounded surface of the contact 11. The rounded

contact button 11 will rock or roll upon the end surface of the core 2 as it seeks to reduce the air gap between the soft iron bodies to a minimum. A rubbing action takes place if the contact button, as initially attracted to the core 2, seats upon a particle of dust or other nonmagnetic material. Another and an important advantage of the invention arises from the fact that successive contact engagements do not take place at the same points on the core 2 and contact button 11. The contact points retain minute magnetic charges of the same sign when the contacts separate, and these charges tend to prevent an engagement of the same points upon the next energization of the coil 1.

The invention is not limited to any particular size but it does permit of small compact constructions that are of special advantage when the available space is limited. The relays as manufactured and used have been quite small, and Figs. 1 to 4 inclusive are on an enlarged scale.

As shown in Figs. 5 and 6, the yoke 8' may be of shallow U-form with one arm supporting the coil 1 and core 2, and the other arm provided with an insulating bushing 9' for the screw 13 to which the contact 11 is connected by a helical spring 12. The yoke or bracket 8' has openings 16 for receiving screws, not shown, for securing the relay to a panel or other support. The circuit connections shown in Fig. 5 are conventional, i. e. a current source S is connected in series circuit with the terminals 1' of the power relay coil 1 through the contacts of an instrument type relay I, and the load 17 and a current source S' are connected in series between the terminal lug 5 of the core 2 and the terminal lug 14 of the movable contact 11.

As shown in Fig. 7, a coil 1 and its core 2 may be supported on a yoke or rectangular frame 18 by angle brackets 19 that have an arm apertured to fit over the core 2 and a base apertured to receive screws 20 that clamp the brackets to the yoke 18. Movable contacts 11 are floated adjacent the opposite ends of the core 2 on springs 12 that, as previously described, are threaded upon screws 13 that extend through and are insulated from the yoke 18 by insulating bushings 9'. The axes of the springs 12 are normal to the core axis in the illustrated relay but it will be apparent that the coaxial arrangement of Figs. 1 to 6 could be employed. The core 2 may be insulated from the brackets 19, or the brackets may be of insulating material when it is necessary or desirable to isolate the yoke or bracket 18 from the load circuit.

In another embodiment of the invention, as shown in Fig. 8, the movable contact 11 is normally supported in spaced relation to the contact surface 3 of core 2 by a coiled spring 21 that extends at right angles to the path of movement of the contact 11. The coil 1 and core 2 are secured to a base or mounting strap 22 by a screw 6, and the spring 21 is brazed to a terminal strip 23 that is supported from the relay base 22 by a post 24 of insulating material.

The embodiments herein shown and described are indicative of the latitude in design and construction of bearingless relays that fall within the scope of the invention as set forth in the following claims.

I claim:

1. A power relay for energization by a sensitive instrument type relay; said power relay comprising a coil on a cylindrical core of magnetic material, a contact secured to one end of said core, a bracket and means securing the coil and core thereto, a movable contact button of magnetic material having a rounded surface opposed to said contact on the core, and means supporting said movable contact on said frame for relative rolling movement of the rounded contact button upon said core contact when the coil is energized; said supporting means comprising a screw support secured to said bracket, a screw threaded through said screw support, and a helical spring having one end adjustably threaded upon said screw, the contact button being secured to the other end of said helical spring; whereby the effective resiliency of the spring may be adjusted by threading the same to a greater or less extent upon said screw, and the normal spacing of the contact button from the core contact for any given effective resiliency of the spring may be adjusted by turning said screw in said screw support.

2. A power relay as recited in claim 1, wherein the axis of said screw and helical spring substantially coincides with the axis of said cylindrical core.

3. A power relay as recited in claim 1, wherein said bracket is of iron and constitutes a magnetic yoke for said coil and core.

4. A power relay as recited in claim 3, wherein said bracket is of U-shape, and said screw support comprises a plate of insulating material secured between the ends of said U-shaped bracket.

5. A power relay as recited in claim 3, wherein said bracket is of U-shape, and said screw support comprises a bushing of insulating material set into one arm of the U-shaped bracket.

6. A relay comprising a coil on a core of magnetic material, a bracket and means mounting said core and coil on said bracket, a contact of magnetic material at each end of and spaced axially from said core, and means including a helical spring supporting each contact from said bracket and insulating the same from said core; said supporting means including insulating bushings set in said bracket, and screws adjustably threaded into said bushings; said helical springs being adjustably threaded upon said screws to determine the effective resilience thereof.

7. A relay as recited in claim 6, wherein said supporting means for each contact includes means mounting the spring of that contact on the bracket with its axis normal to the axis of said core.

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