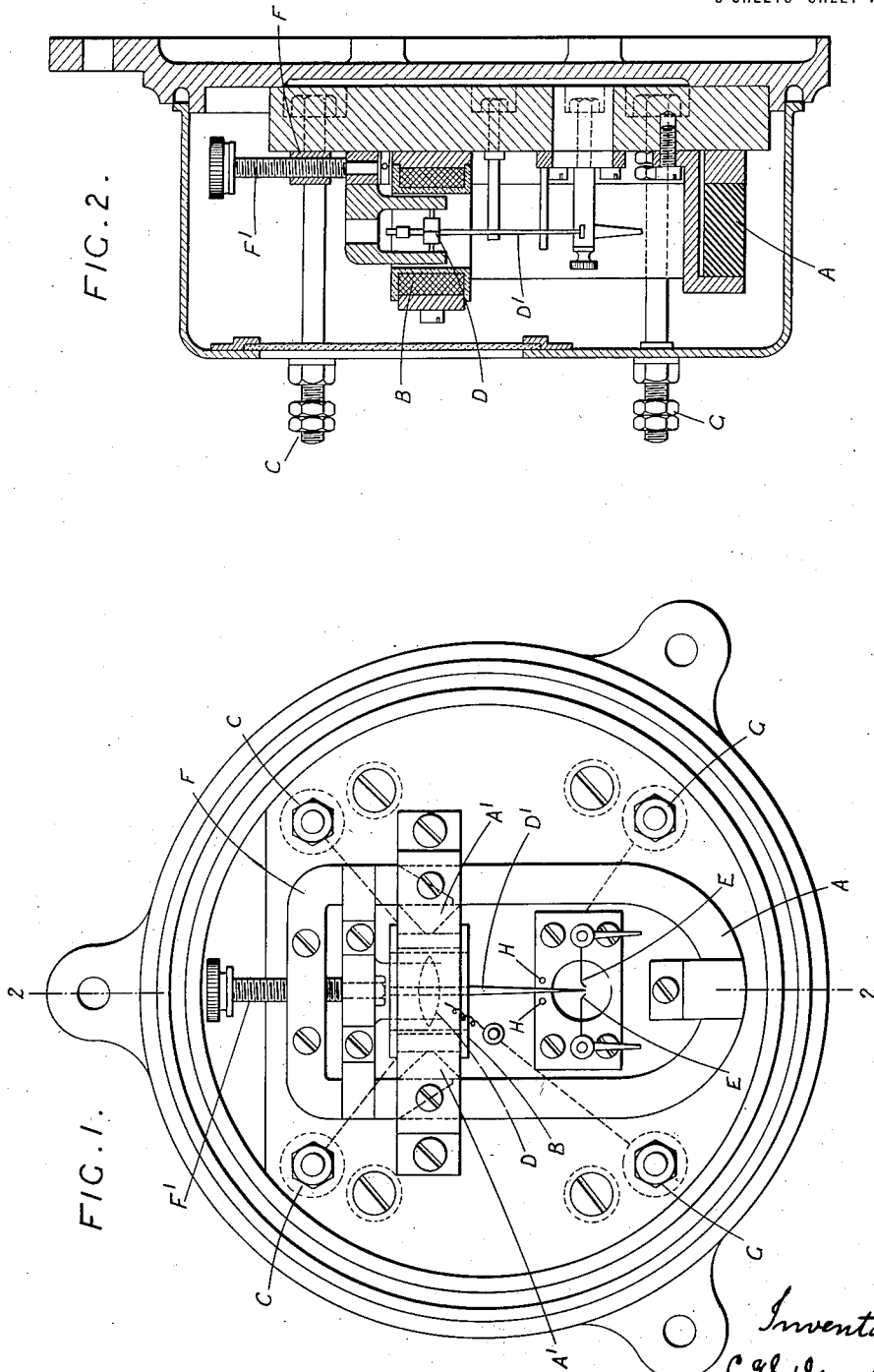


1,328,825.

C. V. DRYSDALE.
ALTERNATING CURRENT RELAY.
APPLICATION FILED AUG. 25, 1919.

Patented Jan. 27, 1920.
5 SHEETS—SHEET 1.



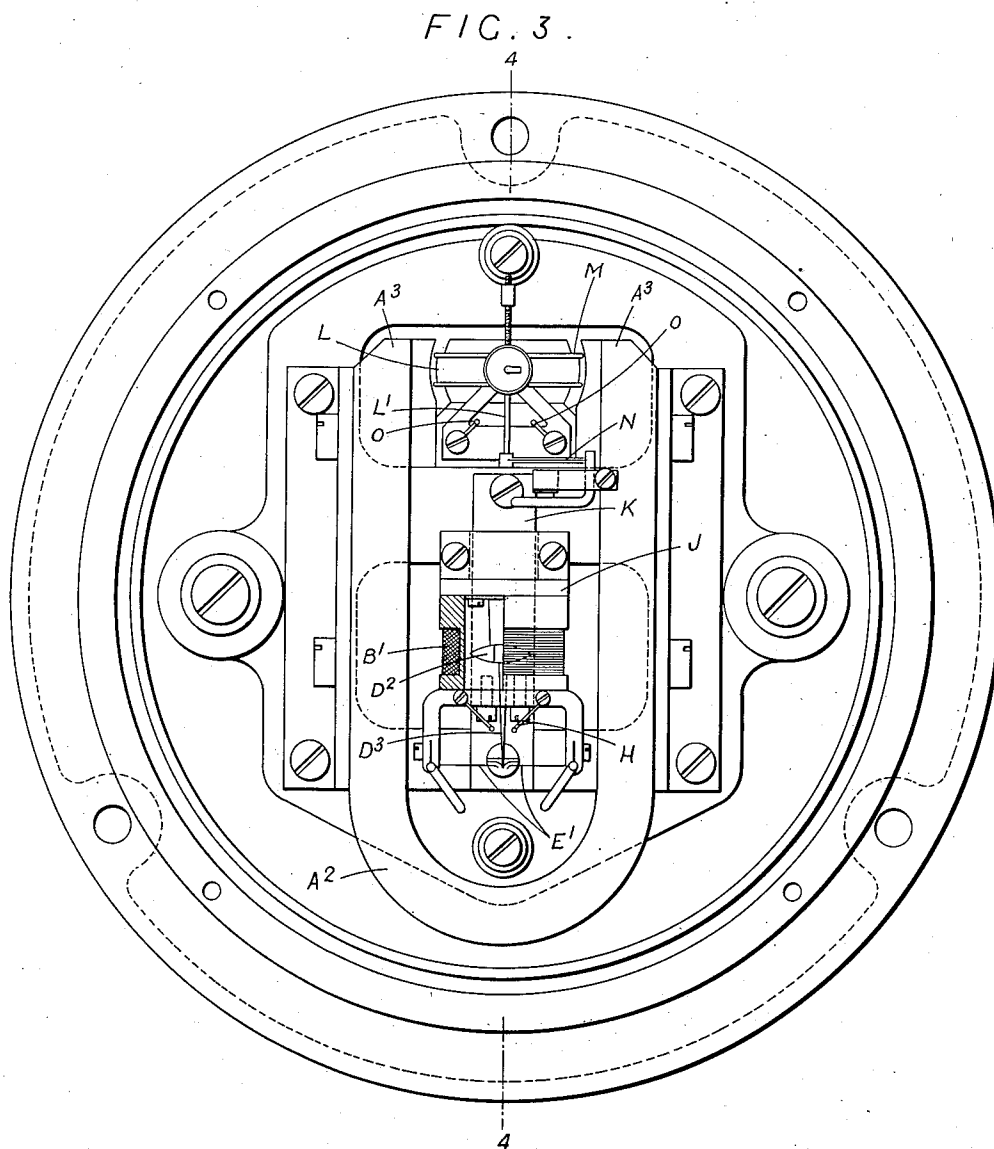
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5 SHEETS—SHEET 2.



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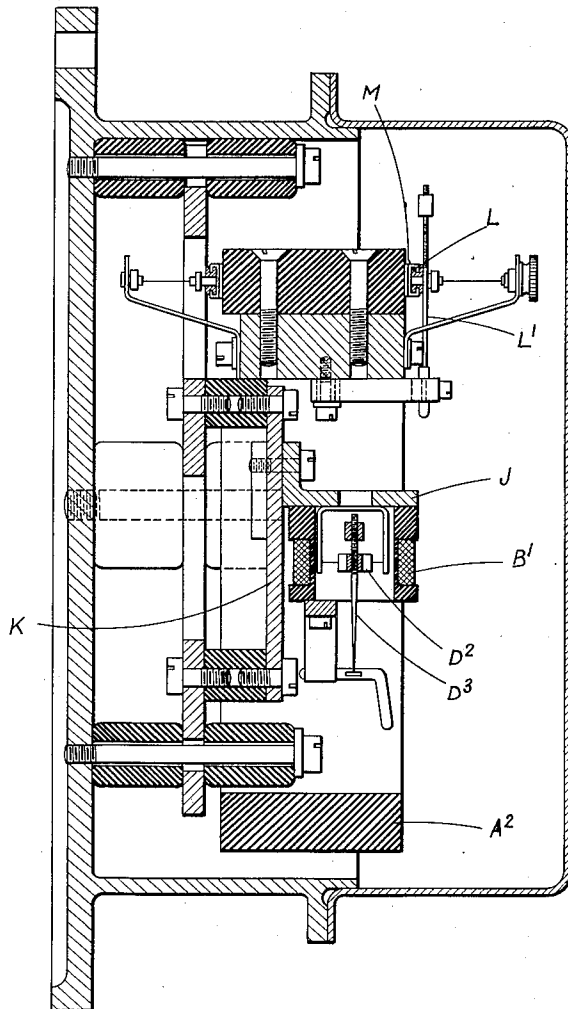
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5 SHEETS—SHEET 3.

FIG. 4.



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5 SHEETS—SHEET 4.

FIG. 5.

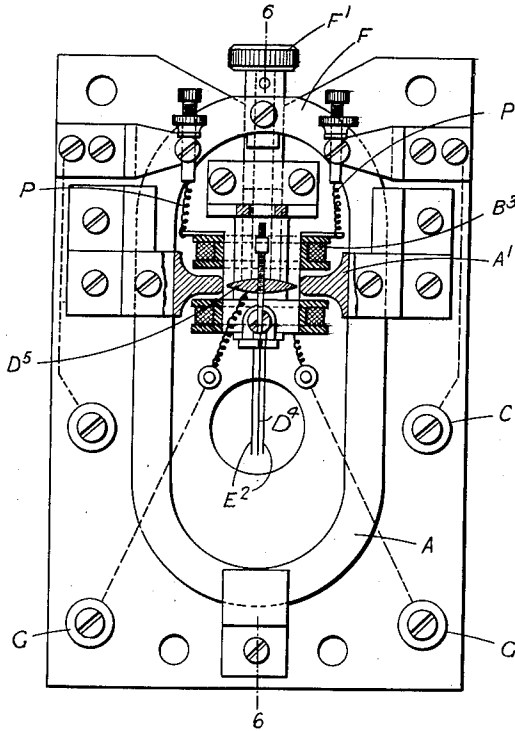


FIG. 6.

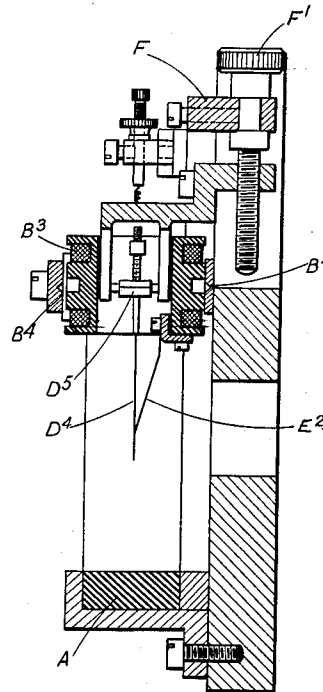


FIG. 10.

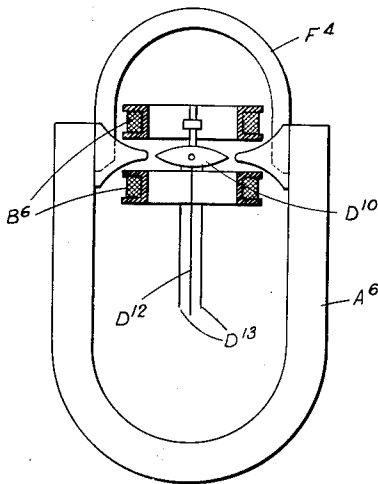
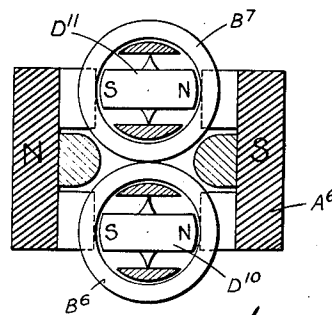


FIG. 11.



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1,328,825.

Patented Jan. 27, 1920.
5 SHEETS—SHEET 5.

FIG. 7.

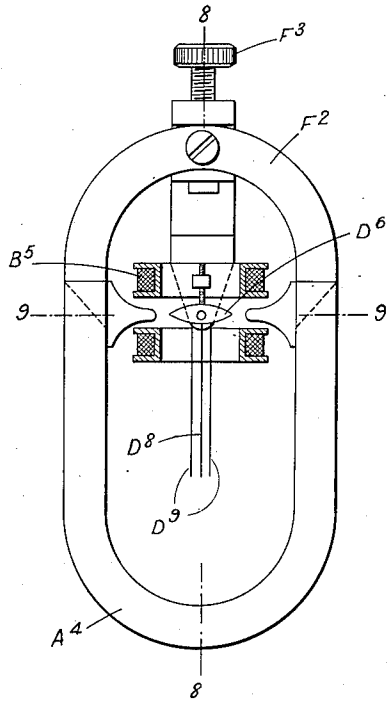


FIG. 8.

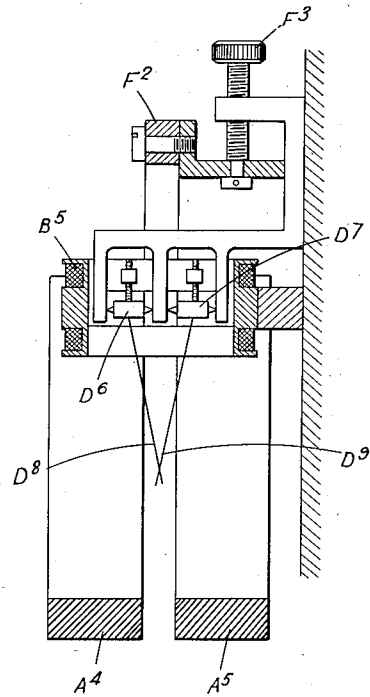
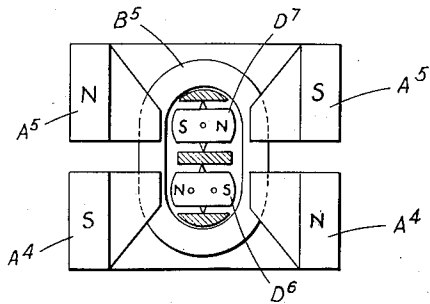


FIG. 9.

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UNITED STATES PATENT OFFICE.

CHARLES VICKERY DRYSDALE, OF DUMBARTONSHIRE, SCOTLAND.

ALTERNATING-CURRENT RELAY.

1,328,825.

Specification of Letters Patent.

Patented Jan. 27, 1920.

Application filed August 25, 1919. Serial No. 319,583.

To all whom it may concern:

Be it known that I, CHARLES VICKERY DRYSDALE, D. Sc., M. I. E. E., a subject of the King of England, and residing at Dumbartonshire, in Scotland, have invented certain new and useful Improvements in Alternating-Current Relays, of which the following is a specification.

This invention relates to alternating current relays in which a contact is obtained by the operation of a small alternating current of definite frequency and refers particularly to relays which can be tuned by varying the strength of the magnetic field in which the vibratory member oscillates.

According to this invention the relay works on the principle of tuning or resonance and the controlling magnetic field is varied for the purpose of tuning either by means of a magnetic shunt or by movement of the relay system between the poles of a horse shoe magnet. An oscillating contact-making magnetic needle is disposed between the poles of a permanent magnet and within a coil through which the alternating current passes. In order to obtain a continuous contact from the intermittent contact derived from this device a secondary relay may be provided comprising a highly damped moving coil which has a tangential rubbing contact. Since the oscillations of the magnetic needle cannot be damped without loss of sensitiveness it may be necessary to provide means whereby contacts due to mechanical disturbances may be avoided. This may be effected by mounting the coil through which the alternating current passes in pivots so that it can oscillate in the same plane as the needle, these oscillations being tuned by springs. Two contact members are then carried by this coil and so disposed that they can make contact with a contact-making arm carried by the needle when the latter oscillates as the results of current flowing through the coil around it. Mechanical disturbances of the device will then merely cause similar movements of all the contact members without contact between them occurring. Alternatively, two similar permanent magnets may be employed and arranged with opposite polarity and with two similar magnetic needles suspended between the poles of the magnets both needles lying within the coil through which the alternating current passes. A single magnetic shunt is provided for the purpose of varying simul-

taneously the fields of these magnets. The needles carry arms which are adapted to make contact together when the needles oscillate as a result of current flowing through the coil but mechanical disturbance will merely cause similar oscillations of the needles and their arms without contact occurring between the latter.

Also alternatively the double needle arrangement may be used with a single permanent magnet and magnetic shunt or with two magnets of similar polarities and operated by two coils in which the alternating current circulates in the opposite sense, the needles carrying contact arms as described above.

The accompanying drawings illustrate by way of example several forms of relay constructed in accordance with this invention. In these drawings:—

Figure 1 is a front view of one construction of the improved relay.

Fig. 2 is a section on the line 2—2 in Fig. 1.

Fig. 3 is a front view of an alternative construction with which a secondary relay is combined.

Fig. 4 is a section on the line 4—4 in Fig. 3.

Fig. 5 is a front view partly in vertical section of a further alternative construction.

Fig. 6 is a section on the line 6—6 in Fig. 5.

Fig. 7 is a part sectional front elevation of the principal portions of yet another construction.

Fig. 8 is a vertical section on the line 8—8 in Fig. 7.

Fig. 9 is a horizontal section on the line 9—9 in Fig. 7.

Fig. 10 is a front view partly in vertical section of a modification of the construction shown in Figs. 7, 8 and 9.

Fig. 11 is a section on the line 11—11 in Fig. 10.

Like letters indicate like parts throughout the drawings.

Referring to Figs. 1 and 2 a suitably mounted permanent horseshoe magnet A has fixed between its poles a coil B to which the alternating current passes from terminals C. Within the coil B is pivoted a soft iron or steel needle D provided with an arm D' having at its end a platinum contact which lies and vibrates between the platinum filaments or contacts E which in this construc-

tion are fixed in some convenient manner to the base on which the magnet A is mounted. The poles A' of the magnet are arranged to give an intense field in the neighborhood of the needle D and adjacent to these poles is a soft iron magnetic shunt F having tapered ends which is carried on a screw F' so that it can be caused to approach the poles or recede from them in order to shunt a greater or less proportion of the magnetic flux away from the poles. In this way the control and the vibration frequency of the needle D and arm D' can be varied. Suitable connections are arranged between the arm D' and also the contacts E and two terminals G to which are connected the local battery and secondary apparatus. The contacts E are adjustable so that the end of the arm D' will touch them lightly as it oscillates on either side of its stationary position and the range through which the arm D' can oscillate is limited by rubber buffers H.

In the construction illustrated in Figs. 3 and 4 the coil B' together with the needle D² and the contacts E' are carried on a bracket J which can be moved along a vertical member K so that the position of the coil and needle between the poles of the magnet A² can be altered and the needle set in magnetic fields of different strengths for the purpose of tuning the oscillations. A scale of frequencies can be marked on the member K. Since the intermittence of the contacts between the arm D³ and filaments E' renders the device unsuitable for use in certain cases a continuous contact can be obtained by means of a secondary moving coil relay as embodied in the construction shown in Figs. 3 and 4. A moving coil L is pivoted or suspended in some convenient manner between the poles A³ of the magnet the movements of the coil being highly damped by means of a copper former M. The coil carries a contact arm L' the end of which makes tangential sliding contact with a horizontally disposed brush of platinum filaments N. The oscillations of the arm L' are limited in range by spring buffers O. The arm D³ is in electrical connection with the coil L so that as the needle D² oscillates and intermittent contact is made between the arm D³ and the contacts E' an intermittent current will pass through the coil L from the local battery. This will result in contact between the arm L' and the brush N and this contact will be a continuous rubbing contact since the arm L' will swing through only a small arc owing to the inertia and damping of the coil L. Thus a steady current will flow through the contact arm L' and the brush N.

In certain cases where the apparatus is liable to be subjected to mechanical disturbance it is necessary to provide some means to prevent such disturbances causing unde-

sired contacts between the arm and the contact filaments. To obviate this the filaments may be mounted so that they can oscillate similarly to the needle and the arm. One method of effecting this is shown in the construction illustrated in Figs. 5 and 6. Here the coil B³ is pivoted as at B⁴ between the poles of the magnet and the contacts or filaments E² are carried by the coil and disposed so that they lie on either side of the contact arm D⁴. The movements of the coil B³ about its pivots are controlled by springs P which are so adjusted that the oscillation periods of the coil and contact members E² and of the needle D⁵ and arm D⁴ are the same. If now the device is subjected to mechanical disturbance for instance of a rotary nature substantially about the axes of the needle D⁵ and coil B³ the contact members carried by needle and coil will swing similarly but without contact occurring between the members D⁴ and E².

An alternative construction that may be adopted with a view to obviating the effects of mechanical disturbance is shown in Figs. 7 to 9. In this case two similar horseshoe magnets A⁴ and A⁵ are employed and disposed side by side with opposite polarity. The coil B⁵ lies between the poles of both magnets and within the coil are two magnetic needles D⁶ and D⁷ arranged in accordance with the polarity of the magnets. The needle D⁶ has a contact arm D⁸ the end of which lies between twin contact arms D⁹ carried by the needle D⁷ the arms D⁸ and D⁹ being inclined toward each other as shown in Fig. 8. It will be apparent that any mechanical disturbance of the apparatus will affect both needles alike so that they will move similarly and undesired contacts will not occur. On the other hand the passage of the alternating current through the coil B⁵ will cause the needles to oscillate in opposite phase so that contact between the arms D⁸ and D⁹ will take place. In this construction the field of both magnets can be varied simultaneously by the magnetic shunt F² which can be moved between the poles of the two magnets by means of the screw F³.

The construction last described may be modified as shown in Figs. 10 and 11. In this case the arrangement is astatic as regards the effect of uniform external fields. A single horseshoe magnet A⁶ is employed with a magnetic shunt F⁴ but two coils B⁶ and B⁷ are used wound in opposite directions. Both coils lie between the poles of the magnet A⁶ and within the coils lie similarly arranged magnetic needles D¹⁰ and D¹¹ which respectively carry the contact arms D¹² and D¹³.

The relay when constructed as illustrated in Figs. 3 and 4 does not as a rule require any compensating device since the coil L in the secondary relay is so sluggish in its

movements that contact will not be made between the arm L' and the brush N until several contacts have been made between the arm D¹³ and the filaments E'.

5 The details of construction may be modified to meet requirements and the purpose for which the apparatus is to be employed.

What I claim as my invention and desire to secure by Letters Patent is:—

10 1. In an alternating current relay working on the principle of tuning or resonance, the combination of a magnet, an oscillating contact-making needle disposed between the poles of said magnet, a coil surrounding said
15 needle through which coil the alternating current passes, and means for varying the strength of the magnetic field in which the needle oscillates, for the purpose of tuning.

2. In an alternating current relay working on the principle of tuning or resonance, the combination of a magnet, an oscillating magnetic needle disposed between the poles of said magnet, a contact-making arm carried by said needle, contacts between which
25 said arm vibrates, a coil surrounding said needle through which coil the alternating current passes, and means for varying the strength of the magnetic field in which the needle oscillates, for the purpose of tuning.

30 3. In an alternating current relay working on the principle of tuning or resonance, the combination of a magnet, an oscillating magnetic needle disposed between the poles of said magnet, a contact-making arm carried by said needle, contacts between which
35 said arm vibrates, a coil surrounding said needle through which coil the alternating current passes, means for varying the strength of the magnetic field in which the needle oscillates, for the purpose of tuning, a highly damped moving coil in the field of the magnet, a contact arm carried by such
40 coil, and a fixed brush over which the contact arm makes continuous tangential rubbing contact through the action of the current derived from the intermittent contacts made by the oscillating system.

4. In an alternating current relay working on the principle of tuning or resonance, the combination of a magnet, an oscillating magnetic needle disposed between the poles of said magnet, a contact-making arm carried by said needle, a coil surrounding said
50 needle through which coil the alternating current passes, pivots for said coil so that it can oscillate in the same plane as the needle, contacts carried by the coil and disposed one on each side of the arm carried by the needle, and means for varying the
60 strength of the magnetic field in which the needle oscillates, for the purpose of tuning.

5. In an alternating current relay working on the principle of tuning or resonance, the combination of two similar permanent
65 magnets arranged with opposite polarity,

two similar oscillating magnetic needles disposed respectively between the poles of the magnets, a coil surrounding both the needles through which coil the alternating current passes, contact arms carried by the needles
70 and adapted to make contact together when the needles oscillate in opposite phase as a result of current flowing through the coil but also adapted to oscillate together without making contact when such oscillations
75 are the result of mechanical disturbance, and means for varying the strength of the magnetic field in which the needles oscillate, for the purpose of tuning.

6. In an alternating current relay work-
80 ing on the principle of tuning or resonance, the combination of a single permanent magnet, two similar oscillating magnetic needles disposed between the poles of the mag-
85 net, two coils one surrounding each of the needles the winding and connection of the coils being such that an astatic system is formed, means for varying the strength of the magnetic field in which the needles os-
90 cillate, for the purpose of tuning, and arms carried by the needles and adapted to make contact together when the needles oscillate in opposite phase as a result of current
95 flowing through the coils but also adapted to oscillate together without making contact when such oscillations are the result of mechanical disturbance.

7. In an alternating current relay working on the principle of tuning or resonance, the combination of a magnet, an oscillating
100 contact-making needle disposed between the poles of said magnet, a coil surrounding said needle through which coil the alternating current passes, and an adjustable magnetic shunt for varying the strength of the
105 magnetic field in which the needle oscillates, for the purpose of tuning.

8. In an alternating current relay working on the principle of tuning or resonance, the combination of a magnet, an oscillating
110 magnetic needle disposed between the poles of said magnet, a contact-making arm carried by said needle, contacts between which said arm vibrates, a coil surrounding said
115 needle through which coil the alternating current passes, and an adjustable magnetic shunt for varying the strength of the magnetic field in which the needle oscillates, for the purpose of tuning.

9. In an alternating current relay work-
120 ing on the principle of tuning or resonance, the combination of a magnet, an oscillating magnetic needle disposed between the poles of said magnet, a contact-making arm carried by said needle, a coil surrounding said
125 needle through which coil the alternating current passes, pivots for said coil so that it can oscillate in the same plane as the needle, contacts carried by the coil and dis-
130 posed one on each side of the arm carried

by the needle, and an adjustable magnetic shunt for varying the strength of the magnetic field in which the needle oscillates, for the purpose of tuning.

- 5 10. In an alternating current relay working on the principle of tuning or resonance, the combination of two similar permanent magnets arranged with opposite polarity, two similar oscillating magnetic needles disposed respectively between the poles of the magnets, a coil surrounding both the needles through which coil the alternating current passes, contact arms carried by the needles and adapted to make contact together when
15 the needles oscillate in opposite phase as a result of current flowing through the coil but also adapted to oscillate together without making contact when such oscillations are the result of mechanical disturbance, and
20 an adjustable magnetic shunt for varying the strength of the magnetic field in which the needles oscillate, for the purpose of tuning.

11. In an alternating current relay working on the principle of tuning or resonance, the combination of a single permanent magnet, two similar oscillating magnetic needles disposed between the poles of the magnet, two coils one surrounding each of the
30 needles the winding and connection of the coils being such that an astatic system is formed, an adjustable magnetic shunt for varying the strength of the magnetic field

in which the needle oscillates, for the purpose of tuning, and arms carried by the needles and adapted to make contact together when the needles oscillate in opposite phase as a result of current flowing through the coils but also adapted to oscillate together without making contact when such oscillations are the result of mechanical disturbance.

12. In an alternating current relay working on the principle of tuning or resonance, the combination of a magnet, an oscillating magnetic needle disposed between the poles of said magnet, a contact-making arm carried by said needle, contacts between which said arm vibrates, a coil surrounding said needle through which coil the alternating current passes, means for altering the position of the needle in relation to the magnet in order to vary the strength of the magnetic field in which the needle oscillates, for the purpose of tuning, a highly damped moving coil in the field of the magnet, a contact arm carried by such coil, and a fixed brush over which the contact arm makes continuous tangential rubbing contact through the action of the current derived from the intermittent contacts made by the oscillating system.

In testimony whereof I sign my name to this specification.

CHARLES VICKERY DRYSDALE.