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RELAY.

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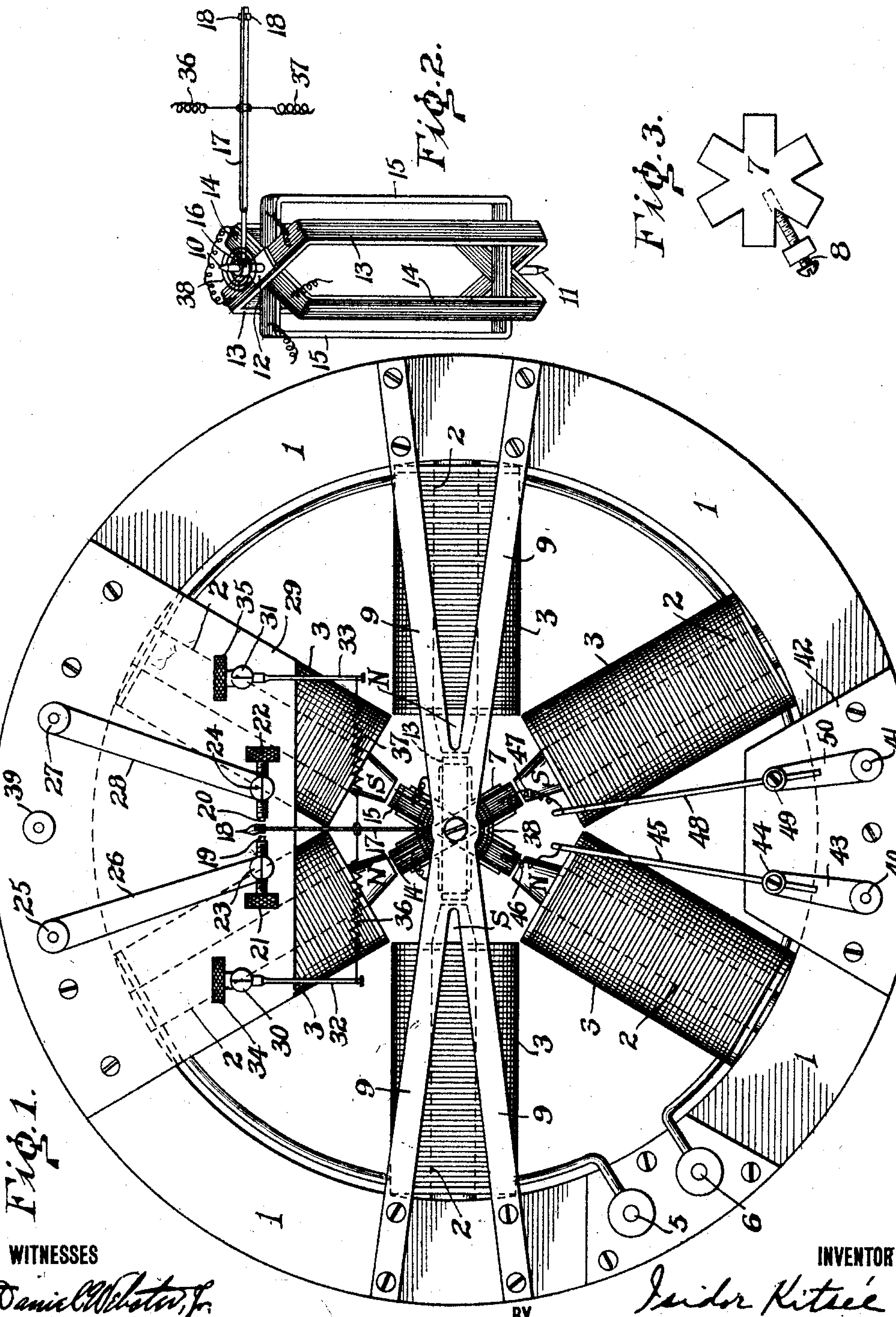
963,374. Patented July 5, 1910.



WITNESSES

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RELAY.

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To all whom it may concern:

Be it known that I, Isidor Kitsee, a citizen of the United States, residing at Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Relays, of which the following is a specification.

My invention relates to relays, and more particularly to polarized relays of a moving coil type.

While the relay constituting this invention is of general application, it is particularly useful where an extremely sensitive relay is required, and is particularly useful in the receiving apparatus associated with a long line or cable, such as a submarine cable, or any other line or circuit having relatively great capacity.

It is the object of my invention to provide an extremely sensitive relay which shall be responsive to weak currents and which shall, nevertheless, make a satisfactory contact and satisfactorily control a local circuit. To this end, I provide a plurality of very intense magnetic fields, and support or mount for movement in such field or fields a plurality of movable coils mechanically connected to form a single moving system, preferably an odd number, and associate with the moving coils a member for operating or controlling contacts for the purpose of controlling a local circuit. And by employing an odd number of coils, and associating with each a pair of magnetic poles, and having the magnetic poles or all the coils alternate with each other, I am able to produce a relatively powerful movement of the moving coil system under the influence of feeble exciting or energizing current.

For an illustration of one of the forms my invention may take, reference is to be had to the accompanying drawing, in which:

Figure 1 is a top plan view of my improved relay. Fig. 2 is a perspective view of the moving coil system. Fig. 3 is a top plan view of the internal core or cores for intensifying the field.

A yoke 1, of iron, steel, or other highly magnetizable material, which may be continuous and take a circular or other suitable form, has secured thereto the radially extending cores 2 having the poles or pole pieces N S. The yoke and cores may be laminated. Upon the cores 2 are disposed windings or coils 3 which may be connected in series with each other and the terminals connected to the binding posts 5 and 6, to which may be connected the conductors of any suitable exciting circuit, the ampere turns of the coils 3 being sufficient to produce very intense magnetic fields. Disposed within or between the pole pieces N S is a stationary core 7 of iron, steel, or other highly magnetizable material, which is supported by the screw 8, preferably of brass or other non-magnetic material, to the frame or base of the apparatus. Between each arm of the core 7 and the opposed pole pieces N S is a narrow gap, the magnetic field in each gap being very intense.

Upon the top of the yoke 1 is secured a bridge or bracket 9, preferably of brass or other non-magnetic material, and upon the under side of the yoke 1 is secured a similar bridge or bracket. At their centers they support suitable pivot supports, preferably carefully ground jewels, to receive the pivots 10 and 11, shown in Fig. 2. The pivot 10 is secured to a plate 12 suitably cemented or bound to the end of the rectangular coil 13. And the pivot 11 is similarly secured by a plate such as 12 to the lower end of the coil 13. The coil 13 is disposed at an angle with respect to the coil 14 and suitably secured thereto by wax, cement, or other means. And a third coil 15 is in turn waxed or cemented to the coil 14, or otherwise suitably secured thereto, the coils 13, 14 and 15 being preferably self-supporting coils wound of many turns of fine wire, these coils being similar to the coils employed in a siphon recorder. The moving system consisting of these coils angularly disposed with respect to each other, is supported by the pivots 10 and 11 in the jewels aforementioned, and the vertical sides of the coils are disposed in the narrow gaps between the arms of the core 7 and the pole pieces N S.

To the pivot pin 10 is secured a brass collar 16 which carries a tongue or arm 17, preferably very light, as of aluminum, and may even be tubular. At its outer end the arm or tongue 17 carries the contacts 18, preferably of platinum iridium, which are adapted to engage similar contacts, 19 and 20, carried respectively by the adjusting screws 21 and 22, which are screw-threaded through the vertical conducting posts 23 and 24 respectively. The post 23 is in electrical communication with the binding post 25 through the connecting strip 26. And, similarly, the post 24 is in electrical communication with the binding post 27 through the connecting strip 28. The posts 23 and 24 and the binding posts 25 and 27 are supported upon the plate 29, of insulating material, secured to or supported by the yoke 1. The posts 30 and 31 are also carried by the plate 29 and supported by these posts are the rods or pins 32 and 33 having heads 34 and 35 respectively. Connecting the pin or rod 32 and the relay tongue or arm 17 is a delicate spring 36. And connecting the rod or pin 33 with the tongue 17, is another delicate spring 37, these springs being preferably of non-magnetic material, and of a material which can be drawn into a fine wire to make a delicate spring. For this purpose, I have used a manganin wire of No. 40 gage, or even smaller. The springs 36 and 37 balance each other and hold the tongue in such position that the contacts 18 are midway between the contacts 19 and 20 and normally not in engagement with them or either of them. The springs 36 and 37 may be adjusted by turning the heads 34 and 35 respectively. To the collar 16 which carries the tongue or arm 17 is secured also the inner end of a flat spiral, preferably non-magnetic, conductor 38 whose outer end is mechanically and electrically connected to the upper bridge or frame 9. This flat spiral conductor 38 is merely a very flexible connection to the tongue or arm 17, and therefore to the contacts 18. The bridge or bracket 9 being secured to the yoke 1, may be in electrical communication therewith and then the binding post 39, extending through the plate 29, into the yoke 1, forms a terminal or means of electrical communication with the movable contacts 18. The conductor 38, while being in the form of a flat spiral spring, exercises practically no control upon the moving system, the moving system being controlled by the delicate springs 36 and 37.

The coils 13, 14 and 15 are all connected in series with each other and so connected that a current passing through them tends to cause all of the coils to assist each other in producing rotation in a given direction. With reversal of current, of course, the direction of movement of the coils in the magnetic fields is also reversed. The terminals of the circuit of the coils are at the binding posts 40 and 41, carried by the insulating plate 42 secured upon the yoke 1. The post 40 is joined by connector 43 to the post 44 in which is held the conducting rod 45 to whose inner end a very flexible electrical conductor 46 is electrically connected and connects to one terminal of the coils. And from the other terminal of the coils extends a very flexible electrical conductor 47 electrically connected to the rod 48 carried by the post 49 which is in electrical communication through the connector 50 with the binding post 51. Thus, the conductors bringing and leading away the received current are connected to the posts 40 and 41 and the current thus traverses all of the coils in series. By the disposition of the poles and coils, as shown, the coils are suspended or movable in extremely intense magnetic fields, alternate poles are of opposite signs, and, therefore, there is a field extending from each pole piece to its neighbor of opposite sign, and there is further a field from each pole piece to its diametrically opposite pole piece. By such arrangement of magnetic field, with respect to the moving coils, and having a plurality of coils of preferably odd number, a maximum torque or rotative effort is produced for a given current traversing the coils. And by this arrangement of poles and coils, the effect is different and greater than the case where a single coil extending between a pair of poles is employed, even if the ampere turns in such coils be the same as the total ampere turns of the three coils herein shown. And if only two coils are employed, it is found that the two neighboring pole pieces will be of the same sign, and the field distribution and strength will be such that a smaller rotative effort is produced with a given current than in the case of an arrangement as here shown, where there is a plurality of coils, and preferably of odd number.

In a relay which I have constructed and used, as hereinafter described, each of the moving coils 13, 14 and 15 had a length of about 3 inches, a diameter of 1.5 inches, and a width of about $\frac{3}{8}$ of an inch. And each coil was wound with No. 40 gage wire, of approximately 590 convolutions, and having a resistance of about 500 ohms, the three coils thus having a resistance of about 1,500 ohms and the total number of convolutions between 1,700 and 1,800. And the yoke 1 had an outside diameter of $11\frac{1}{2}$ inches, an inside diameter of 9 inches, and a height of $2\frac{3}{4}$ inches. With such an instrument, I was enabled to receive and record current impulses transmitted from Canso, Nova Scotia, over a submarine cable extending to New York city, the cable length being between 900 and 1,000 miles, and having about 1,800,000 K R. And, as an example of the extreme sensitiveness of the relay, it is stated that the potential of the current impressed upon the cable at Canso was only 4 volts, while in regular cable telegraphy, employing a siphon recorder, the potential used is 26 volts. It may also be stated that the siphon recorder, being a standard cable siphon recorder as used in every-day practice on the same cable, with 4 volts impressed upon the cable at Canso, in New York gave deflections so minute as not to be readable as practical signals. With this same current the relay herein described responded promptly and fully to satisfactorily control a local circuit. Furthermore, the relay shown and described is very prompt in its response to received current, the current impulses transmitted from Canso in the case recited being current impulses sent as rapidly as a skilled operator could possibly send them by a manual key. Nevertheless, the relay responded perfectly and satisfactorily to these rapid impulses, while the siphon recorder did not. In all these comparisons my relay and the siphon recorder were subjected to exactly the same conditions. It is to be understood, however, that I do not wish in any way to be limited by the dimensions and magnitudes hereinbefore given in connection with my improved relay.

By the arrangement shown, where each coil has its separate magnetic field, and where each coil is also subjected to the field of another coil, and where the field for each coil is circumferentially narrow, the movement of the coils is very small but with relatively very great torque for very small energizing current. And in this regard, my relay is widely different both in structure and in effect as compared with moving coil instruments associated with pole pieces having a relatively great circumferential extent.

What I claim is:

1. In a relay, a plurality of pairs of magnetic poles, a movable coil for each pair of poles, said coils secured together to form a single moving system and having their axes coincident, and each coil being subjected to its own field and also to the field of another coil.

2. In a relay, a plurality of pairs of magnetic poles, alternate poles being of opposite signs, a movable coil for each pair of poles, said coils being secured together to form a single moving system, and each coil subjected to its own field and also to the field of another coil.

3. In a relay, a plurality of pairs of magnetic poles, alternate poles being of opposite signs, a movable coil for each pair of poles, all the coils secured together to form a single moving system, and an internal core for each coil for intensifying its field.

4. In a relay, a plurality of movable coils secured together to form a single moving system and having their axes coincident, and a magnetic field for each coil, each coil being subjected to its own magnetic field and also to the field of another coil.

5. In a relay, a field yoke or ring, a plurality of poles extending inwardly therefrom, a moving coil for each pair of poles, said coils being disposed at an angle with respect to each other and secured together and having their axes coincident.

6. In a relay, a plurality of moving coils secured together to form a single moving system and having their axes coincident, said coils being disposed at an angle with each other, and a magnetic field for each coil, each coil being subjected to its own magnetic field and also to the field of another coil.

7. In a relay, a field ring or yoke, a plurality of poles extending inwardly therefrom, alternate poles being of opposite signs, a moving coil for each pair of poles, said moving coils disposed at an angle with respect to each other and having their axes coincident.

8. In a relay, a plurality of movable coils secured together to form a single moving system and having their axes coincident, said coils being disposed at an angle with each other, and a pair of magnetic poles for each coil, each coil being subjected to its own field and also to the field of another coil.

9. In a relay, a plurality of movable coils secured together to form a single moving system, a pair of poles for each coil, a core for each coil for intensifying its field, alternate field poles being of opposite signs.

10. In a relay, an odd number of movable coils secured together to form a single moving system, said coils connected in series with each other and being disposed at an angle with respect to each other, and a magnetc field for each coil.

11. In a relay, an odd number of movable coils secured together to form a single moving system, said coils being disposed at an angle with respect to each other, and a magnetic field for each coil, each coil being subjected to its own magnetic field and also to the field of another coil.

12. In a relay, an odd number of coils secured together to form a single moving system, said coils being disposed at an angle with respect to each other, and a pair of diametrically opposed poles for each coil.

13. In a relay, an odd number of coils secured together to form a single moving system, said coils being disposed at an angle with respect to each other, and a pair of diametrically opposed poles for each coil, each coil being subjected to its own field and also to the field of another coil.

14. In a relay, a plurality of movable coils secured together to form a single moving system and having their axes coincident, said coils being disposed at an angle with respect to each other, and a separate magnetic field for each coil, and alternate poles of the fields being of opposite signs.

15. In a relay, a plurality of movable coils secured together to form a single moving system and having their axes coincident, said coils being disposed at an angle with respect to each other, and a separate magnetic field for each coil, each coil being subjected to its own magnetic field and also to the field of another coil.

16. In a relay, a plurality of coils secured

together to form a single moving system and having their axes coincident, a separate magnetic field for each coil, neighboring poles of the different coil fields being of opposite signs, and said coils all connected in series with each other.

17. In a relay, a plurality of moving coils secured together to form a single moving system and having their axes coincident, a separate field for each coil, alternate poles of the field being of opposite signs, a contact carrying member controlled by said coils, and a contact adapted to be engaged by said contact carrying member.

18. In a relay, a plurality of coils secured together to form a single moving system and having their axes coincident, a separate magnetic field for each coil, alternate poles of the fields being of opposite signs, a contact carrying member controlled by said coils, stationary contacts, said contact members being controlled by said coils to engage said stationary contacts.

19. In a relay, a plurality of moving coils secured together to form a single moving system and having their axes coincident, a separate magnetic field for each coil, alternate poles of the fields being of opposite signs, a contact member controlled by said coils, stationary contacts, and resilient means for holding said contact member normally out of engagement with said stationary contacts.

20. A sensitive relay comprising a yoke, a plurality of radially extending cores secured to said yoke, neighboring poles of said cores being of opposite signs, a central core for each pair of poles for intensifying the field, a moving system disposed between said poles and internal cores and comprising a plurality of coils secured together and disposed at an angle with each other, said coils being electrically connected in such manner as to assist each other in producing rotative effort, a contact member carried by said coils, two stationary contacts, and delicate resilient means adapted to bias said contact member to a position between said stationary contacts.

21. In a relay, a plurality of coils secured together to form a single moving system and having their axes coincident, a pair of field poles for each coil disposed on opposite sides of each coil, the neighboring poles of the fields having opposite signs.

22. In a relay, a plurality of movable coils secured together to form a single moving system, a pair of poles for each coil, alternate poles being of opposite signs, and the relation of each coil to its pair of poles being the same as that of every other coil to its pair of poles.

23. In a relay, a field ring or yoke, a plurality of pairs of field poles extending inwardly therefrom, a plurality of movable coils secured together and having their axes coincident associated with said field poles, and energizing windings for the field poles.

24. In a relay, a field yoke or ring, a plurality of field poles extending inwardly therefrom, a moving coil for each pair of poles, said coils having their axes coincident and secured together to form a single moving system, a stationary contact carried by the field system, a movable contact carried by the moving coil system, and a coil support carried by said field system.

In testimony whereof I have hereunto affixed my signature in the presence of the two subscribing witnesses.

ISIDOR KITSEE.

Witnesses:
E. T. McCall,
A. E. Steinbock.