No. 886,740. PATENTED MAY 5, 1908.

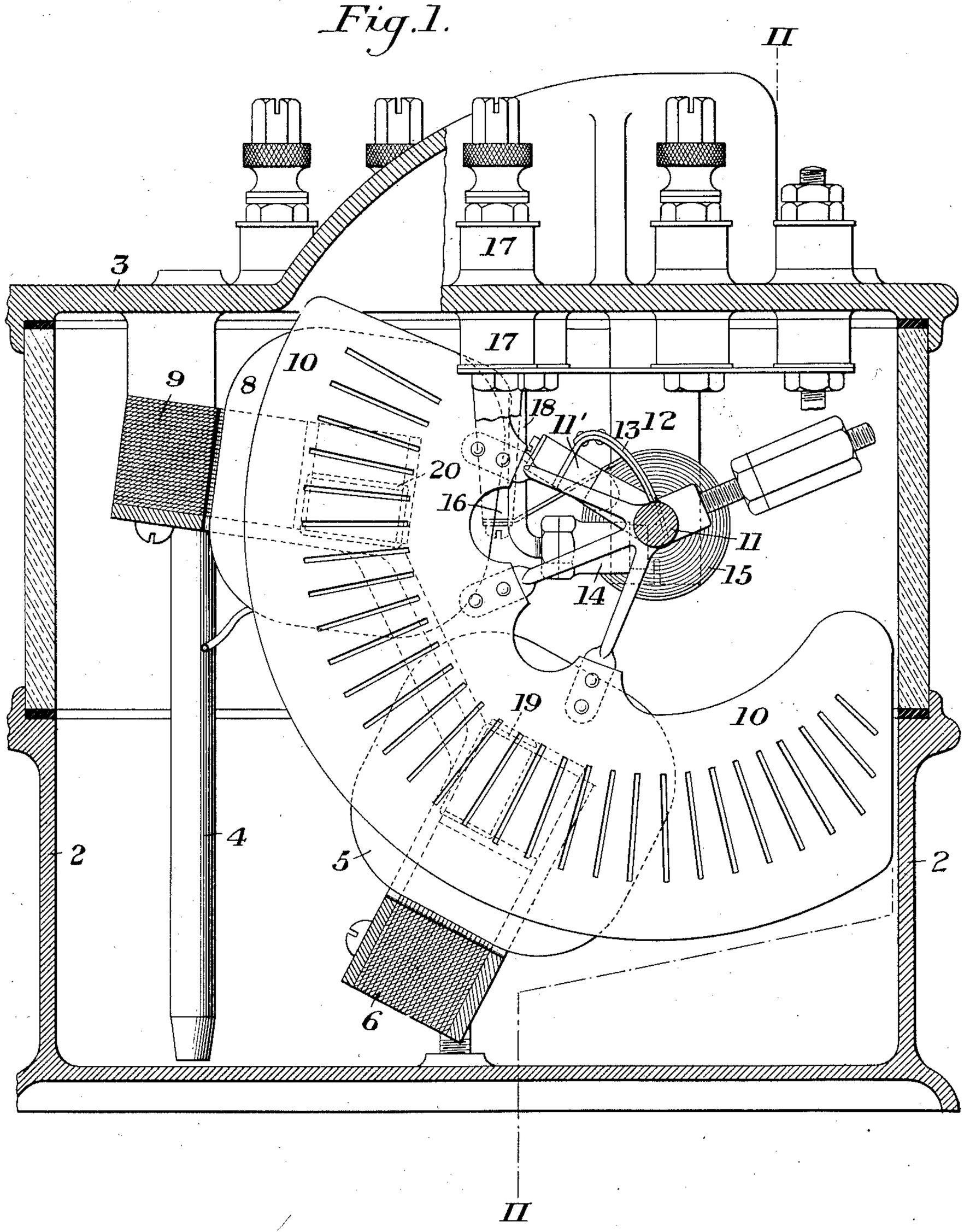
L. H. THULLEN.

RELAY FOR SIGNALING APPARATUS.

APPLICATION FILED MAR. 25, 1907.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

R. A. Balderson.
W. W. Swartz

INVENTOR

L. H. Thullen,
by Bakewell & Byrnes,
his Attys.

No. 886,740. PATENTED MAY 5, 1908.

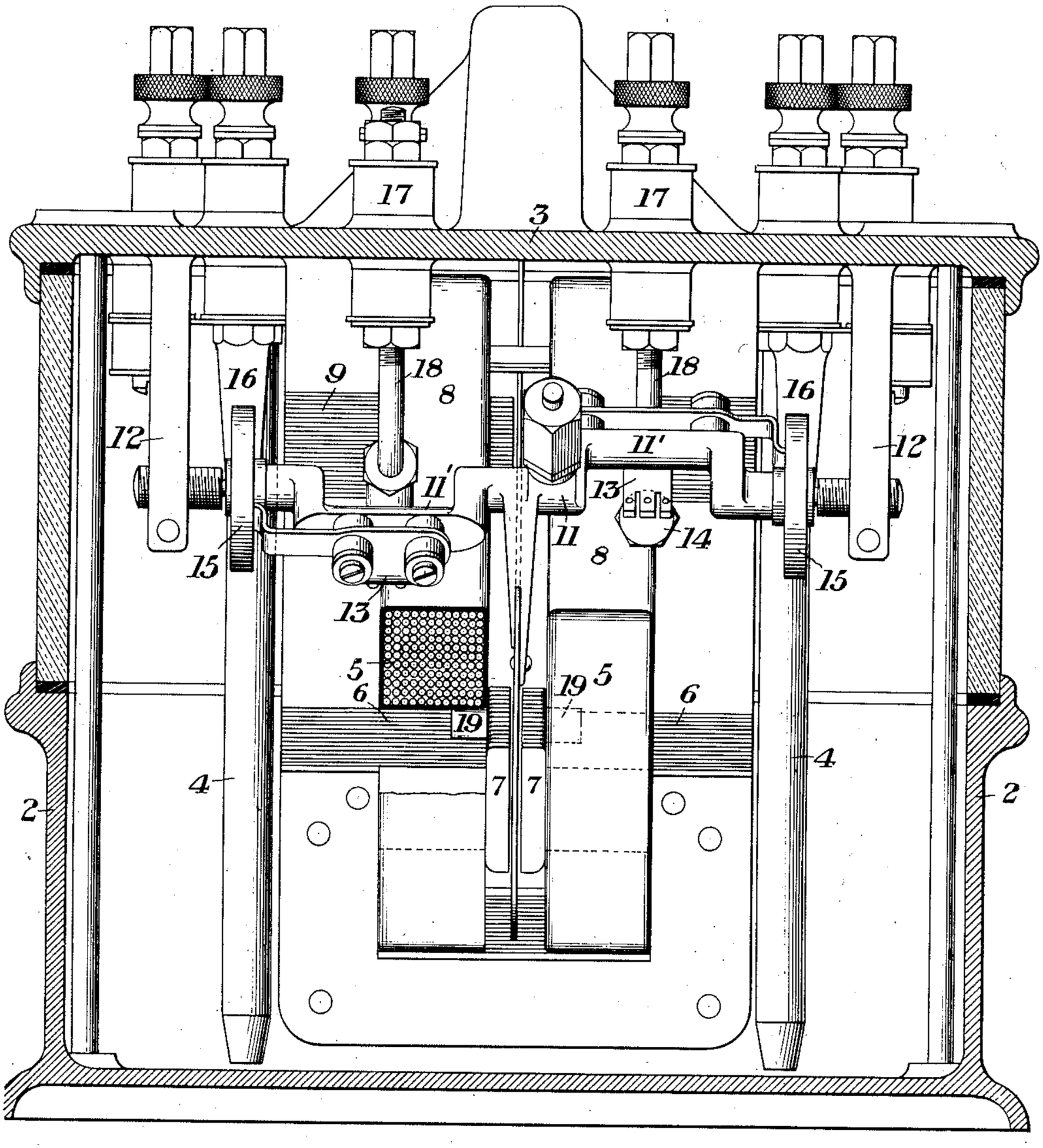
L. H. THULLEN.

RELAY FOR SIGNALING APPARATUS.

APPLICATION FILED MAR. 25, 1907.

4 SHEETS—SHEET 2.

Fig. 2.



WITNESSES

R. A. Baldwin.
W. W. Swartz

INVENTOR

L. H. Thullen,
by Bakewell & Byrnes,
his Attys.

No. 886,740. PATENTED MAY 5, 1908.

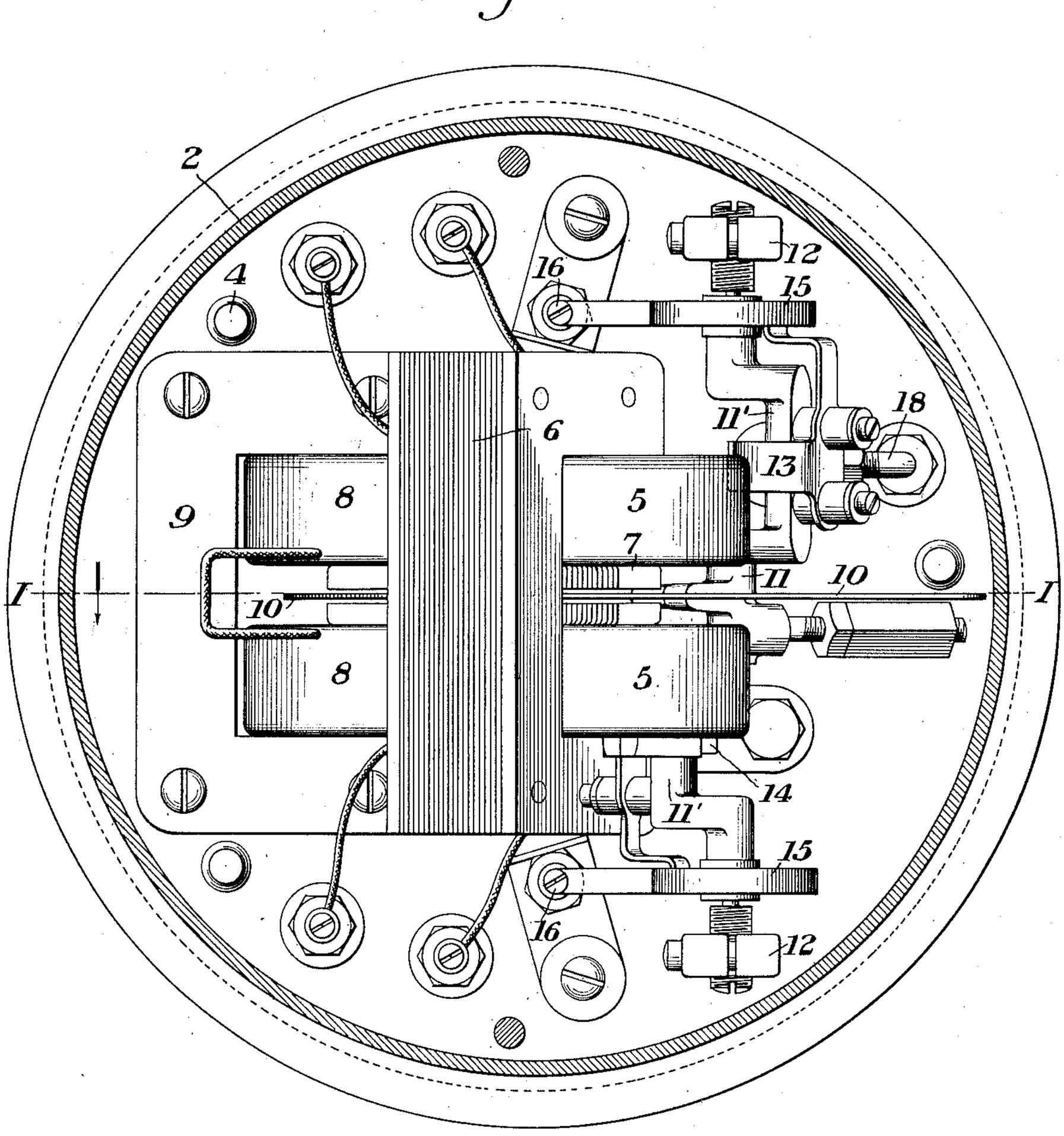
L. H. THULLEN.

RELAY FOR SIGNALING APPARATUS.

APPLICATION FILED MAR. 25, 1907.

4 SHEETS—SHEET 3.

Fig. 3.



WITNESSES

R. A. Balderson

W. W. Swartz

INVENTOR

L. H. Thullen,

by Bakewell & Byrnes,

his Attys.

No. 886,740. PATENTED MAY 5, 1908.

L. H. THULLEN.

RELAY FOR SIGNALING APPARATUS.

APPLICATION FILED MAR. 25, 1907.

4 SHEETS—SHEET 4.

Fig. 5.

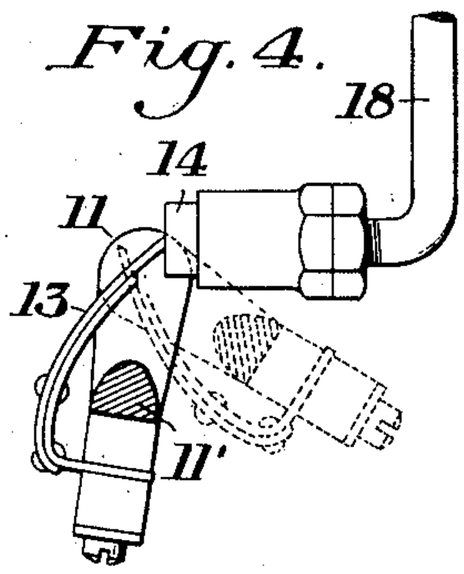


Fig. 4.

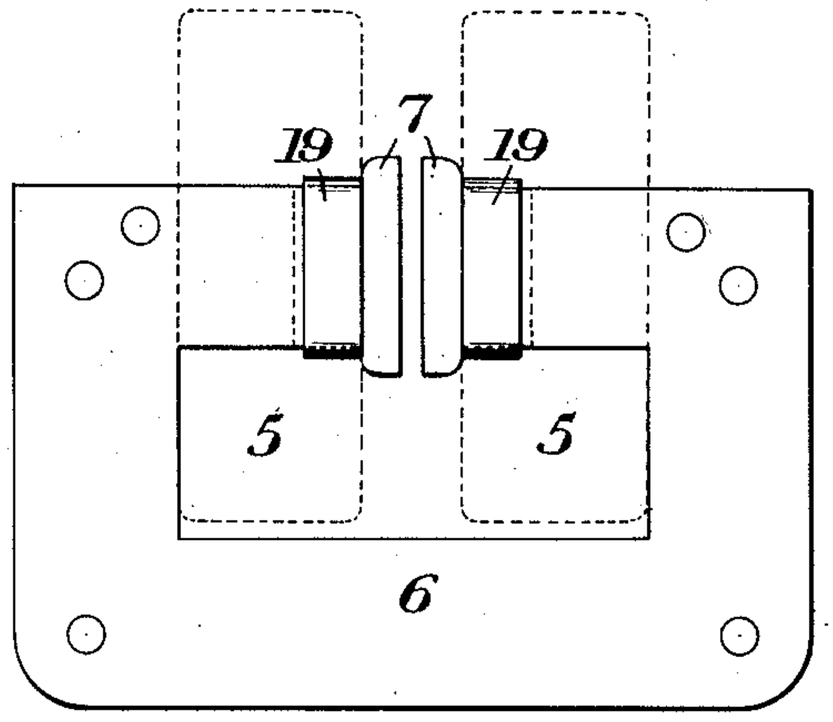
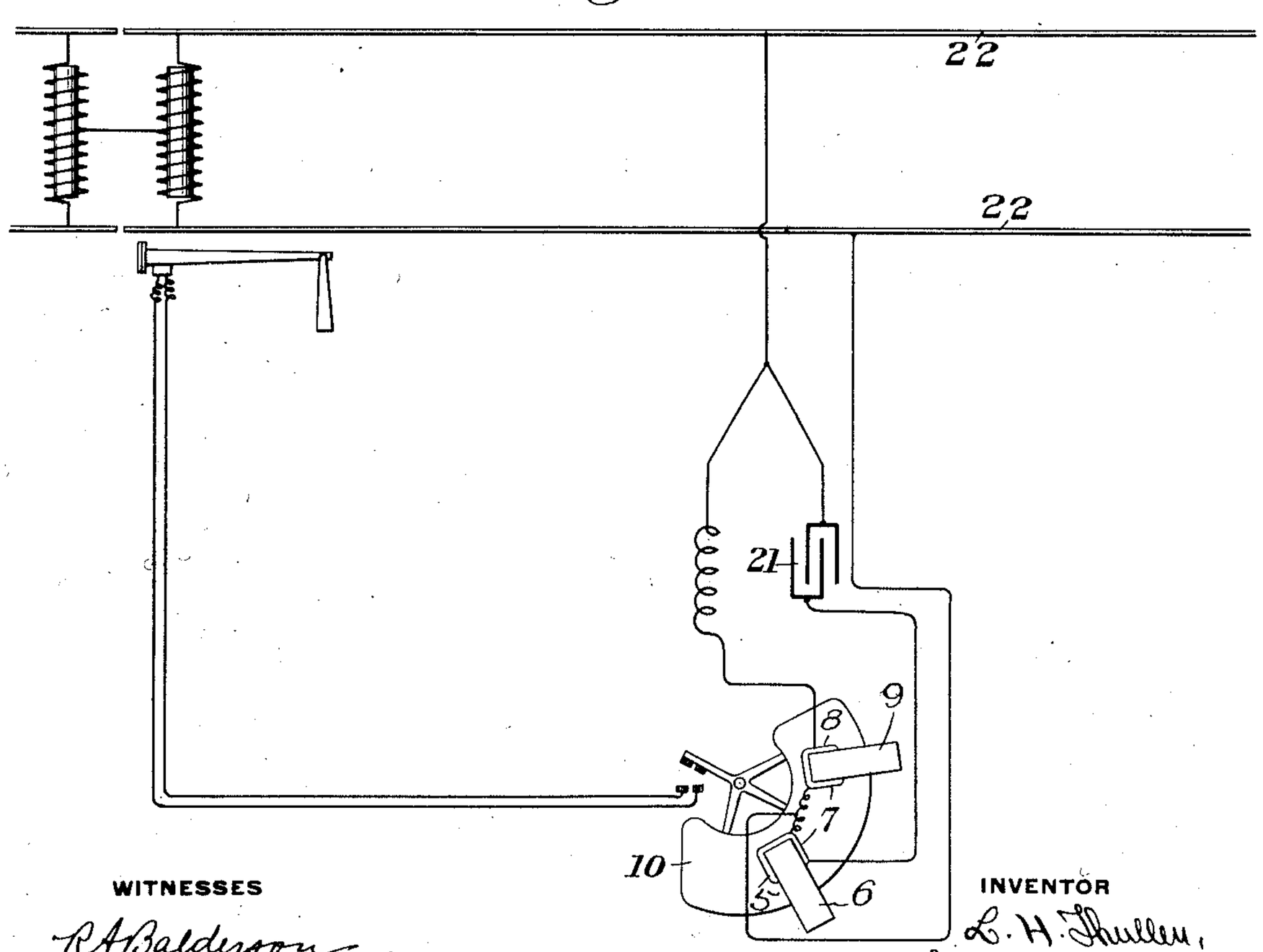


Fig. 6.



WITNESSES

R. A. Baldersoon

W. W. Swartz

INVENTOR

L. H. Thullen,

by Bakewell & Byrnes,

his Attys.

UNITED STATES PATENT OFFICE.

LOUIS H. THULLEN, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

RELAY FOR SIGNALING APPARATUS.

No. 886,740. Specification of Letters Patent. Patented May 5, 1908.

Application filed March 25, 1907. Serial No. 364,432.

To all whom it may concern:

Be it known that I, LOUIS H. THULLEN, of Edgewood Park, Allegheny county, Pennsylvania, have invented a new and useful Relay for Signaling Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a central vertical section of one form of relay embodying my invention taken on the line I—I of Fig. 3; Fig. 2 is a vertical section taken on the irregular line II—II of Fig. 1; Fig. 3 is a horizontal section; Fig. 4 is a detail view of one of the contacts; Fig. 5 is a detail view of one of the laminated cores with the coils thereon shown in dotted lines; and Fig. 6 is a diagram illustrating the circuit connections for the relay.

My invention has relation to an alternating current relay for use in signaling systems where alternating current of one frequency is used for propulsion purposes, and an alternating current of a different frequency is used in the track or signaling circuit, as shown in my pending application, Serial No. 208,171, May 16, 1904.

The object of my invention is to provide a simple efficient relay of this character which will be operative by the higher frequency signaling current only, and it consists in a relay having two coils which operate inductively upon a contact actuating device, one of said coils being capable of carrying a preponderance of the high frequency current, and the other coil being capable of carrying a preponderance of low frequency current, the combined action of the two coils when traversed by low frequency current upon the contact actuating member being *nil*. Means are also provided for controlling the direction of movement of the contact actuating member.

My invention also consists in the novel construction, arrangement and combination of parts, all substantially as hereinafter described.

Referring to the accompanying drawings, the numeral 2 designates a suitable case or closure having a removable cover 3 to which the relay mechanism is attached. This cover is provided with depending legs 4 which form a support for it when it is removed from the outer portion 2 of the closure.

5, 5 designate two coils connected in series and wound upon the laminated cores 6 having the adjacent pole pieces 7. 8, 8 designate two other coils which are wound in a similar manner upon a similar laminated core 9. Arranged to swing between the adjacent pole pieces of these two sets of coils and in inductive relation thereto is a movable vane 10, preferably of aluminum which is fixed to a rotary shaft 11 supported in the bearings 12 carried by the cover 3. The shaft 11 is formed with cranked portions 11′, each of which carries a contact member 13 which by the movement of the shaft is designed to be brought into and out of contact engagement with the relatively-fixed contact 14. The contact members 13 are connected with the external circuit by means of the flexible ribbons or coils 15 leading to the binding or terminal posts 16, while the relatively stationary contacts 14 are connected to the terminal posts 17 by means of the conductors 18.

When current traverses the coils 5, 5, the aluminum vane 10 moves or rotates in the upward direction from its position shown in Fig. 1, while when current traverses the coils 8, 8, the direction of rotation is downward. The direction of movement is controlled by means of a sleeve or ferrule 19 of copper placed upon the upper half of the pole pieces of the coils 5, 5, and by a similar ferrule 20 placed on the lower half of the pole pieces of the coils 8, 8. If the number of turns and the current were the same in both coils 5, 5 and 8, 8, there would be no rotation of the vane 10, since the energy exerted by one set of coils would counter-balance the energy exerted by the other set of coils, and the weight of the vane would hold it in the position shown in Fig. 1, with the contacts open. With a different number of turns in one set of coils, or a higher value of current in one coil than in the other, the rotation of the vane, however, is in the direction of the coil having the predominating number of ampere turns.

The principle of operation of this relay depends therefore upon the relative number of ampere turns in the different coils. The amount of current traversing these coils may be varied in any well known way, as by increasing the self-induction of one set of coils, or of the circuit including such coils, and by varying the resistance of the other set of coils, or of the circuit including the same.

This latter variation may be effected by means of a condenser 21 connected in series with the coils 8, 8.

The principle of varying the current traversing these coils is more fully explained in my said application, Serial No. 208,171.

The coils 8, 8 constitute what I designate the low frequency coils, and are preferably so wound as to have a maximum amount of self-induction; or they may be so arranged in connection with other apparatus that the circuit which contains them will have considerable self-induction. It is a well known fact that in a circuit having self-induction, more current will flow through the circuit at a low frequency than at a high frequency. The coils 5, 5 designate what I term the high frequency coils, and are wound so as to have little self-induction, or are connected in a circuit which has little self-induction but considerable resistance or capacity, thereby causing current of high frequency to predominate in this coil. When the two sets of coils of this character are connected to the track rails 22 of a block section which is traversed by alternating current of two frequencies, the low frequency current being the propulsion current, and the high frequency current the track or signaling current, the action will be as follows:—

Under normal conditions, there will be no low frequency current traversing any part of the relay, and the only current therein will be the high frequency signaling current. In this case the high frequency current will traverse both sets of coils, as they are connected to the same source, but owing to the relatively high self-induction of the coils 8, 8 these coils will shut out a large percentage of this current, while the coils 5, 5 having relatively small self-induction, will permit a relatively large flow of this current through their windings. The predominating current therefore will be through the coils 5, 5 which will cause the vane 10 to revolve in the upper direction and close the contacts of the relay. Under abnormal conditions, caused by the resistance being higher in one of the rails 22 than in the other rail of the block section, there will be present a current of low frequency at the point of connection of the relay. The action in this case will be as follows:—The coils 5, 5 having little self-induction but considerable resistance, or having a condenser in their circuit, will shut out a large percent. of the low frequency current; while the coils 8, 8 having self-induction only offer a freer path to this current. The current therefore will predominate in the coils 8, 8, thereby causing the vane 10 to move by gravity in a downward direction and open the contacts of the relay.

In practice it is not essential that the low frequency current shall move the vane in any particular direction, but it is essential that when low frequency current is present in the relay the combined action of the two coils upon the vane 10 shall be *nil*. If at such time the vane is in the position shown in Fig. 1 with the contacts open, it will remain stationary, while if the vane is in the raised position with the contacts closed it will move to its lower position and open the contacts by the action of gravity. So long as the high frequency current predominates in the coils 5, the vane 10 will be held in a position with the contacts closed.

The advantages of my invention result from the use in the relay of the differential coils arranged to control the contact actuating member in the manner described. Each of the two sets of coils having their windings connected in series may be considered as a single coil, and the term "coil" as used herein and in the claims can be thus understood. The term "resistance" as used herein, and in the claims, is also to be understood as including either ordinary resistance or any equivalent for the present purpose, such as the condenser shown.

Various changes may be made in the construction and arrangement without departing from my invention. Thus the coils may be variously arranged; the mode of winding and connecting them to secure their differential action may be changed; and the arrangement and character of the contacts may be widely varied, without departing from my invention.

I claim:—

1. An alternating current relay, having two windings, laminated cores for said windings, the pole pieces of the cores having opposite portions thereof sheathed with copper, and a movable contact actuating member in operative relation to said windings, said windings having means in circuit therewith whereby the action of the current in one or the other windings will predominate according to the frequency of the current; substantially as described.

2. An alternating current relay having a movable contact operating member and two windings, and means whereby each of said windings exert a split-phase action upon the movable member, said windings having means in their circuits whereby one or the other predominates in its action upon the movable member according to the frequency of the current which traverses them; substantially as described.

3. An alternating current relay having a movable member and two windings and means whereby one of said windings will transmit a preponderance of high frequency current, means whereby the other winding will transmit a preponderance of low frequency current, the two windings acting to actuate the movable member in opposite directions, and means whereby each winding

exerts a two-phase action upon the movable member; substantially as described.

4. An alternating current relay, having a movable contact actuating member and two windings tending to actuate said member in opposite directions when energized, means whereby one of said windings will transmit a preponderance of current of one frequency, and means whereby the other winding will transmit a preponderance of current of another frequency, said member being supported to cause its gravity to assist the action of one of said windings; substantially as described.

In testimony whereof, I have hereunto set my hand.

LOUIS H. THULLEN.

Witnesses:

JOHN MILLER,

H. M. CORWIN.