

June 14, 1927.

T. L. LEE

1,632,609

ELECTRICAL INSTRUMENT

Filed April 4, 1925

Fig. 1

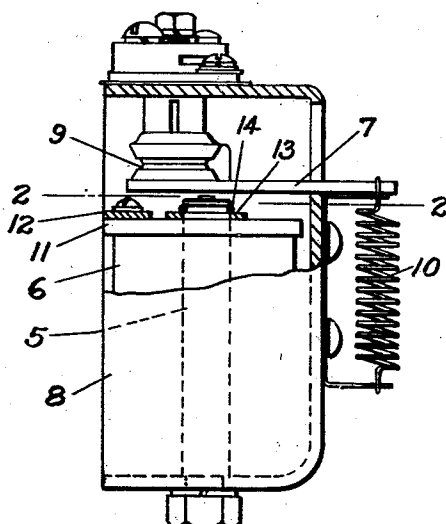


Fig. 2

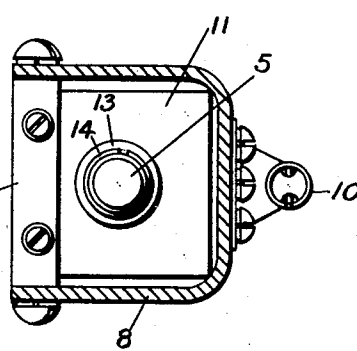
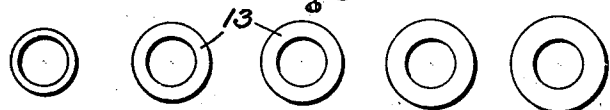


Fig. 3



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UNITED STATES PATENT OFFICE.

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ELECTRICAL INSTRUMENT.

Application filed April 4, 1925. Serial No. 20,781.

This invention relates to electrical instruments, such as voltage controlling relays and the like, in which magnets and electromagnetic windings are used. In some such instruments it is desirable to compensate for the effect of temperature upon the windings, and it has been proposed to accomplish this by the use of a magnetic shunt carrying a part of the flux and consisting of material such, for example, as certain nickel-steel alloys, having a pronounced temperature coefficient of permeability substantially different from that of the iron or steel constituting the principal portion of the magnetic circuit.

In the manufacture of instruments such as just described, it has been found difficult, owing to unavoidable variations in manufacture and in the characteristics of the compensating alloys used, to secure invariable results in the use of such alloys. While such variations may be met by changing the thickness or extent of the bodies of compensating materials employed, this is not convenient when manufacturing in large quantities. The object of the present invention, therefore, is to provide a simple and effective means for adjusting the effect of the magnetic shunt without introducing variations in the dimensions of the body of shunt material. I have found that this may be accomplished by the use of a readily exchangeable body of magnetic material, of a different temperature coefficient and of less extent than the shunt, which is applied to the latter in such a way as, in effect, to partially short-circuit the latter in so far as the flux-path is concerned.

The invention, accordingly, consists in the construction hereinafter described, as it is defined in the annexed claims.

In the accompanying drawings, Fig. 1 is a side-elevation, partly in section, of an instrument embodying the present invention. Fig. 2 is a sectional plan-view of the line 2-2 in Fig. 1; and Fig. 3 is a plan-view of a series of interchangeable adjusting members suitable for use in the instrument shown.

The invention is illustrated as embodied in an instrument having a cylindrical magnetic core 5 of steel, surrounded by a winding 6. An armature 7 cooperates with the core and is pivotally mounted upon what may be described as the "yoke-member" 8 of the instrument. The member 8 completes

the magnetic circuit and has the form, in the illustrated instrument, of a box-like steel shell, to the lower end of which the core 5 is fixed. The armature 7 controls contacts 9, and is itself controlled by a spring 10.

The details of construction just described are not in themselves essential to the invention, as the magnetic circuit, and the construction of the armature, the contacts etc., may take widely different forms consistently therewith.

The compensating shunt, as illustrated, has the form of a rectangular plate 11, which may consist of some material such, for example, as nickel-steel, having a pronounced negative temperature coefficient of permeability. This plate is perforated to surround the upper polar extremity of the core 5, and is secured to the yoke 8 by means of a bar 12 of any convenient material. The effect of this shunt is to short-circuit a part of the magnetic flux which would otherwise pass through the armature, and since the efficacy of the shunt diminishes with rise in temperature, it thereby tends to compensate for the increase of resistance which occurs at the same time in the winding 6.

The adjusting device characteristic of the present invention is shown as having the form of a perforated disc or washer 13, which may be of iron or steel, and which surrounds the core and lies upon the upper surface of the shunt 11. As a convenient means for securing the washer 13 in place, the core is provided with an annular groove, and a split ring 14 or spring wire lies in this groove and engages and retains the washer.

In the manufacture of instruments such as just described, a quantity of washers 13 may be provided having several different diameters, as shown in Fig. 3. The compensating shunt will be designed to have a somewhat excessive compensating effect, so as to overcompensate the instrument. After the instrument has been assembled, without the adjusting washers, it may be tested and the exact degree of overcompensation ascertained. By means of a table or formula, an adjusting washer 13 of the correct diameter can then be selected and applied to the instrument, with the result of adjusting the compensation to the exact degree required. It will be apparent that this washer affords an alternative path, of relatively high permeability, for a portion of the flux which

would otherwise pass through the compensator, and thus, in effect, diminishes the length of the flux path through the compensating material.

5 While the washer 13 provides a device, for the purpose in question, which is convenient and inexpensive in form, it will be understood that this adjusting member may have various forms suitable for instruments
10 of various designs in which it may be used.

The invention claimed is:

1. In an electrical instrument, the combination, with a magnet, of a compensating magnetic shunt consisting of metal having
15 a pronounced temperature coefficient of permeability; and means for adjusting the effect of said shunt, comprising a body of magnetic material, of different temperature coefficient, removably attached to said shunt
20 and of less extent than the shunt.

2. In an electrical instrument, the combination,

with the core of an electromagnet, and a compensating magnetic shunt consisting of a plate surrounding a polar extremity of the core and consisting of metal having
25 a pronounced temperature coefficient of permeability, of means, for adjusting the effect of said shunt, consisting of a washer, of magnetic material, lying upon said shunt and attached to the core.

3. In an electrical instrument, the combination, with the core of an electromagnet, and a compensating magnetic shunt surrounding a polar extremity of the core and consisting of metal having a pronounced
30 negative temperature coefficient of permeability, of means, for adjusting the effect of said shunt, consisting of a plate of magnetic material, of less extent than said shunt, and means for securing said plate removably to
40 the core in engagement with the shunt.

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