Oct. 25, 1932. L. A. GEBHARD 1,884,654

RELAY AND CIRCUIT BREAKER

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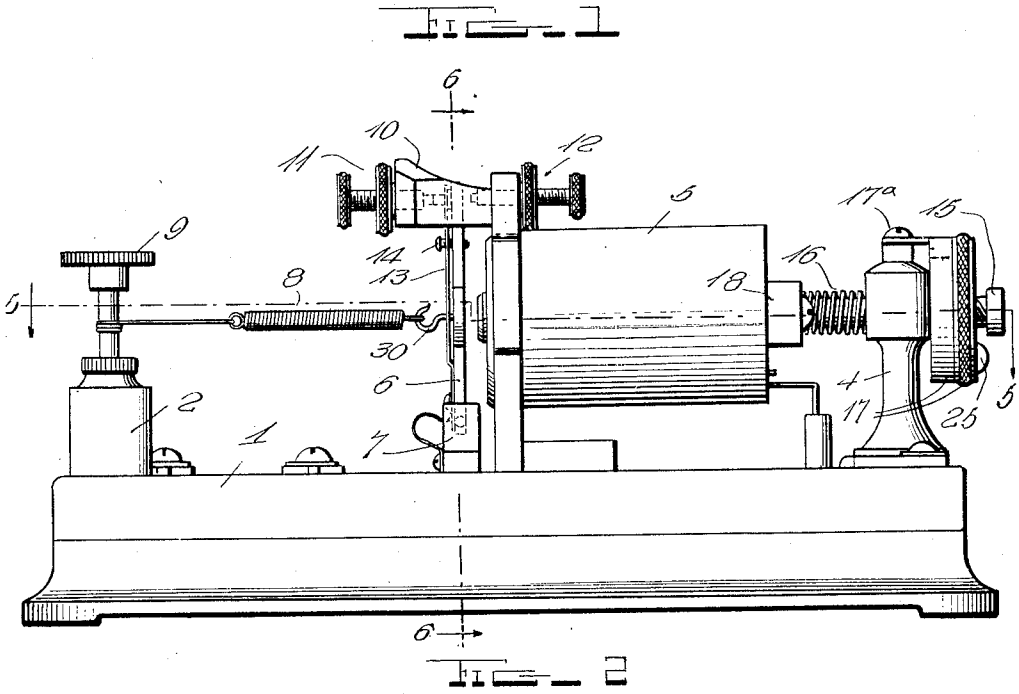

Fig. 1

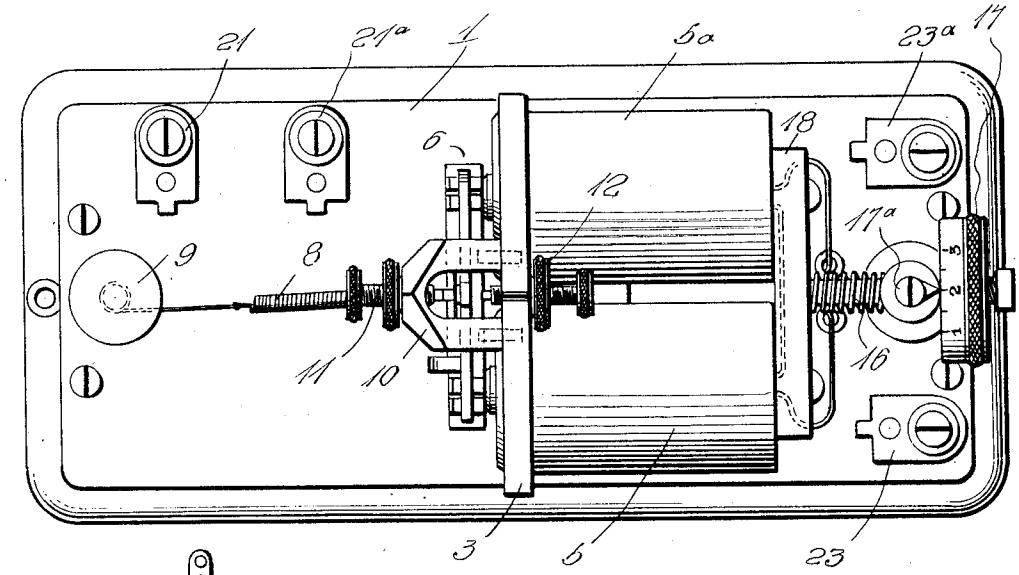

Fig. 2

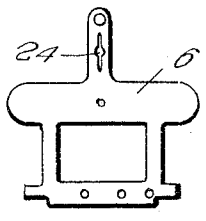

Fig. 10

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FIG. 3

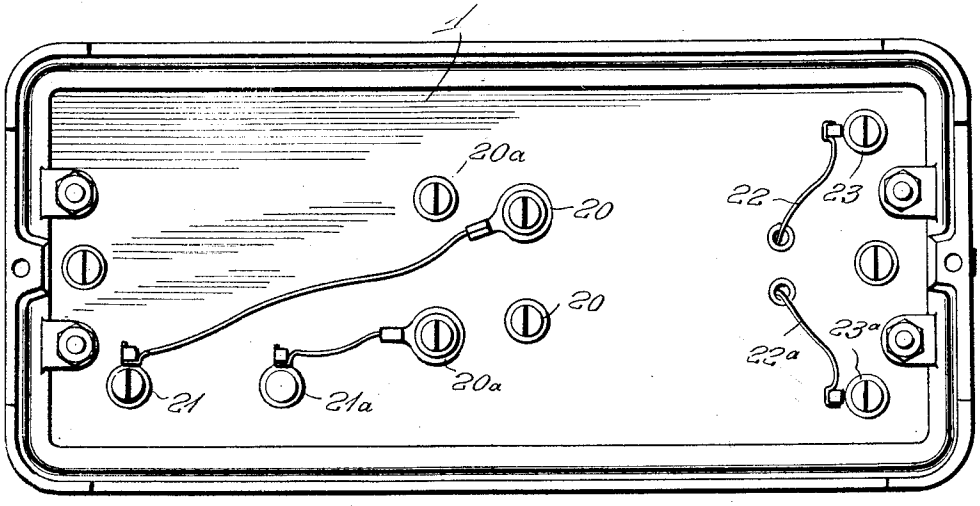

FIG. 4

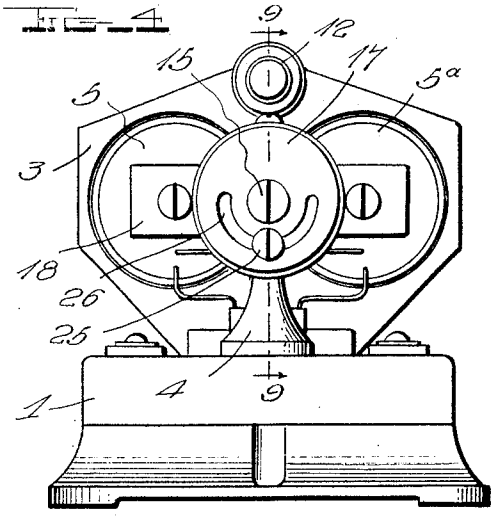

FIG. 7

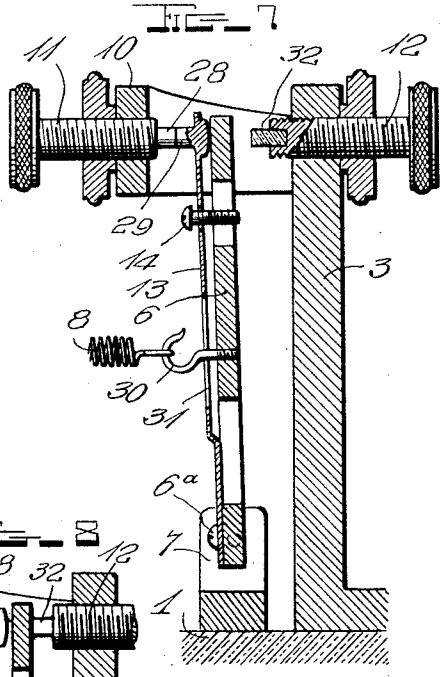

FIG. 9

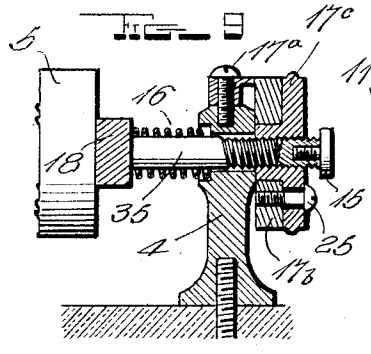

FIG. 8

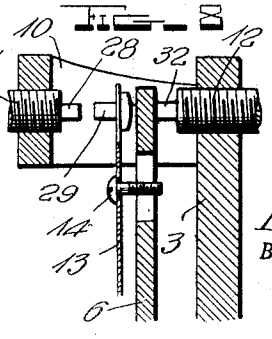

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FIG. 5

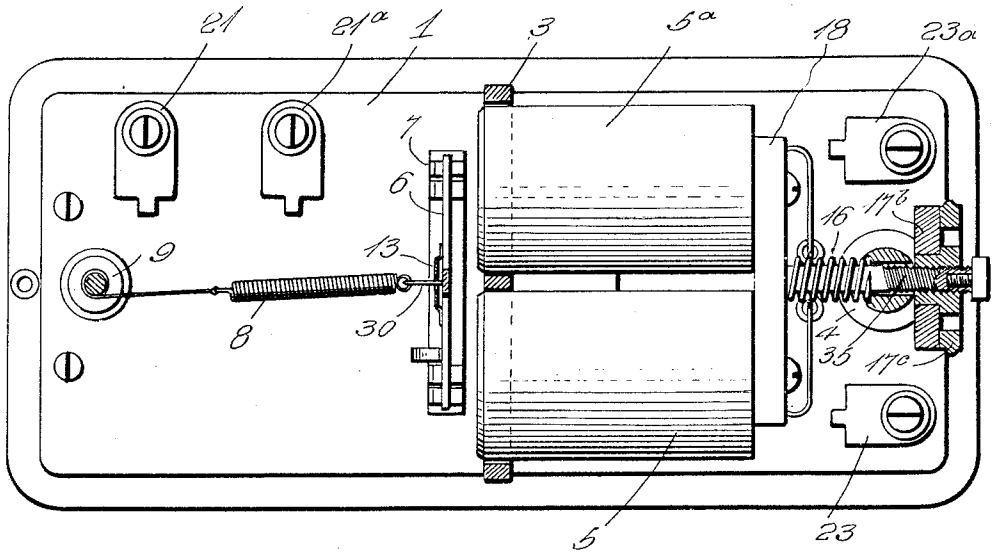
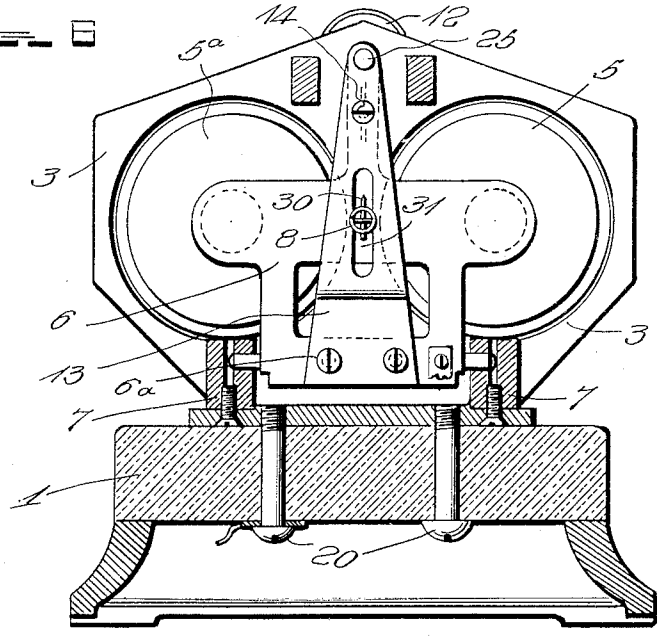


FIG. 6



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Patented Oct. 25, 1932 1,884,654

UNITED STATES PATENT OFFICE

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RELAY AND CIRCUIT BREAKER

Application filed December 3, 1928. Serial No. 323,524.

My invention relates to a relay and circuit breaker in general and more specifically to relays and circuit breaker adapted to control an electrical circuit when the current exceeds or is less than a predetermined value.

An object of my invention is to provide certain improvements in relays and circuit breakers whereby the same will operate quickly upon a predetermined value of electrical energy.

Another object of my invention is to provide a relay and circuit breaker which is calibrated to the definite limits of electrical energy required for its operation.

Still another object of my invention is to provide a relay and circuit breaker which is calibrated to the definite limits of electrical energy required for its operation and wherein means are provided for adjusting the operating characteristics according to such calibration within the said limits.

Other and further objects of my invention reside in the structural features of my relay and circuit breaker which may best be understood by referring to the specification following and to the accompanying drawings wherein:

Figure 1 is a side elevation showing the relay and circuit breaker of my invention; Fig. 2 is a plan view of my relay and circuit breaker; Figs. 3 and 4 are illustrations showing bottom and end views of the relay and circuit breaker of my invention; Figs. 5 and 6 are illustrations showing top and end views with parts of the relay and circuit breaker removed; and Figs. 7, 8, 9 and 10 are illustrations showing structural features of the armature, contacts and calibration means employed in the relay and circuit breaker of my invention.

Figure 1 shows a side elevation of the relay in its entirety mounted on a base 1. Base 1 may be of suitable insulating material or may be of metal and provided with suitable insulating bushings for supporting the several parts. A standard 2 is carried by base 1 and carries spindle 9. An upstanding member 3 is supported by base 1 near the center thereof. Upstanding member 4 is likewise carried by base 1. Member 4 may be constructed from suitable insulating material or of metal. An electromagnet 5 is supported by member 3 and member 4 and is movable in respect thereto. A magnetic armature 6 is pivotally supported with respect to the upstanding member 7. Armature 6 is held away from electromagnet 5 by resilient means 8, the tension being adjustable by means of spindle 9.

The movement of armature 6 is restricted by frame member 10. The latter is provided with adjustable screw members 11 and 12 by means of which the movement of armature 6 may be controlled between the desired limiting positions. A spring contact member 13 is carried by armature 6 and is provided with adjustable screw 14 extending through member 13 into a threaded section of armature 6. The shank of screw 14 is free from spring contact member 13 but the head thereof bears against the same and provides an adjustment between member 13 and armature 6. A supporting member 35 for electromagnet 5 extends through member 4 and is free to move therein. This supporting member is provided with a stop screw 15 for preventing disengagement with upstanding member 4. A knob 17 is threaded to receive the end of the supporting member 35. A spring 16 is concentrically disposed around supporting member 35 between upstanding member 4 and the magnetic end member 18. Knob 17 is calibrated around its periphery and a pointer 17*a* supported on member 4 extends immediately adjacent thereto as shown whereby indications of the adjustments may be observed.

Fig. 2 is a top plan view of the relay and circuit breaker of my invention. Like reference characters are employed in all of the figures of the drawings. Electromagnets 5 and 5*a* are electrically connected in series and are supported by the magnetic laterally extending end member 18. End member 18 completes the magnetic circuit through electromagnets 5 and 5*a*. Knob 17 and pointer 17*a* clearly show the calibration by which the different adjustments may be determined to enable the relay to be reset to any selected positions. Terminals 21, 21*a*, 23 and 23*a* are

carried by base 1, the electrical connections of which are shown in Fig. 3.

Fig. 3 is a bottom plan illustration showing the base 1, terminals 21, 21*a*, 23 and 23*a* mounting screws 20 and connecting wires 22 and 22*a*. Connecting wires 22 and 22*a* pass through suitable insulating bushings in base 1 and connect to electromagnets 5 and 5*a* respectively. Screws 20 engage with upstanding member 3, shown in Fig. 1. Screws 20*a* engage with pivot member 7 and secures the same to base 1. Screw members 20 and 20*a* may be electrically insulated each from the other.

Fig. 4 illustrates an end view of the relay and circuit breaker of my invention which shows more clearly the calibrated adjustment knob 17 for controlling the operating characteristics. Knob 17 is threaded on the shaft or supporting member 35 which is mechanically connected to end member 18. End member 18 is common to electromagnets 5 and 5*a*. Knob 17 is prevented from disengaging with the threaded portion of the shaft by means of screw 15. Knob 17 is divided into two disks placed adjacent and parallel to each other. The disk nearest retaining screw 15 is provided with a semi-circular aperture 26 through which screw 25 passes and engages with disk 17*b*.

Fig. 5 of the accompanying drawings shows knob 17 in partial cross section. Knob 17 in its entirety comprises individual disks 17*b* and 17*c*. Disk 17*c* is threaded to accomodate the threaded portion of shaft 35. Shaft 35 is connected to end member 18 and freely passes through the bearing provided in upstanding member 4. Spring 16 encircles shaft 35 and rests between members 4 and 18. Knob 17 rests against member 4 under the action of spring 16. Disk 17*c* of knob 17 may be moved independently with respect to disk 17*b* when screw 25 is loosened in slot 26.

The periphery of disk 17*b* is suitably calibrated, which calibration may be adjusted to correspond to the operating characteristics of the relay with a known standard of measurement such as a reliable meter. Disks 17*b* and 17*c* are then locked together by means of screw 25, shown in Fig. 4. Screw 25 engages with a threaded hole in disk 17*b*. Supporting member 3 is shown in cross-section which permits an unobstructed top elevation view of armature 6 and spring contact member 13. Hook 30 is clearly shown extended through an aperture in spring contact 13 and connected to armature 6.

Figs. 6, 7 and 8 show the structural features of armature 6, spring contact 13 and other parts of the relay and circuit breaker of my invention in greater detail. In Fig. 6, armature 6 is pivoted in suitable bearings provided in members 7. Members 7 are carried by base 1. Armature 6 is positioned adjacent and in electromagnetic relation to the core members of electromagnets 5 and 5*a*. Spring contact member 13 is secured to the lower end of armature 6 by means of screws 6*a*. An aperture 31 is provided in spring contact member 13 of sufficient width for hook 30 to pass therethrough without touching. Hook 30 is connected to armature 6 and does not touch spring contact member 13. The retaining force exerted by spring 8 is therefore not directed to member 13 but directly to armature 6. Screw 14 projects through member 13 and engages in a threaded hole provided in armature 6. The shank of screw 14 does not bind against spring contact member 13, but the head of screw 14 is larger than the hole through member 13 and provides means for adjusting the special relation of member 13 and armature 6 near contact member 25. These features are more clearly shown in Figs. 7 and 8.

Fig. 7 is a cross-sectional view showing upstanding member 3 carried on base 1 and armature 6 pivoted in member 7. A U-shaped member 10 is integral with upstanding member 3 and supports adjustable contact members 11 and 12. Member 11 is provided with contact member 28 which may be of platinum or any suitable contact metal. Member 12 is provided with an insulating member 32 which may be of silicate or phenol composition. Members 11 and 12 have like threaded portions and may be interchanged. By interchanging members 11 and 12 the relay and circuit breaker is adapted to complete an electrical circuit when and only when the energy is of the proper value. Spring contact member 13 may be removed from armature 6 by removing screws 6*a*. Spring member 13 may then be located on the side of armature 6 nearest the metallic contact member 11 when members 11 and 12 are interchanged from the positions shown in Fig. 7. Spring contact member 13 is provided with an aperture 31 through which hook 30 passes. Member 13 is free to move independently of armature 6. A hole is provided in member 13 near contact member 29 through which the shank of adjusting screw 14 passes. The movement of member 13 is not restricted by the shank of screw 14 but the head of the screw abuts with spring member 13 when the movement of armature 6 is sufficiently pronounced. This is better illustrated in Fig. 8 of the accompanying drawings which shows spring member 13 immediately adjacent to the head of screw 14 and carried by the movement of armature 6 to the position shown.

Fig. 9 shows the supporting member or shaft 35 which is mechanically connected with the electromagnets. Member 35 is connected to end member 18 the latter being common to both electromagnets. Shaft 35 extends through supporting member 4 and the movement longitudinally is not restrict-

ed by the bearing therein. Knob 17 in its entirety comprises disks 17*b* and 17*c* the latter of which is suitably threaded to accommodate the threaded portion of shaft 35. Disk 17*b* is angularly adjustable with respect to disk 17*c* over the extended cylindrical portion 17*d* of the disk 17*c*. Disks 17*b* and 17*c* are free to move independently with respect to each other unless restricted by screw 25. Screw 25 passes through the semicircular slot in disk 17*c*, more clearly shown in the foregoing figures. Screw 25 is threaded into a hole in disk 17*b* and when properly adjusted causes disks 17*b* and 17*c* to be closely clamped together. The periphery of disk 17*b* is calibrated to indicate the energy required to operate the relay. Screw 15 prevents excessive movement of shaft 35. Spring 16 encircles shaft 35 and rests between members 4 and 18 thereby causing disks 17*b* and 17*c* to bear against member 4 at all times. Pointer or indicator 17 is carried by the top of member 4 and rests adjacent to the scale provided on disk 17*b*. Disk 17*b* may be removed and a like disk but one having a different calibration may be substituted.

The operation of the relay and circuit breaker of my invention and the many advantages of this type of apparatus will be understood from the accompanying drawings. By referring to Figs. 1 and 2, major adjustments are clearly indicated. The source of energy is connected to terminals 23 and 23*a*.

Let us assume that the source is alternating current or direct current fluctuating in value. A fluctuating magnetic field is established by electromagnets 5 and 5*a*. This magnetic field offers an attraction for armature 6. A suitable standard of measurement device such as an ammeter or microammeter is associated with the source of energy connected to terminals 23—23*a*. Knob 17 is adjusted to a position where the attraction of armature 6 is complete and armature 6 moved against member 12. The indication of the standard of measurement is observed and the calibration of knob 17 is set to indicate this value. Screw 25 is then tightened. A sensitive meter and local circuit may then be connected to terminals 21—21*a*. Knob 17 is adjusted to a value which allows the return of armature 6 and which permits the contact of spring member 13 to contact with member 11. Knob 17 is then adjusted and the meter connected with terminals 21—21*a* closely observed. If it is noticed that the contact between members 11 and 13 is unsteady, screw 14 is adjusted. The fluctuating or alternating magnetic field causes armature 6 to vibrate. By correctly adjusting screw 14, this vibration will not affect member 13 and hence will not cause the circuit connected with terminals 21—21*a* to be unsteady. Adjustment members 11 and 12 may be interchanged, as aforementioned, to complete an external circuit when a predetermined value of energy is admitted to electromagnets 5 and 5*a*. Members 11 and 12 may be electrically insulated each from the other and associated with individual electrical circuits to be controlled. In this manner, a load circuit and a source of energy may be connected with the windings of electromagnets 5 and 5*a* and an increase in the load would cause an additional energy booster or any desired apparatus or circuit to be connected to the circuit for dividing the load.

The relay and circuit breaker of my invention provides a rugged and reliable energy indicating device and may be employed where the ordinary type of meter is unsuitable. The adjusting knob for controlling the spacial relation between the armature and the electromagnets may be calibrated to read directly the value of electrical energy or the value may be determined by comparing the indication shown on the knob with a chart or graph. It is of course necessary to calibrate the adjustment knob with some known standard. The energy of unknown value is connected to the electromagnets and the contact members associated with the armature connected to a suitable indicating circuit. The knob would then be adjusted to the position where the indicating circuit was energized or where it was not energized, depending upon the indication desired.

The relay and circuit breaker of my invention, while adaptable to alternating and fluctuating sources of energy, may be likewise employed where mechanical vibration and shocks in the immediate vicinity of the relay would cause other types to be of little value.

I realize that many modifications of the relay and circuit breaker of my invention are possible without departing from the spirit of my invention and it is to be understood that I do not intend that my invention be limited to the foregoing specification or to the accompanying drawings but only as defined in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a relay, an electromagnet, an armature pivotally mounted for actuation by said electromagnet, a contact member mounted on the side of said armature remote from said electromagnet, and a resilient member attached to said armature on the side thereof remote from said electromagnet and mounted to engage said contact member for permitting a marginal freedom of motion of said armature in its magnetically unactuated position without disengaging said contact member.

2. In a relay, an electromagnet, an armature pivotally mounted for actuation by said electromagnet, a contact member mounted on the side of said armature remote from said

electromagnet, a resilient member attached to said armature on the side thereof remote from said electromagnet and mounted to engage said contact member for permitting a marginal freedom of motion of said armature in its magnetically unactuated position without disengaging said contact member, and means remote from the pivot of said armature for limiting the maximum displacement of said resilient member with respect to said armature.

3. In a relay, an electromagnet, an armature pivotally mounted for actuation by said electromagnet, a contact member mounted on the side of said armature remote from said electromagnet, a spring attached to said armature for opposing the attraction of said electromagnet thereon, and a resilient member attached to said armature on the side thereof remote from said electromagnet and substantially parallel to said armature and mounted to engage said contact member for permitting a marginal freedom of motion of said armature in its magnetically unactuated position without disengaging said contact member, said resilient member being apertured for the passage of said spring.

4. In a relay, an electromagnet, an armature, means for adjusting the spacial relation of the armature and electromagnet of said relay, a knob connected with said means, said knob comprising individually movable sections, one of said sections being movable only in respect to adjustments of said spacial relation, and the other of said sections being provided with calibrations and adapted to be locked to said movable section in a selected position for indicating the spacial relation of said armature and electromagnet.

5. In a relay, an electromagnet, an armature pivotally mounted for actuation by said electromagnet, a contact member mounted on the side of said armature remote from said electromagnet, a connecting member attached to said armature, a coil spring attached to said connecting member for opposing the attraction of said electromagnet on said armature and a resilient member attached to said armature on the side thereof remote from said electromagnet and substantially parallel to said armature and mounted to engage said contact member for permitting a marginal freedom of motion of said armature in its magnetically unactuated position without disengaging said contact member, said resilient member being apertured for the passage of the connecting member which connects with said spring.

6. In a relay, an electromagnet, an armature pivotally mounted for actuation by said electromagnet, a contact member mounted on the side of said armature remote from said electromagnet, a resilient member attached to said armature on the side thereof remote from said electromagnet and mounted to engage said contact member for permitting a marginal freedom of motion of said armature in its magnetically unactuated position without disengaging said contact member, said resilient member being apertured at a point remote from the pivot of said armature and an adjustable screw carried by said armature, the shank of said screw passing through the aperture in said resilient member and the head of said screw projecting beyond the sides of said aperture for engaging the side of said resilient member remote from said armature for limiting the maximum displacement of said resilient member with respect to said armature.

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